UNIVERSITY OF CAMBRIDGE
Faculty of Education

Life-Worthy Learning Skills: A Curriculum Intervention to Promote Self-Regulated Learning

Gavin Mark Turner

Homerton College

Supervisor – Dr Michelle Ellefson

External Examiner - Dr Laura Dörrenbächer-Ulrich

Internal Examiner – Dr Sara Baker

Date of submission – August 2020

This thesis is submitted for the degree of Doctor of Education

Preface

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text.

It is not substantially the same as any work that has already been submitted before for any degree or other qualification except as declared in the Preface and specified in the text.

It does not exceed the prescribed word limit for the Education Degree Committee.

Gavin Mark Turner: Date: 17th June 2021

Life-Worthy Learning Skills: A Curriculum Intervention to Promote Self-Regulated Learning

Abstract

Taking the form of a portfolio of papers written across my six-year research journey, this professional doctoral thesis presents the findings of a discipline-independent curriculum intervention designed to improve students' self-regulated learning skills. The study also examines the relationship between students' self-regulated learning skills and their academic achievement. Research suggests that discipline-independent training interventions improve students' self-regulated learning skills, also having a major impact on students' academic achievement across childhood and adolescence. Founded on Zimmerman's (2000) cyclic model of self-regulated learning, the 10-week discipline-independent intervention underpinning this research was designed and implemented to support the development of Year 9 (13-14 year old) students' self-regulated learning skills. Following a pre-test post-test non-equivalent group design, participants were divided into two groups by way of purposeful sampling, with each group receiving the training intervention consecutively during the academic year 2017/18. Data was collected at three timepoints (before the start of Phase 1, at the end of Phase 1, and at the end of Phase 2) using the Motivated Strategies for Learning Questionnaire (MSLQ) and an original and tailored instrument created specifically for this research; the Self-Regulated Learning Experimental Design Survey (SRLEDS). Forming a significant contribution to the field, this instrument was validated using the MSLQ. Results show that although students' self-regulated learning skills and academic achievement improved across timepoint, there were not any significant differences between group and nor did students' self-regulated learning skills predict their level of academic achievement. In light of this, the discussion focuses on providing context to these results, exploring local changes within the research setting that account for the findings before outlining the implications of this study for both research and practice. In addition to the development and validation of the SRLEDS, this study also contributes to the fields of research and practice by offering a critical reflection on the challenges of using control groups within a live school research setting. In response to this, an alternative research design is proposed as well as a range of future research directions, with implications for practice highlighted and discussed.

Acknowledgements

My gratitude is owed to a number of colleagues, family and friends that have supported me throughout this epic six-year journey. Whilst not always a smooth ride with numerous bumps in the road, I am hugely grateful to the following people as without their help, I would not have been able to undertake and complete this research.

Firstly, I would like to express my sincere thanks to my supervisor, Dr Michelle Ellefson, whose oversight, advice and feedback kept me on the right track throughout my six-year journey. I am very fortunate to enjoy such a positive professional relationship with Michelle, and without her patience, guidance, and immense knowledge, I would not be where I am today. For all her time, effort, and support, thank you.

I would also like to thank all members of the INSTRUCT research lab, both past and present. The lab provides a fantastic forum for sharing each other's research and ideas, in addition to a valued support network.

I would like to acknowledge and offer my sincere thanks to my examiners, Dr Sara Baker and Dr Laura Dörrenbächer-Ulrich, for agreeing to be examiners, their time and questions during the viva itself and for the corrections that they have suggested. Given the changes made in response to these corrections this thesis is now stronger, and I am grateful for their counsel and input. Thank you.

I'd also like to express my thanks to the Headmaster, senior leaders, teaching colleagues and students at St Edward's School, the setting for this research. Their engagement, support and participation in this study made it possible.

To my family, whose value to me only grows with age. They support me through everything I do and the best in me I owe to them. To you all, thank you.

Finally, I would like to thank my amazing wife, Laura. It seems bizarre to think that I have been studying for longer than we have been married, however you have been by my side from the very beginning, encouraging me to apply for the course and supporting me on every step of the journey. You inspire me to be the best husband, father, and person that I can be, and I genuinely could not have finished my thesis without your backing. I will now move my laptop off the kitchen table as promised!

Table of Contents

List of Figures

List of Tables

How to read this Portfolio

This thesis takes the form of a portfolio. It comprises eight papers that have been written during my six years as a Doctor of Education (EdD) candidate in preparation for viva. Each paper begins with a short introduction providing the context of the paper, outlining the contribution that the paper makes to the portfolio, as well as a summary of the key ideas at the end in the form of a brief conclusion. These sections underpin the portfolio structure as they draw out the key points in each paper, offering continuity and connection across the portfolio. Although the date of authorship of each paper is stated, all papers have been edited numerous times since in response to both feedback and the on-going development of my own understanding and ideas. This iterative approach allowing for the continuous editing of papers over the six years forms strong justification for the use of a portfolio structure above the more traditional PhD thesis structure, enabling me to accurately convey the progress in my understanding and thinking. My hope is that this portfolio provides a detailed and comprehensive account of my learning journey across the six years of professional doctoral study.

Paper 1

Introduction

Paper 1 sets the scene for this research project by providing a compelling and clear justification for the research focus, self-regulated learning. This construct is defined through the exploration of the existing literature, drawing on the research of leaders in this field as well as my own practice-based reflections. The epistemological lens of constructivism through which this research will be viewed is then outlined. As the starting point for this research project, this paper lays the foundations for professional doctorate research and in doing so, forms a highly significant contribution to this portfolio.

Written May 2016, revised June 2021.

1.1 Why this? Why now? Why me?

The primary objective of any act of learning, over and beyond the pleasure it may give, is that it should serve us in the future (Bruner, 1960). It can therefore be argued that the purpose of education is to prepare young people for the future (Claxton, 2008). However, the future for young people currently studying in today's education system is increasingly uncertain. Today's learners will emerge from the relative safety of school into a constantly evolving social, political and technological landscape. Due to the rapid pace of technological progress and innovation, the volume of information that learners are exposed to has increased dramatically and will no doubt continue to grow at an intimidating rate (Zeidner & Stoeger, 2019). Daily life now involves managing the complex interaction and exchange of information between people, communities, societies and across cultures (Chong, 2006).

When today's learners progress from secondary education, they will be challenged by different settings, developments, and rapid changes in both their professional and personal lives, none of which they will have been formally prepared for. It is also suggested that the frequency with which people change jobs and careers will continue to rise (Brown, 2001), stressing the need for learners to be able to constantly learn new things (Stoeger et al., 2015). Whether today's learners remain in one role in their professional lives or whether they move rapidly from one to another over the course of their working lives, they will be confronted by frequent changes across a range of scales. In support of this, Zeidner and Stoeger (2019) state that given the increasing number of career paths that our current students will pursue within their working lives, their occupation success will require individuals to constantly update their knowledge, retool and acquire new skills and information. One consequence of these changes is the relative obsolescence of subject-specific knowledge, resulting in the necessity for lifelong learning as a key competence for many professions (European Council, 2002; Perels, Dignath, & Schmitz, 2009; Perels, Gürtler, & Schmitz, 2005). Although subject-specific knowledge may become obsolete, a rapid growth in new knowledge is ubiquitous throughout the world creating what is dubbed as the *21st century knowledge economy*. This now means that schools face the challenge of not only teaching students the substance of subjects that comprise the curriculum, but also the process of learning itself (James & McCormick, 2009). Vermunt and Verloop (1999) discuss the *inertness of knowledge* - although students may have acquired a lot of knowledge at school, they may not have acquired the capacity to apply this knowledge to solve problems in practice in the real world. As such, how best do we, as teachers, prepare them for these changes? Is it the subject-specific content that students spend many hundreds of hours learning that will be important to them, or the skills that they develop whilst engaging with this content? This question links strongly to an on-going dispute between classical objectivist theorists, whose view on the design of instruction is founded on the idea that teaching is in essence about the transfer of knowledge from an external source to the learner, and advocates of the more recent constructivist theories of learning and teaching (Duffy & Jonassen, 1992; Prawat & Floden, 1994; Vermunt, 1998).

In response to this Rozendaal et al. (2005) state that nowadays knowledge tends to become obsolete very quickly due to the rapid technological changes outlined above, in addition to market changes and continuous innovations in how work is organised to keep pace with our turbulent society. These contemporary trends in development demand the evolution of the learning landscape and in turn, the adoption of a mindset that calls for greater adjustments in learners' actions, behaviours and learning (Chong, 2006). However, in schools are we fostering learning environments where the mindset for adjustment is encouraged and developed? Learners must be able to adapt to new learning situations whilst demonstrating the persistence needed to overcome challenges in a wide variety of, as yet, undiscovered personal and professional contexts. The learning environment must, therefore, provide the opportunities for this mindset to be developed.

In terms of the school environment, there has been a fundamental shift in emphasis away from the passive memorisation and the recitation of factual information (DiFrancesca et al., 2016). Contemporary instruction increasingly focuses on the acquisition of learning processes and skills for attaining new knowledge, allowing learners to play an active role in the 21st century knowledge economy, rather than on the acquisition of basic skills or simply a large amount of information (Michalsky & Schechter, 2018; National Research Council, 2011). These skills are crucial for turning complex multimodal knowledge and information into deep conceptual understanding (Dignath & Büttner, 2008; Hattie, 2013; Veenman, 2011), and any dysfunction in these skills are indubitably detrimental to the acquisition of more complex knowledge (Azevedo, 2014; Greene, Bolick, & Robertson, 2010). The focus within schools therefore, has shifted to equipping and training students to become effective self-regulated, lifelong learners (Baars & Wijnia, 2018; DiFrancesca et al., 2016; Luftenegger et al., 2012).

In a society that requires lifelong learning, the ability to regulate one's learning and manage achievement efforts towards defined goals are competencies that we should be supporting students to develop. This provides a significant challenge to both schools and policy makers in terms of how best to facilitate the development of these skills and dispositions. Furthering this, Boekaerts (1999) states that being able to regulate your own learning is viewed by educational psychologists and policy makers alike as the key to successful learning in school and beyond. Self-regulated learning is recognised as a fundamental goal of education as it plays a crucial role in successful academic learning (Bandura, 1977; Dignath-van Ewijk, Fabriz, & Büttner, 2015; Ewijk, Dickhäuser, & Büttner, 2013; Fernandez & Jamet, 2017; Hawe & Dixon, 2017), and is a key competence for both higher academic education and future workplace learning (Bransford et al., 2000; Raaijmakers, Baars, Paas, et al., 2018). With the ever-increasing trends towards online learning, possessing appropriate self-regulated learning skills is considered crucial for today's learners operating in the *digital society* (Schunk & Zimmerman, 2007; Zeidner & Stoeger, 2019). In addition to this future-time perspective, Michalsky and Schechter (2018) contend that a significant majority of learners across a wide range of ages are not optimally self-regulated, lacking the knowledge and skills necessary to effectively manage their own learning, offering strong support for the focus of this study.

The context of Educational Psychology has seen profound changes over the last 30 years (Montalvo & Torres, 2004), and as one of the essential axes for practice (Zimmerman & Bandura, 1994), self-regulated learning has been a focus of increasing educational research. Self-regulated learning has its conceptual roots in a range of psychological fields, however it is from Vygotsky that many of the most influential ideas have been drawn (Robson, 2016a). Robson cogently argues that Vygotsky sees self-regulated learning as a prime example of *higher mental process* that forms a major part of his sociocultural theory (Vygotsky, 1978). Although self-regulated learning has received considerable research attention in the last 20 years (Robson, 2016b), interest in students' abilities to self-regulate emerged during the 1970s and early 1980s, born out of efforts to study human self-control and the acceptance of the limitations of prior attempts to improve achievement; attempts that stressed the importance of mental ability, socio-environmental background of students or indeed the qualitative standards of schools. Clearly there were other variables at work in determining students' academic achievement, and Schunk (2005a) comments on numerous studies showing that learners' skills and mental abilities did not fully explain their achievement. A broad and accumulating body of literature indicates that effective self-regulated learning skills provide a foundation for positive classroom behaviour and can be used to predict long-term academic achievement (McClelland & Cameron, 2012). Research suggests that self-regulated learners show more adaptive learning behaviour, report more positive motivational characteristics and also perform better on cognitive and learning tasks (McInerney et al., 2012; Zeidner & Stoeger, 2019). This view is supported by research which indicates that self-regulated learning has a positive effect on students' learning as well as their studying behaviours (Hattie, Biggs, & Purdie, 1996), and Boekaerts (1999) describes this growing body of research into self-regulated learning as a *tidal wave* that has swept Educational Psychology.

Each characteristic trait of self-regulated learning is believed to be trainable and that educators can facilitate students' acquisition of self-regulated learning skills (Butler, 1997, 1998; Hofer, Yu, & Pintrich, 1998; Schunk, 1998). In support of this, research shows that self-regulated learning can be effectively taught to students of all ages (e.g. Dignath et al., 2008; Dörrenbächer & Perels, 2016a; Sontag & Stoeger, 2015). Since self-regulatory processes are teachable (Dignath et al., 2008; Sontag & Stoeger, 2015; Zimmerman, 2002), teachers therefore play a crucial role in promoting the development of self-regulated learning skills (Lombaerts, Backer, et al., 2009). Perry and colleagues (Perry & VandeKamp, 2000; Perry, VandeKamp, Mercer, & Nordby, 2002; Perry, Phillips, & Dowler, 2004) repeatedly demonstrated that adjustments made by teachers to their teaching practices and the learning environment, had positive effects on students' development of self-regulated learning skills. Research indicates that teachers' design of a lesson or learning sequence is critical for helping their students develop academically effective forms of self-regulated learning (Michalsky & Schechter, 2018; Randi, 2004; Randi & Corno, 2007; Zimmerman, 2008b). As such, a number of national and international institutions have now incorporated the instruction of self-regulated learning in their education programmes as part of lifelong learning initiatives (e.g. European Qualifications Framework of Lifelong Learning, European

Commission, 2008; European Council, 2002). This demonstrates the importance and influence of changes at policy level in terms of the promotion of self-regulated learning, changes which effect a wide range of stakeholders including schools, teachers, students and parents (Hattie, 2009; Peeters, De Backer, Kindekens, Triquet, & Lombaerts, 2016).

The reason for this explicit focus on the instruction of self-regulated learning at policy level is that self-regulated learning is not spontaneously acquired, but is shaped and developed through engagement with environments that provide opportunities for students to have greater control over their own learning (Zimmerman, 2000). Most theories assume that children develop the capacity to self-regulate during primary school years (Lombaerts, Backer, et al., 2009), and that self-regulated learning and metacognitive strategies develop with age (Pressley et al., 1992). For decades experts have agreed that metacognition and self-regulated learning develop after the age of eight, however research from the last two decades reveals that metacognitive ability and self-regulated learning can be detected in younger children (Perry, 2002; Whitebread et al., 2009). De Corte, Verschaffel, and Masui (2004) identify a number of guiding principles for designing *powerful* learning environments that support the development of self-regulated learning: they include social interaction between students (collaboration), active construction of knowledge (constructivism), learning embedded in authentic situations to foster transfer (situatedness), and the development of self-regulatory skills (self-direction).

I have taught Geography for 16 years across four contrasting school settings where considerable variation has been observed in the cognitive and metacognitive abilities of students, in addition to the broad spectrum of qualitative standards of the schools themselves. As a researching practitioner, it is clear that there is a need for a more focused view of students' learning across both schools and educational research; one that places greater emphasis on the development of students' learning skills. In addition to this personal perspective, it is noteworthy that many of the professional development movements experienced during my career view students as playing a reactive role to imposed changes in their learning environment. A self-regulated learning perspective places the student at the centre of the learning process and in doing so, allocates a significant amount of responsibility to the student for both the learning processes and outcomes (Stoten, 2015). These are the types of learners that will flourish in the constantly changing world into which they will be propelled at the close of secondary education.

As outlined previously, one of the most important goals of education is to help students acquire and increase self-regulated learning skills, not only to help them successfully navigate their way through their school years, but also to provide them with the skills to continue to learn once they have left the bounds of formal education; lifelong learning (Hadwin & Winne, 2001; Nota et al., 2004; Zimmerman, 1986). In this regard, self-regulated learning is regarded as a crucial component of lifelong learning (Dörrenbächer & Perels, 2016b; Luftenegger et al., 2012). Linking this to tertiary-level education (university), the destination for over 95% of the students that leave the research setting, Dignath-van Ewijk et al. (2015) outline the findings of Sageder (1994) who found in his analyses that 25% of higher education students displayed negative conditions of motivation and attribution, which led to a decline in academic performance or worse, dropout. Research conducted by Peverly et al. (2003) supports this showing that university students regularly show a deficiency in the knowledge and use of self-regulated learning strategies. Within the context of university medical courses, although the students selected for admission to these courses are among those ranked at the top in terms of academic achievement, many medical students struggle with effective time-management and balancing a heavy and complex workload (Barbosa et al., 2018). It is clear, therefore, that some students are not equipped with the self-regulated learning skills needed to succeed at this level; skills that were not developed at during their school years. Whilst arguing that self-regulated learning is a vital life skill for both children and adults, Fitzsimons and Finkel (2011) also emphasise long-term effects suggesting that effective self-regulated learners may even be physically healthier, achieve more career success, and experience higher levels of well-being.

Despite my unwavering passion for the subject that I teach, I contend that greater emphasis must be placed on the development of these skills or *cognitive assets*, rather than simply the substantive content on which students will be examined and against which academic achievement will be judged. These binary, achievement-based judgements give rise to a constricted view of teachers' professional development and encourage practitioners to adopt a performance-based view of learning outcomes. A focus on the development of self-regulated learning skills not only empowers students to access higher levels of summative achievement, but it also encourages students to become masters of their own learning; a skill-set that will help them beyond the bounds of formal education (Zimmerman, 1990). Zimmerman (2005) asserts that perhaps our most important quality as humans is our capability to self-regulate, seen as being crucial for success throughout life (Whitebread & Bingham, 2011).

A self-regulated learning perspective also shifts the focus of educational analyses from students' learning abilities and instructional environments as fixed entities, towards students' self-initiated processes for improving their methods and environments for learning. This approach views learning as an activity that students do for themselves, proactively and overtly, rather than as a covert event that happens to them reactively as a result of teaching experiences. Furthering this, students should therefore no longer be the objects of their teacher's behaviour, but need to be animators of their own teaching and learning processes. The interaction that students have with their teachers and peers plays a crucial role in the development of self-regulatory skills (Boekaerts & Cascallar, 2006), and therefore teachers have significant responsibility for creating an environment that develops students' capacity to undertake this role (Hawe & Dixon, 2017).

When reflecting on my own practice I would contend that the development of students' learning skills has too often been covert, implicit within syllabus-focused lessons on the relentless drive towards summative checkpoints. In this regard students are viewed as passive vessels to be filled with subject-specific knowledge and information, rather than being actively engaged in the learning process, aware of their own thinking, and handed the responsibility to direct their motivation towards valuable goals (Montalvo & Torres, 2004). An improvement in students' self-regulated learning skills fosters deep and meaningful learning experiences as well as significant gains in students' achievement. As a result of these positive effects, policy makers and school leaders are increasingly initiating new developments aimed at promoting students' self-regulated learning in educational practice (Matzat & Vrieling, 2016).

1.2 Towards a Definition of Self-Regulated Learning

Despite the sheer volume of research interest in self-regulated learning, or possibly because of it, no simple and unified definition exists (Andrade & Dugan, 2011; Boekaerts & Corno, 2005; Boekaerts, Koning, & Vedder, 2006; Zimmerman, 2001). *Self-regulation* refers to an overarching construct that depicts the exercise of control over oneself and has been extensively investigated and described in classroom settings using a variety of rubrics such as metacognition, self-regulation and self-regulated learning (Effeney et al., 2013). In spite of this extensive research, the conceptual boundaries between these terms appears blurred and often entangled in the literature (Dinsmore et al., 2008). Multiple self-regulated learning theories posit widely diverse explanations of the construct, its processes and components, using similar names for theoretically different components and different names for theoretically similar components; a problem known as *construct irrelevance* (Andrade &

Dugan, 2011; Entwistle & McCune, 2004). This can lead to research based on ill-defined goals and a lack of empirical support for multiple, independently hypothesised components; something I must guard against (Andrade & Dugan, 2011). However, most researchers agree that self-regulated learning is not an all-or-none process or the property of a system, but it refers to multi-component, iterative, self-steering processes that targets one's own cognitions, feelings and actions, as well as features of the environment for modulation in the service of one's own goals (Boekaerts & Cascallar, 2006).

The development of self-regulated learning as a field of study was the result of a focus on self-regulation in academic settings (Butler, 1987; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000, 2001, 2008). Self-regulated learning is perceived as an umbrella concept overarching multiple strategies that make learners more effective (Peeters et al., 2016). Self-regulated learners are students that control their learning by actively setting goals, deciding on appropriate strategies, planning their time, organising and prioritising materials and information, modifying approaches, monitoring their learning by seeking feedback on their performance and making appropriate adjustments for future learning activities (Butler, 1987; Dent & Koenka, 2016; Effeney, Carroll, & Bahr, 2013; Puustinen & Pulkkinen, 2001; Winne, 1995; Winne & Hadwin, 1998; Zimmerman, 1989, 1990, 2001). These students are able to recognise when different strategies would be more effective, evaluating relative strengths and weaknesses of their approach, and ultimately adapting their approach in response (Boekaerts, 1997; Dent & Koenka, 2016; Winne, 1995). Winne (1995) uses the term *adaptive* to describe the self-regulated learning strategies used by successful students, contrasted against *maladaptive* strategies, those that may not yield success. Such students personally initiate and direct their own efforts to acquire knowledge and skills, rather than relying on teachers, parents, or other agents of instruction (Zimmerman, 1989). These students are also able to develop knowledge, skills and attitudes that can be transferred from one learning context to another. As discussed in the rationale for this research, it is the development of these transferable skills that is of great importance, allowing students to become lifelong learners who are able to change and adapt in response to the constantly shifting world into which they will be propelled.

Self-regulated learning is viewed as a variable process rather than a personal attribute or set of skills inherent to expertise that is either present or absent – even the most helpless of learners attempt to control their learning, but the quality and consistency of their processes are low (Zeidner & Stoeger, 2019). Kaplan (2008) suggests that modern scholars conceptualise self-regulated learning as a diverse and varied set of strategies, some of which students may use and some which they may not given their interpretation of the task, signalling a movement away from self-regulated learning being construed as a *unitary* construct. Furthering this, students exercise greater control and ownership over their learning when they have clear goals and understand where they are going (Hattie & Timperley, 2007; Hawe & Dixon, 2017). Within the context of elite level musicians, McPherson et al. (2017) argue that self-regulated learners posses the capacity to plan, set goals and imagine future success, and this shapes how they subsequently behave. Skilled self-regulated learners seek feedback from external sources such as teachers and peers, but also construct information themselves (Butler & Winne, 1995; Hawe & Dixon, 2017), self-reacting as they strive to achieve their goals, by recognising where they are going wrong and adjusting their approach to achieve their goals (McPherson et al., 2017). This capacity for reflective self-consciousness provides a platform for learners to critically examine their own actions, thoughts and feelings at all temporal stages of learning efforts, enabling them to regulate their own learning and enhancing the chances of success (McPherson et al., 2017).

Although there is some diversity to the ways in which self-regulated learning is outlined in different models, most models agree that internal self-regulated learning factors (e.g. attention) work together with external factors (e.g. classroom environment) to produce context-specific self-regulated learning (Cho & Jonassen, 2009; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). However, contemporary self-regulated learning theorists have avoided dualistic distinctions that focus on the internal and external control of learning. Instead, learners are theorised to regulate their learning through both covert cognitive means and also by overt behavioural means. Also, most self-regulated learning researchers agree that internal self-regulated learning factors are explained by motivation, metacognition and cognition factors (Cho & Jonassen, 2009; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). Mornell, Osborne, and McPherson (2018) view this approach to self-regulated learning as an important advance on existing deliberate practise literature, as it provides a framework that clarifies the behavioural, cognitive and motivational resources needing to be applied for efficient and effective learning at all levels. In this regard, breaking any cycle of sub-optimal practise strategies requires the adoption of new strategies that augment or replace old habits (Mornell et al., 2018); a strong case for the focus of this study.

Self-regulated learning has been described as the place where metacognition and motivation intersect and students can therefore be defined as self-regulated learners to the degree that they are metacognitively, motivationally and behaviourally active participants in the learning process (Zimmerman, 1989). It describes the self-directed learning processes through which learners proactively transform mental competencies into academic performance through self-generated goals and strategies (Zeidner & Stoeger, 2019; Zimmerman et al., 2015). Put simply, self-regulated learning is the fusion of skill and will (Paris & Paris, 2001). Boekaerts (1999) outlines the problem with a complex construct like self-regulated learning in that it is positioned at the junction of many different research fields, each with its own history, paradigms, terminology and current research directions (Boekaerts, 1997; Boekaerts & Corno, 2005). As such, a review of the relevant literature must be focused, accurate and logical in its discussion. Linking to teaching practice, self-regulated learning should not be viewed as a synonym for successful or optimal learning, and Bereiter (1990) highlights one of the main obstacles to supporting students' learning through the principles of self-regulated learning is that both teachers and students have naïve models of what they understand by self-regulated learning. Reflecting on this point within the context of the setting for this research, this is particularly pertinent as I perceive both students and teachers to have only a low-level or, in some cases, a deficient understanding of what is meant by self-regulated learning. That said, self-regulated learning is viewed as a powerful construct by researchers. It allows them to identify and describe the various components that are part of successful learning in addition to the ability to explain the reciprocal and recurrent interactions that occur between and among the different components. Extensive research over the past three decades has focused on self-regulated learning and a vast amount of literature now exists regarding self-regulated learning processes, their motivational preconditions and their resulting outcomes (Dresel et al., 2015).

From a teachers' perspective, self-regulated learning promotes the transfer of knowledge and skills to real-world situations, allowing students to become increasingly independent from their teachers whilst extending and updating their own knowledge base (Boekaerts, 1996). From a students' perspective, the ability to self-activate and self-direct efforts to acquire knowledge and skills by implementing specific strategies, rather than just passively reacting to their teachers' instructions must be an attractive and motivating proposition, especially given the evidence base that supports medium-term and long-term benefits to academic achievement and lifelong learning (Broadbent & Poon, 2015; Broadbent et al., 2020; Nota et al., 2004; Richardson et al., 2012; Zeidner & Stoeger, 2019).

Effeney et al. (2013) state that in the psychological and neuropsychological literature, self-regulation and the cognitive processes that serve on going, goal-directed behaviours are closely associated to the term *executive function*. Executive function is an umbrella term that is associated with the co-ordination, regulation and optimisation of the cognitive processes necessary for the formulation of goals, the planning of how to achieve them and the effective execution of those plans (McClelland & Cameron, 2019). Executive functions are high order cognitive skills that coordinate and *project manage* goal directed behaviours, allowing us to adapt to changing circumstances in a context-appropriate way (Baker, 2018; Lee et al., 2018). In this regard it is the conductor that controls, organises and directs cognitive activity, affective responses and behaviour. Miyake et al. (2000) and Finders et al. (2021) identify three distinct but interrelated executive function sub-components: working memory (updating and manipulating mental representations), inhibitory control (supressing pre-potent responses) and cognitive or attentional flexibility (the ability to switch between tasks or goals)(Lee et al., 2018). Together, executive function skills play a key role in facilitating academic achievement and classroom self-regulation (Finders et al., 2021). In terms of the development of executive functions, Lee et al. (2018) state that there is only weak empirical evidence distinguishing these three subcomponents in preschool children, suggesting that executive function comprises a unitary factor in early childhood before a divergence of these subcomponents as a function of age (Lerner & Lonigan, 2014).

In terms of the factors influencing the development of executive function, Lee et al. (2018) highlight maternal scaffolding and maternal executive function as key factors in its development. Maternal scaffolding is characterised by the constructs of *contingency*, that is the parental adjustment of levels of support to create an optional challenge for the child (Wood et al., 1976), and *intrusiveness*, parent-centred interaction marked by negative affect, overstimulation or an overwhelmingly increased pace of activity (Cuevas et al., 2014; Lee et al., 2018). Maternal executive function is a close correlate of child executive function, with moderate positive associations found at seven years of age (Wang et al., 2012) and strong associations during adolescence and young adulthood (Jester et al., 2009; Lee et al., 2018). These associations suggest some degree of heritability in terms of child executive function, highlighting the importance of biology in the development of self-regulation something discussed at length in Section 2.4.2.

The exact way executive function acts as a self-regulatory control system continues to be debated. One perspective suggests that self-regulation is the overarching concept which incorporates key components of executive function, while others view executive function as the control process that overarch all contexts and content domains, with self-regulated learning subsumed into executive function. This perspective suggests a conceptual hierarchy between executive function and self-regulated learning, with self-regulated learning being viewed as contextualised application of executive function (Effeney et al., 2013).

In terms of my own view on the relation between self-regulation and executive function, I subscribe to the framework proposed by Nigg (2017), who put forward a roadmap for a unified approach in developmental science by integrating various concepts related to self-regulation into a single framework (Vink et al., 2020). Self-regulation is used as a general umbrella term for a domain-general construct that encompasses all self-regulation components, including executive functions (Finders et al., 2021; McClelland & Cameron, 2019; Nigg, 2017; Vink et al., 2020). Nigg (2017) states that executive functions are the top-down processing of information, including emotion information, and therefore in involved in a domain general way in all top-down aspects of self-regulation. That said, Nigg (2017) emphasises that executive function should not simply be equated with top-down self-regulation, as self-regulation is an adaptive change in internal state, emotion, thought or action, whereas executive function is a set of cognitive capacities that enable self-regulation to occur (McClelland & Cameron, 2019). Consequently executive function is available for purposes other than self-regulation, for example solving a mental maths problem requires executive function but is not self-regulating (Nigg, 2017).

Stoeger et al. (2015) offer three reasons as to why self-regulated learning is becoming increasingly important. Firstly, as a result of rapid technological progress the rate of information growth has increased dramatically; therefore, reaching expertise in a given field now requires better and more intense learning processes than in the past. Further to Brown's (2001) comments, who outlined the increasing frequency with which today's learners will change jobs and careers, the second reason for the increasing importance of self-regulated learning is that the ability to engage in lifelong learning has become more important than ever. In order to equip today's learners with the skills required to cope with frequent changes in personal and professional circumstances, Stoeger et al. (2015) suggest that educational reforms have given greater emphasis to the development of self-regulatory skills. Lastly, numerous studies suggest that self-regulated learners possess more adaptive learning behaviours and are more effective at overall learning (e.g. Dent & Koenka, 2016; Dignath et al., 2008; McInerney et al., 2012; Richardson et al., 2012). This offers strong justification for the rationale behind the research focus and sets the stage for discussion of the epistemological lens through which this research will be conducted.

1.3 Epistemological Viewpoint – Constructivism

Epistemology is the branch of philosophy that attempts to explain the origin and nature of knowledge (Airasian & Walsh, 1997; Simpson, 2002). Constructivism, defined as such by Schunk (2008), views knowledge as a working hypothesis rather than as a truth. Instead of knowledge being imposed from external sources, knowledge is constructed within and is therefore subjective, personal and a product of our own cognitions (Schunk, 2008; Simpson, 2002). One of the most significant developments in educational research has been the increasingly prominent role played by constructivist approaches (Cobb & Yackel, 1996).

The central principle of constructivism is that meaning is actively constructed by learners (Cobb & Yackel, 1996; Lourenço, 2012; Piaget, 1926; Simpson, 2002; Vygotsky, 1978; Wadsworth, 1971). The construct of active agency centres around Piaget's (1926) concept of equilibration, where learners organise their experiences into schemata. When encountering new experiences, Piaget posited that one of two processes occurs: assimilation or accommodation. Assimilation takes place when new ideas are incorporated into existing schema, whereas in the process of accommodation new schema are constructed to accommodate different or unique information. Piaget also hypothesised that disequilibration can occur during cognitive conflict between expectations and experience, requiring either assimilation or accommodation to return to equilibration: cognitive *status quo*.

The second key principle of constructivism is that learning and cognitive development are socially positioned activities, emphasising the interaction of people in the acquisition of knowledge and skills (Airasian & Walsh, 1997; Lourenço, 2012; Schunk, 2008; Vygotsky, 1978; 1981). That said, it is important to note that in constructivism cognitive growth and development is not only rooted in the interaction between people, it shares the assumption with Social Cognitive Theory (see Paper 2) that people, behaviours and environments interact in reciprocal fashion (Bandura, 1977, 1986; Schunk, 2008). Constructivism therefore acknowledges that individuals cannot effectively construct meaning in isolation and thus require social interaction in order to construct meaning. As a classroom teacher this principle gives rise to some important pedagogical implications, specifically that the cognitive restructuring and acquisition of new knowledge and skills will not take place without the opportunity to work with others or collaborate during learning opportunities.

Another key principle of constructivism pertinent to this research is that learning and cognitive development are self-regulated processes (Piaget, 1926; Vygotsky, 1978; Wadsworth, 1971). This principle is based on the premise that self-regulatory processes provide the tools which people can use to control their thoughts, feelings, actions, and motivation. Drawing on Piaget's notion of disequilibration as a result of cognitive conflict, it is only through the identification of a state of disequilibration that learners can employ and execute self-regulatory strategies and processes that will allow them to return to equilibration. These self-regulatory processes control learners' motivation, behaviour, and metacognitive thoughts, allowing them to accurately assess and action the processes required to undergo this cognitive restructuring.

Boekaerts and Cascallar (2006) state that self-regulated learning researchers have profited from doing research in social constructivist learning environments, mainly because in these learning environments students wrestle with complex and challenging group learning tasks allowing researchers to examine the relationships between the processes needed to learn meaningfully in a content domain, and the self-regulated learning strategies that are necessary and sufficient to steer and direct learning. In these environments knowledge acquisition is a process of knowledge construction, with learners assimilating knowledge by relating new input to previously gained knowledge (Dignath & Büttner, 2018). These authors also posit that constructivist learning in context should occur during activities that resemble real-life situations, challenging students with authentic and meaningful problems, encouraging the transfer of skills across domains.

1.3.1 Vygotsky's Sociocultural Theory

Lev Semenovich Vygotsky, born in 1896 in Russia, proposed a sociocultural theory that emphasised the social environment as a facilitator of learning and development (Schunk, 2008). His writing has since been translated into English giving rise to questions over the accuracy of translation and potential linguistic interpretation errors, in addition to the mediation that now exists between the reader, translator, editor and Vygotsky himself. Sutton (1983) has shown that there are issues relating to Vygotskian translations and that researchers should proceed with caution. However, Whitebread and Bingham (2011) assert that today understandings of children's early learning within modern developmental psychology and among early educators in the UK are much more influenced by Vygotsky's sociocultural theory, providing further support for its use as the epistemological lens for this research.

Vygotsky challenged the widely accepted Piagetian view that psychological structures are individualistic constructs and an internal model of outside reality (Meadows, 2004). He rejected introspection and changed the way consciousness was viewed by considering the influences of the environment. Instead Vygotsky offered a theory where cognitive abilities and capacities are developed in part by social phenomena and are consequently public and intersubjective, created through interaction with the social environment. He argued that any function in a child's cultural development appears twice or on two planes; firstly on the social plane and secondly on the psychological plane (Vygotsky, 1981).

Wertsch (1985) further explains Vygotsky's theory about the origins of individual psychological processes, as higher mental function appears initially as an external form before being internalised fostering cognitive development. This is in unique contrast with individualistic cognitive approaches as knowledge and skills are learned socially from more competent peers, leading to internalisation. In this regard the child is supported by the adult or more capable peer in the guided reinvention of the accumulation of knowledge and skills (Meadows, 2004). The skills required by the learner at the most primitive stage of learning are observation and imitation, however it can be argued that even these fundamental skills would not develop without social interaction. Van Oers (1996) provides a mathematical context for the use of observation and imitation-learning skills, suggesting that students should imitate culturally established mathematical practices when they interact with the teacher in order to enhance their mathematical knowledge and skills. Interestingly, observation and imitation form the first two levels of the development of self-regulatory skills (Zimmerman, 2013), reinforcing the importance of self-regulation as a key principle underpinning the sociocultural epistemology.

Meadows (2004) asserts that internalisation is an important concept that lies at the heart of Vygotskian theory. Understanding the relationship between the external and the internal has been one of the great challenges for philosophy and psychology. Vygotsky stresses a close and complex relationship between external social processes and internal psychological ones (Meadows, 2004; Wertsch, 1985), stating that all higher mental functions are internalised social relationships - their composition, genetic structure, and means of action – in a word, their whole *nature* (Vygotsky, 1981). He theorised that it is these social relationships, interpersonal interactions with persons and their environment, that stimulates developmental process and cognitive growth leading to the gradual emergence of control over external processes such as signs and systems of communication. The use of sociocultural tools such as signs, symbols and language is described as mediation and is what facilitates higher mental processes (Karpov & Haywood, 1998). Mediation is therefore the use of communicable systems for representing intrapsychological reality and action in response to it. As a classroom teacher the pedagogical implications of this are that I must not simply provide the opportunity for students to mediate through collaborative learning activities, but these interpersonal learning opportunities must underpin my teaching philosophy. Without these interpersonal learning opportunities, it could be argued that I am not applying these sociocultural principles to my teaching and therefore using them to guide students' cognitive growth and development.

It would be remiss of me to round off my discussion of Vygotsky without exploring the concept of the *zone of proximal development*. Vygotsky (1978) defines this as the distance between the actual developmental level as determined by independent problem solving, and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. He presents the zone of proximal development as part of his discussion of learning and development, where he argues that at least two developmental levels must be present if we are to provide learning opportunities which will enable the child to develop (Meadows, 2004; Vygotsky, 1978; Wertsch, 1985). The zone of proximal development outlines these two developmental levels - the lower level as the current level of problem solving that the child can do independently, unaided, highlighting their current level of cognitive mastery, and the higher level where problems can only be solved with assistance from an adult or more capable peer. Vygotsky stresses the only *good learning* is that which is slightly in advance of development, highlighting the need to pitch learning tasks at a level just beyond what the learner is currently capable of successfully completing independently. This gives rise to practical questions of where this level is for each learner on different learning tasks and how this level changes over time and across different disciplines that make up a student's curriculum. However, it also raises important conceptual questions over the use and development of self-regulated learning skills while the learner is in the zone of proximal development.

1.4 Paper 1 Summary

This opening paper of this EdD portfolio has provided a clear context and rationale for the research focus, self-regulated learning. The construct of self-regulated learning has been defined and discussed, drawing on a wide range of literature and research. The epistemological lens of constructivism through which this research will be viewed has then been outlined and reasoned, linking to Vygotsky's sociocultural theory that emphasises the social environment as a facilitator for learning and cognitive development. This paper provides a compelling introduction to this portfolio and a strong foundation on to which the theoretical framework and methodology can be added in subsequent papers.

Paper 2

Literature Review – Self-Regulated Learning

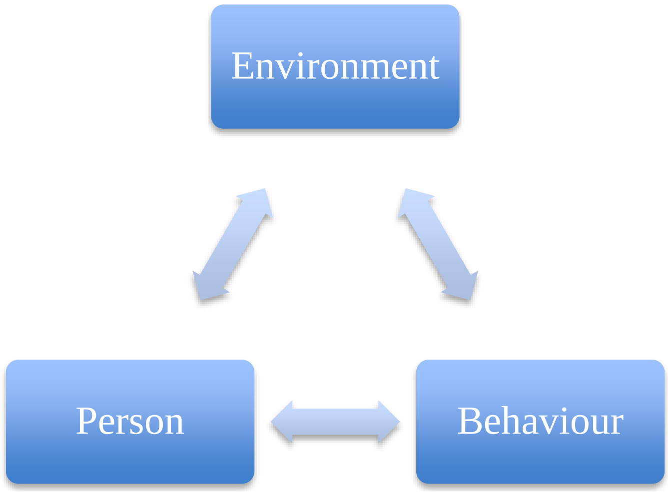
This paper builds on the key themes outlined in Paper 1 by discussing Bandura's Social Cognitive Theory before applying this construct to self-regulated learning. The two broad categories of self-regulated learning models, process and component models, are then introduced, compared, and contrasted. The self-regulated learning model forming the theoretical framework of this study, Zimmerman's cyclic model, is then outlined and critically analysed, drawing on a wide range of literature and research. This paper then continues to explore key areas pertinent to this study, including the relative influences of the environment and biology on the development of self-regulated learning, self-regulated learning and achievement, in addition to the pedagogy of self-regulated learning interventions. The paper closes with an examination of the literature relating to teacher training and self-regulated learning. By providing a critical review of the relevant literature relating to self-regulated learning, this paper forms a significant contribution to this portfolio.

Written August 2016, revised June 2021.

2.1 Self-Regulated Learning – A Social Cognitive Paradigm

Bandura's Social Cognitive Theory stresses the notion that learning occurs in a social environment (Schunk, 2008). He theorised human behaviour as operating within a framework of *triadic reciprocality* among behaviours, environmental variables and covert personal (i.e. self) factors (see Figure 2.1.1). In the context of Social Cognitive Theory, self-regulated learning is not determined merely by personal processes; these processes are assumed to be influenced by environmental and behavioural events in reciprocal fashion (Zimmerman, 1989). Behaviour is a product of both self-generated and external forces of influence, summarising the essence of this separable but interdependent triadic formulation (Bandura, 1986; Puustinen & Pulkkinen, 2001). However, Bandura (1986) signalled that reciprocality does not mean symmetry in strength between the different domains of bidirectional influence. It is important to acknowledge the variation in terms of the strength of influence between the three factors shown in Figure 2.1.1 and how these factors will change in different contexts. The relative strength of the personal, behavioural and environmental influences can be altered by personal efforts to self-regulate in response to outcomes of behavioural performance and also changes to the environmental context (Zimmerman, 1989). The significance of this theoretical framework is emphasised in Bandura's (1986) contention that learning is largely an information processing activity in which information about the structure of behaviour and about environmental events is transformed into symbolic representations that serve as guides for action. Linking this to my own research context, it is important to be sensitive to the impact of personal experience shown temporally through the varying levels of self-regulated learning abilities with which students arrive at the school. In addition, there is the variation of the environmental context that can be observed between departments, classrooms, and teachers.

Figure 2.1.1
Triadic Reciprocality Model of Causality (Bandura, 1986)



Whilst I acknowledge the arguments supporting the rubricisation of Bandura as a neo-behaviourist, namely his focus on modelling and observational learning (e.g. Green, 1989; Travers, 1993), I would argue that Bandura’s Social Cognitive Theory is highly compatible with the sociocultural principles outlined in Paper 1; an assertion that underpins the epistemological and theoretical framework of this research. As discussed in Paper 1, for any theory to be considered constructivist it must place a primary focus on the founding principle that meaning is actively constructed as a response to experience. Bandura (1986) highlights this active construction of meaning, as learning and development require distinguishing between standards of what one knows and standards of what one desires to know. It is the latter standards, together with perceived self-efficacy that exert selective influence over which of many activities will be actively pursued (Bandura, 1986). These thoughts provide strong support for the notion of constructivism due to the active pursuit of the construction of knowledge so evident in these words. However, it can also be argued that a metacognitive component is alluded to, as it infers metacognitive awareness of the gap between what one knows and what one desires to know. An awareness of this *gap* is shaped by an individual’s observational learning and their construction of meaningful interpretations from on-going modelled events, leading to equilibration and internalisation (Bandura, 1986).

The second key principle of constructivism outlined in Paper 1 was that learning and cognitive development are socially positioned activities. Bandura (1986) asserts that a new-born baby arrives without any sense of self – the self must be socially constructed through transactional experiences with the environment. This highlights not only the centrality of socially positioned activities in the development of the self, but also emphasises the framework of triadic reciprocality that Bandura put forward, clearly delineating the reciprocal interaction between the self, environmental variables and behaviours.

Schunk (2008) argues that social cognitive perspectives can be applied extensively to self-regulation and self-regulated learning, further supporting a sociocultural epistemology of this theoretical framework. Social Cognitive Theory asserts that self-regulatory mechanisms provide the potential for self-directed change, thus influencing both behaviour and the environment. Clark and Zimmerman (2014) affirm that self-regulation is the process by which an individual attempts to control the three (triadic) factors outlined by Bandura, in order to attain a goal. The classical social cognitive perspective viewed self-regulation as comprising three sub-processes: self-observation, self-judgement, and self-reaction. These performance-related sub-processes are assumed to interact with each other in a reciprocal fashion. Consequently the manner and degree to which individuals can affect their own behaviour is dependent on the accuracy and quality of their self-observation and self-monitoring, the judgements they make with regard to their actions and attributions, and lastly the evaluative and affective reactions they have to their own behaviour (Simon, 1999). To develop self-regulatory skills, Bandura (1986) recommends observing social models who actively display these three sub-processes, then actively trying to master these functions: another strong link to the first two levels in the development of self-regulatory processes.

Bandura's point offers further support to the notion of the active construction of knowledge but also stresses the need for support from social models, or as Vygotsky (1978) articulates, more capable peers.

Zimmerman (1989) used Bandura's triadic analysis of human functioning in conjunction with research on cognitive modelling, feedback, and the role of strategies to develop a social cognitive model of self-regulated learning. By considering the interaction of the three factors identified by Bandura, Zimmerman (1989) was able to identify and apply the feedback pathways operating between the three factors within the social cognitive model (see Figure 2.1.2). Feedback from these processes enables self-regulated learners to adapt to changes in their social and physical environments, behavioural outcomes, and covert thoughts and feelings (Zimmerman, 2013).

Figure 2.1.2
A Triadic Analysis of Self-Regulated Functioning (Zimmerman, 1989)

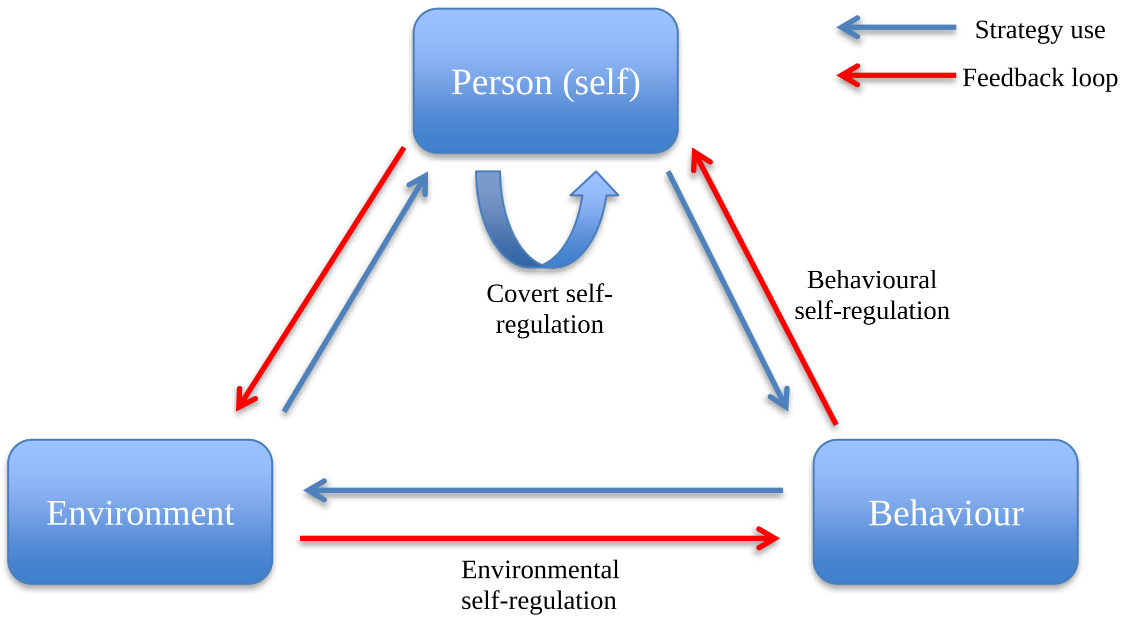


Figure 2.1.2 shows a triadic analysis of self-regulated functioning, including the three interdependent strategic feedback loops that regulate covert, behavioural and environmental processes (Zimmerman, 1989, 2013). Behavioural forms of self-regulation refer to self-

observing one's performance and adapting it strategically. Environmental forms of self-regulation involve monitoring and strategically controlling the constantly changing environmental conditions. Covert forms of self-regulation refer to adapting thoughts and feelings (Zimmerman, 2013). Empirical evidence supporting the pivotal role that social and environmental factors play in self-regulated learning is plentiful (e.g. Patrick, Ryan, & Kaplan, 2007; Perry, VandeKamp, Mercer, & Nordby, 2002; Wolters, 2004). Table 2.1.1 provides a greater context to the triadic analysis of self-regulated functioning shown in Figure 2.1.2, identifying the sub-categories for the triadic determinants of self-regulated learning (Clark & Zimmerman, 2014).

Table 2.1.1
Triadic Determinants of Self-Regulated Learning (Clark & Zimmerman, 2014)

Learning Environment Influences	Person (self) influences	Behvaioural Influences
Physical context	Prior knowledge	Self-observation
Social sources	Self-efficacy beliefs	Self-judgement
	Goals or intentions	Self-reaction
	Metacognitve processes	- Environmental
	Affective processes	- Covert personal behavioural

2.2 Models of Self-Regulated Learning

Since the birth of self-regulated learning in educational research, a number of models have been hypothesised, discussed and used as a theoretical framework. There are two broad groups of models; process models of self-regulated learning and component models (Kistner et al., 2010; Winne & Perry, 2000; Wirth & Leutner, 2008). Process models of self-regulated learning focus on the phases of events that constitute the ideal process of self-regulated learning and the sub-process requirements placed on the learners (Pintrich, 2000; Winne &

Hadwin, 1998; Zimmerman, 1998, 2000, 2001). Process models identify and differentiate between phases before, during and after learning efforts and subsequent learning states, in which the learning behaviour can be adapted (Klug et al., 2011).

Component models complement process models, describing the competencies that facilitate learning in a self-regulated way. Component models of self-regulated learning (e.g. Boekaerts, 1999) consist of three relatively stable competencies that are embedded as layers into each other and are relatively enduring attributes of the person; cognitive, metacognitive and motivational (Klug et al., 2011). The inner, cognitive layer consists of strategies that the learner uses to regulate the process of knowledge acquisition and information processing. The middle layer, metacognitive regulation, facilitates the super-ordinated regulation of learning. The final outer layer, motivational regulation, involves the management of internal and external learning resources, such as motivation, emotion, time management and the learning environment itself. Although the cognitive, metacognitive and behavioural dimensions of self-regulation are distinct, in practice they are generally intertwined; changes in one dimension may well lead to changes in the other dimensions (Ning & Downing, 2015).

Table 2.2.1 shows a comparison of five key self-regulated learning models identified in the literature. They have been compared and categorised according to their type of definition, theoretical foundations, and the nomenclature of the different phases of self-regulated learning as outlined by the authors. The two broad divisions outlined by Wirth and Leutner (2008) are evident in the figure, in addition to the dichotomy in definitions between a goal-oriented process and metacognitively governed process. These differences arise from the theoretical foundations underpinning the authors' models; however it is important to note the use of Bandura's Social Cognitive Theory in the development of Winne's, Pintrich's and Zimmerman's models of self-regulated learning. Following the detailed examination of numerous meta-analyses, self-regulated learning interventions based on Social Cognitive

Theory achieve the largest effect sizes (Dignath, Büttner, & Langfeldt, 2008; Dignath & Büttner, 2008; Stoeger, Fleischmann, & Obergriesser, 2015). As such, this research project and literature review will focus on Zimmerman’s model of self-regulated learning which provides a theoretical framework of self-regulated learning based on Social Cognitive Theory.

Table 2.2.1

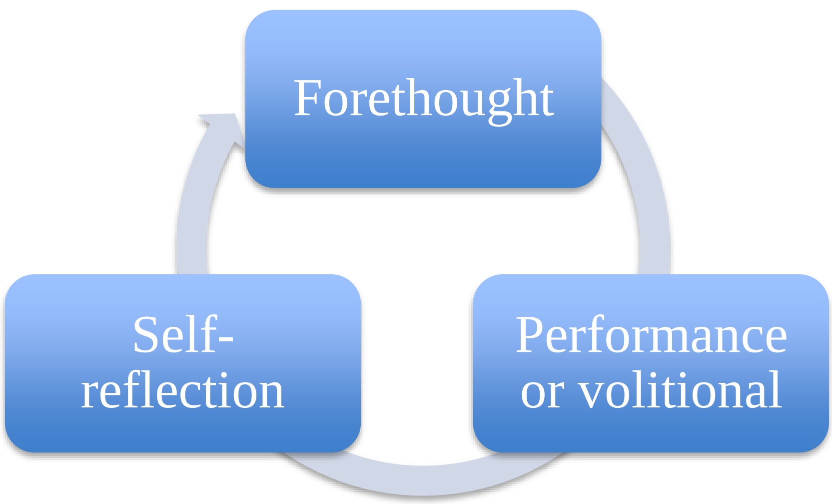
Comparison of the Five Key Self-Regulated Learning Models

Component/ Process	Author	Type of definition	Theoretical foundation	Summary	Preparatory/ Preliminary phase	Performance Phase	Appraisal Phase
Process	Zimmerman (2000)	Goal-oriented process	Bandura's (1986) Social Cognitive Theory	Known as *Zimmerman's Model*, this model represents three cyclical phases of self-regulated learning that explains the interrelation of metacognitive and motivational processes.	Forethought – task analysis, self-motivation	Performance – self-control, self-observation	Self-reflection – self-judgement, self-reaction
Process	Pintrich (2000)	Goal-oriented process	Bandura's (1986) Social Cognitive Theory	A four-phase model which each has four different areas for regulation: cognition, motivation/affect, behaviour and context.	Forethought, planning, activation	Monitoring, control	Reaction and reflection
Process	Borkowski (2000)	Metacognitively governed process	Information processing and metacognitive research	A process-oriented model of metacognition which describes the development of self-regulation (referred to as executive functioning by the author), as proceeding from learning lower level cognitive skills gradually linked to positive motivational states.	Task analysis, strategy selection	Strategy use, strategy revision, strategy monitoring	Performance feedback
Component	Boekaerts (1991)	Goal-oriented process	Kuhl (1985) social action theory and Lazarus and Folkman (1984) transactional stress theory	A structural model in which self-regulation is divided into six components: domain-specific knowledge and skills, cognitive strategies, cognitive self-regulatory strategies, motivational beliefs and theory of mind, motivation strategies, and motivational self-regulatory strategies.	Identification, interpretation, primary and secondary appraisal, goal setting	Goal striving	Performance Feedback
Component	Winne and Hadwin (1998)	Metacognitively governed process	Bandura (1986), Zimmerman (2000), Carver and Scheier (1990), Kuhl (1985), Paris and Byrnes (1989)	A four-phase model with a strong metacognitive perspective that acknowledges the goal-driven nature of self-regulated learning, whereby students manage their own learning by monitoring, use of (meta)cognitive strategies, and regulating motivation.	Task definition, goal setting, planning	Applying tactics and strategies	Adapting metacognition

2.3 Zimmerman's Model of Self-Regulated Learning

Zimmerman (1998, 2000) developed a model of self-regulated learning which stems from the social cognitive theoretical framework formulated by Bandura (1986). Over the last 25 years this model has served as a cornerstone in self-regulated learning research (Dunn & Lo, 2015). Zimmerman's model is the basis for many intervention studies as it contains several components that are trainable via strategy instruction (Dörrenbächer & Perels, 2016a; Perels et al., 2009), providing strong justification for its selection as the theoretical framework for the present study. Zimmerman (2011) defines self-regulated learning as a set of processes whereby learners personally activate and sustain cognitions, affects, and behaviours that are systematically oriented towards the attainment of personal goals. Perels, Gürtler, and Schmitz (2005) emphasise that Zimmerman regards this definition as a process definition of self-regulated learning as opposed to a definition that emphasises a trait, stage or ability, therefore allowing for explanation of why learners may self-regulate one performance but not another.

Figure 2.3.1
Cyclical Phases of Self-Regulated Learning (Zimmerman, 2000)



One aspect of Zimmerman's model of self-regulated learning that differentiates it from other models is that it is conceptualised as a cyclical process (see Figure 2.3.1), where feedback from prior performance is used to make adjustments to current and future achievement efforts. Linking strongly to Bandura's (1986) triadic reciprocality, where personal, behavioural and environmental factors are dynamic and constantly changing during performance, and therefore require self-oriented feedback loops that stem from these sources. In summary, the students' active adaptation to personal, behavioural and environmental changes is central to this process (Dörrenbächer & Perels, 2016a).

Zimmerman's model of self-regulated learning is characterised by three cyclical phases that occur across a learning cycle. In the first phase, forethought, influential processes that precede learning efforts set the stage for learning. The second phase, the performance or volitional phase, involves processes that occur during learning efforts and affect concentration and action. The third phase, self-reflection, involves processes that occur after learning efforts, the outcomes of which feedback into the forethought phase forming the start of the next cycle. A summary of the phase structure and sub-processes occurring within each phase can be seen in Table 2.3.1.

Table 2.3.1

Phase Structure and Sub-Processes of Self-Regulation (Zimmerman, 2000)

Cyclical self-regulatory phases		
Forethought	**Performance/Volitional Control**	**Self-reflection**
Task analysis	Self-control	Self-judgement
- Goal Setting	- Self-instruction	- Self-evaluation
- Strategic Planning	- Imagery	- Causal attribution
Self-motivation beliefs	- Attention focusing	Self-reaction
- Self-efficacy	- Task strategies	- Self-satisfaction/ affect
- Outcome beliefs	Self-observation	
- Intrinsic interest/value	- Self-recording	- Adaptive-defensive
	- Self-experimentation	
- Goal orientation		

2.3.1 Forethought Phase

The forethought phase precedes actual task performance and subsumes processes that set the stage for the learner's future learning activities (Schunk, 2014; Zeidner & Stoeger, 2019; Zimmerman, 2000). This phase incorporates the beliefs, attitudes and processes with which a student engages prior to tackling a learning activity (Dunn & Lo, 2015). As shown in Table 2.3.1, Zimmerman (2000) identifies two distinctive and inter-related categories of sub-processes as part of the forethought phase: task analysis and self-motivational beliefs. These are said to set the tone or approach for learning (Cleary & Zimmerman, 2004).

In order for students to regulate their own learning, first they must become aware of the task demands by analysing the task in addition to its cognitive and behavioural demands. Zimmerman (2000) states that a key component of this task analysis is goal setting. Goal setting refers to the decisions made by learners about specific outcomes of learning or performance (Locke & Latham, 1990). Students consider two crucial variables when establishing goals: the assessment criteria and the performance level they want to achieve (Panadero & Alonso-Tapia, 2014; Winne & Hadwin, 1998). Students have difficulty establishing appropriate goals when the criteria against which their performance is assessed is not shared in advance (Panadero & Alonso-Tapia, 2014). This has important pedagogical implications in order to support students' development of self-regulated learning skills in the classroom. Assessment criteria should be made explicit when introducing a learning task, allowing students to activate the sub-processes in the forethought phase. This practice-based implication is supported by research that found positive effects on students' learning when assessment criteria are explicitly stated (Andrade & Valtcheva, 2009; Jönsson, 2013; Jönsson & Panadero, 2017).

High-level self-regulators set distal outcome goals for themselves and use more proximal process goals to regulate their performance in pursuit of these distal goals. There are strong links here to learners' self-efficacious beliefs. In support of this, Bandura and Schunk (1981) published evidence that as students pursued and attained proximal goals in Mathematics, they developed greater self-efficacy and intrinsic interest. However, Bandura also hypothesised that rather than goal setting influencing self-efficacy, the reverse of this is also possible, as personal goal setting is influenced by self-appraisal of capabilities (Bandura, 1993). This interplay highlights the dynamic and symbiotic relationship between self-efficacy and goal setting, something to be revisited later in this section. Applying this to practice, learners must be given time before beginning a task to set goals for their learning, also being supported in the development of their goal setting skills.

The second sub-process that forms part of task analysis is strategic planning. In order for a skill to be mastered or used optimally, appropriate strategies have to be selected. Planning is a key self-regulatory process and is a good predictor of success (Zimmerman, 2008a). Pressley and Woloshyn (1995) state that appropriately selected strategies enhance performance by aiding cognition, controlling affect and directing motoric execution. The dynamic nature of personal, behavioural and environmental factors gives rise to the need for cyclical adjustment in the planning and selection of self-regulatory strategies (Zimmerman, 2000). As with goal setting, the planning, selection and adjustment of appropriate strategies will initially require support from more capable peers. It is only through engagement with new strategies that learners can move forward in this regard. Linking to the rationale for this research focus, it is these self-regulatory sub-processes that will be of great value to students beyond secondary education, where individuals must be able to adjust their goals and strategy choice in order to thrive in constantly shifting interpersonal and contextual conditions.

Self-regulated learning skills are of little value if learners cannot motivate themselves to use them. In the ever-changing demands of daily life, a high motivation to learn is a fundamental requirement (Spinath & Spinath, 2005; Zimmerman, 2000). As a classroom teacher this comment resonates strongly as effective learners are able to foster the sustained motivation required to successfully negotiate learning tasks, tests and examinations, but also beyond school in future academic challenges. Spinath and Spinath (2005) go on to highlight the need for teachers to possess both the knowledge and means with which to enhance students' learning motivation, describing it as a *necessity* in a learners' portfolio of skills. Furthermore, a large body of research shows that learners who have been trained in self-regulated learning processes display high levels of motivation (Boekaerts, 1997; Lombaerts, Backer, Engels, Braak, & Athanasou, 2009; Perry & VandeKamp, 2000; Zimmerman, 2002).

Self-efficacy is defined as one's beliefs in their ability to successfully complete a task (Bandura, 1977, 1986). While all motivational beliefs are important, efficacy is a critical motivation process because of its effectiveness in predicting learners' choice of activities, effort levels and persistence when encountering challenge (Bandura, 1977; Dunn & Lo, 2015). For example, if students possess high self-efficacy expectations they are more motivated to learn as they believe they possess beneficial strategies that will help them to learn and will make effective use of these strategies when encountering difficulty (Schunk, 2005a; Panadero & Alonso-Tapia, 2014). In contrast, if a student perceives himself or herself to be incapable or as lacking the strategies needed to successfully complete tasks, their motivation will decrease. By foreseeing their own failure to complete the task they will put little effort into completing the learning activity. There is evidence from self-regulated learning studies which suggests that students with high self-efficacy have shown more diverse use of cognitive learning strategies than low self-efficacy students (Cho & Jonassen, 2009; Pintrich, 1999). This raises the question of how teachers can improve students' self-efficacy beliefs that will subsequently enhance both their motivation to learn and their use of a greater range of cognitive learning strategies?

It is important to note that a number of researchers cite an important link between self-efficacy and goal setting. The more capable the students perceive themselves to be (high self-efficacy), the higher the goals they set for themselves and the more committed they are in the pursuit of these goals. This gives rise to important questions as to how students construct their self-efficacious beliefs and from what stimuli? Can goal setting influence learners' self-efficacy beliefs? In response to this Zimmerman (2000) states that goals can reciprocally effect self-efficacy beliefs as self-regulated learners often adopt process goals for themselves whose progressive mastery provides them with immediate satisfaction about the learning progress made, thus positively influencing their beliefs about their ability to complete future learning tasks. That said, this is only possible if the students are metacognitively aware of their progress, achieved through the regular reflection on progress through the learning task, providing natural checkpoints at which goals can be altered and strategies evaluated.

Pintrich, Roeser, and DeGroot (1994) investigated the relationship between self-efficacy and components of self-regulated learning. The results of their study suggested a strong positive correlation between academic self-efficacy beliefs and cognitive strategy use, and self-efficacy beliefs and self-regulation. An investigation conducted by Zimmerman and Martinez-Pons (1990) added empirical support to the theory that components of self-regulated learning are developmental in nature, with the authors concluding that students show developmental increases in academic self-efficacy over time due to their growing academic knowledge. The Self-Regulated Learning Interview Schedule (SRLIS) was administered to participants drawn from 5^{th} (10-11 years old), 8^{th} (13-14 years old) and 11^{th} (16-17 years old) grades to identify relationships between academic self-efficacy in reading comprehension and mathematical problem solving, and students' use of 14 classes of self-regulated learning strategies. The two efficacy measures were found to be correlated, with gifted students demonstrating greater self-efficacy in both academic areas than students of regular ability, and older students demonstrating greater academic self-efficacy in both subjects than younger students.

The second self-motivational belief is outcome expectations. Outcome expectations are beliefs about the success of a given task (Zimmerman, 2011). If learners possess low outcome expectations they will not make the effort needed to be successful. Pajares (1997, 2012) points out the common misconception that although outcome expectation and self-efficacy are very similar, they are different constructs. This is highlighted by Panadero and Alonso-Tapia (2014) who use the pertinent example of a researcher to emphasise the difference between the two constructs. A researcher can have high self-efficacy beliefs but low outcome expectations if they believe that they are capable of doing excellent research, however their awareness of the potential for mistakes and the vulnerability posed by external evaluation of any research conducted gives rise to low outcome expectations. As both a teacher and a researcher, this duality of beliefs is important to acknowledge as neither construct, self-efficacy nor outcome expectations, is a fixed, static trait. They are dynamic personal constructs and similarly to Bandura's triadic reciprocity, they will grow and develop in response to interaction with both behavioural and environmental factors.

Thirdly, intrinsic interest and value are said to be variables that energise learners' initial approach to the learning task (Panadero & Alonso-Tapia, 2014). In terms of task value, if students perceive the task to be interesting, important, useful and ultimately worthwhile, they are more motivated to perform the task and to learn from it. Task value has simply been defined as the incentive for engaging in different tasks (Pintrich et al., 1991, 1993). Relating this to practice, it is important that all learning tasks and activities are explicitly related to the syllabus or specification studied to stress the relevance and usefulness to learners. By understanding its utility, students are more motivated to engage with that learning task as they can clearly see how the proposed learning activity will benefit them. Similarly to self-efficacy and outcomes expectations, task value and interest are easily conflated constructs. However, Ainley et al. (2002) differentiate between these by providing clarity with regard to interest, highlighting three sub-categories: individual, situational and topic.

Individual interest is a person's pre-disposition to attend to a certain stimuli, event or object. Certain aspects of the environment, for example the task characteristics or content features of the task, generate situational interest. And lastly, topic interest is the level of interest generated as a result of a certain topic being presented upon which the task is based.

The fourth variable for motivation is that of goal orientation, defined as the integrated set of beliefs, intentions and purposes that drive engagement in academic tasks (Ames, 1992). It is a conscious striving towards learning progress, the striving for learning, task, or mastery goals. Despite the controversy in the field as to whether there are three or four different goal orientations (Panadero & Alonso-Tapia, 2014), there is a large body of research that supports the idea that learning goals, also referred to as mastery goals, foster and sustain greater levels of intrinsic motivation and personal interest in a learning task (Butler, 1987, 1988; Deci & Ryan, 1985; Dweck, 2000; Mueller & Dweck, 1998). Further empirical research evidence suggests that learners with mastery goals select and make use of cognitive learning strategies that promote deeper learning, demonstrate higher self-efficacy, have more advanced reflection processes and they recover faster from failure in academic tasks than those students who do not adopt this goal orientation (Barron & Harackiewicz, 2001; Bouffard & Couture, 2003; Bråten & Strømsø, 2004; Harackiewicz, Barron, & Elliot, 1998; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Middleton & Midgley, 1997; Midgley, Kaplan, & Middleton, 2001; Schunk, 2005a; Wolters & Rosenthal, 2000; Wolters, 2004).

In Schunk's (2005b) review of Pintrich's educational legacy, he reported that mastery goal orientation was positively related to deeper cognitive processing and negatively related to surface cognitive processing. Mastery approach goals were positively related to self-efficacy, task value, and positive attributions and affect. The author stated that students who believed they were capable of learning were more likely to adopt mastery goal orientations. Conversely, he suggested that students who were not confident in their academic capabilities were more likely to adopt performance-avoidance goal orientation.

Kaplan and Midgley (1997) reported that self-efficacy moderated the relationship between both mastery and performance goal orientation and adaptive and maladaptive strategy use in their study of 229 7th and 8th grade students (12-14 years old). Self-efficacy was positively correlated with mastery goal orientation in English and Mathematics, while performance goal orientation was not correlated with either subject. These findings are further supported by research conducted by Middleton and Midgley (1997) on a sample of 575 6th grade students (11-12 years old), where mastery goal orientation positively predicted academic self-efficacy and use of self-regulated learning strategies, and negatively predicted avoiding seeking help when needed.

Zusho et al. (2003) found moderate correlations between metacognitive strategy-use and motivational constructs such as task value, interest and mastery goals. Zusho (2017) states that such findings are further supplemented by a wealth of other data, for example in one of the earliest studies Pintrich and de Groot (1990) noted moderate to strong correlations between 7th graders (12-13 year olds) use of cognitive strategies and their reports of self-efficacy and mastery goals. Using prior and subsequent semester grades and the Motivated Strategies for Learning Questionnaire (MSLQ), the researchers collected data on motivational and self-regulated learning components of classroom academic performance in both Science and Mathematics. Results indicated that higher levels of self-efficacy correlated positively with cognitive strategy use and self-regulated learning. Linking to a previously discussed self-motivation sub-process, self-efficacy was also positively correlated with prior and subsequent academic achievement, further supporting the notion that students with strong self-regulated learning skills achieve better grades.

Despite supporting the claims that achievement goal orientation has a powerful influence on academic success, Panadero and Alonso-Tapia (2014) argue that the role of goal orientation is less clear in Science learning and that more research is required to expand on the current level of understanding. Linking this to practice, it is clear that teachers need to foster a learning environment that encourages the development of a mastery goal orientation, as students with this mindset will be more motivated to learn and will develop strong self-regulatory processes in both the performance and self-reflection phases.

The four processes outlined above are interrelated and interact during the forethought phase of Zimmerman's cyclic model of self-regulated learning. Kuhl (2000) states that their influence can happen in seconds and learners might not even be aware of these processes happening. Despite this lack of awareness, these motivational processes are vital in determining learners' movement from analysing and visualising the task to actually performing it (Panadero & Alonso-Tapia, 2014). Self-regulated learning is the interconnected framework of these processes that operate to determine development and sustainability, and motivation is said to be a critical factor in this framework (Zumbrunn, 2011).

A major criticism of this first phase of Zimmerman's model is that it is cognitively oriented and that emotion does not play a major role in the forethought phase (Panadero & Alonso-Tapia, 2014). Conversely Boekaerts' model of self-regulated learning (Boekaerts, 1999; Boekaerts & Corno, 2005) cites a greater role of emotion in the planning phase relative to Zimmerman's model. Boekaerts argues that self-regulated learning can be top-down relating to growth goals, or bottom-up relating to well-being goals – this difference in taxonomy places greater emphasis on the role of emotion in goal setting. That said, Panadero and Alonso-Tapia (2014) suggest that one of the reasons why Zimmerman might not have included emotions in the forethought phase is that emotions are highly complex and consequently the motivational effects of emotions are difficult to measure. In the forethought phase Zimmerman places far greater emphasis on the widely researched construct of self-efficacy, possibly because it has been proven to be a good predictor of performance relative to efforts to measure emotions physiologically which have revealed poor predictions (van Dinther et al., 2011).

2.3.2 Performance Phase

The performance phase or volitional phase can be summarised as attempts by learners to monitor and control their cognitions, motivation, behaviour and contextual factors in order to enhance learning (Schunk, 2005b). These performance processes effect learners' attention and action, helping to motivate them towards the goals set during the forethought phase. Corno (1994) discusses volition as an old psychological construct with more modern, philosophical ties, defined as the tendency to maintain focus and effort towards goals despite potential distractions. Rather than discussing performance and volition as separate constructs, I fully endorse Zimmerman's conflation of these terms as this *middle* phase of self-regulatory processes is not simply the act of monitoring and the control of cognitions, motivation and behaviour, but it is the control of these factors in the face of a wide range of potential distractions, towards the goals set during the forethought phase. Once again this highlights the interconnectedness between the different phases and sub-processes of

Zimmerman's model of self-regulated learning, but also the social cognitive underpinnings of triadic reciprocality between the person, the environment and behaviour.

As shown in Table 2.3.1, there are two main types of performance or volitional control processes: self-control and self-observation. Self-control processes include self-instruction, imagery, attention focusing and task strategies, helping learners to concentrate on the task and optimise their efforts (Puustinen & Pulkkinen, 2001). Self-instruction involves learners either overtly or covertly describing how to proceed as they engage with a leaning task (Zimmerman, 2000). These are self-directed orders or descriptions about the task that is being performed, and these types of verbalisations are believed to improve learning and are considered crucial for self-regulation (Schunk, 1982). As an important pedagogical implication, students should be encouraged to self-instruct, verbalising their progress through the learning task being performed. Learners might attach a stigma to self-instruction, as it could be perceived as a weakness to have to self-instruct resulting in disinclination to engage with this hugely beneficial sub-process of self-regulated learning. As such, careful consideration must be given to the pedagogical implementation and support of this useful facet within the classroom context.

Imagery is the formation of mental images that organises information and helps learners to focus their attention on enhancing learning (Zimmerman, 2011). Images increase interest as they allow the student to visualise situations linking to previously mentioned motivational sub-processes (Panadero & Alonso-Tapia, 2014). Sport psychologists endorse the use of imagery to visualise the perfect execution of a shot or a pass, thus giving the player a stronger memory of the function in addition to the ability to recall this image when under the pressure of match play. This is no different for scholastic contexts as learners are able to visually map concepts, essay plans, questions and answers, allowing them to develop links and make progress towards the predetermined goals defined in the forethought phase.

The third sub-process to be highlighted as part of self-control in the performance phase is attention focusing. Attention focusing is designed to improve learners' concentration and screen out other covert processes or external distractions (Zimmerman, 2000). From a classroom teacher's perspective, this is the skill with the greatest observed variation with regard to learners' abilities to focus their attention. It can be argued that there are now more distractions than ever before that draw learners' attention away from learning activities. Be they social or technological, the most effective learners can manage these distractions and employ strategies that allow them to screen out external sources of distraction allowing them to focus and learn successfully (Corno, 1993). This includes but is not limited to the physical environment in which the learning is taking place, again emphasising Bandura's triadic reciprocality and the bidirectional interaction between the different domains of influence: personal, behavioural and environmental.

The final sub-process to fall under the umbrella of self-control is that of task strategies. Self-regulated learners have a clear understanding of the task and its outcomes, and they are able to make use of specific and relevant strategies that will support their learning towards the successful completion of the task. Allowing learners time to consider and select strategies before they engage in the learning activity itself will encourage the development of this sub-process. However, this needs to be preceded by the transmission and explanation of different task strategies themselves, drawing another strong link to Vygotsky's sociocultural principles where the classroom teacher is playing the role of the more capable peer, scaffolding the learning within the zone of proximal development enabling cognitive restructuring to occur.

Self-observation, the second process in the performance phase, refers to a student's tracking of specific aspects of their own performance, the conditions that surround it and the effects that it produces (Zimmerman, 2000). Expert self-observers are able to track themselves at a highly detailed process level and make fine-grained adjustments in order to continue progress towards the goals set in the forethought phase. To effectively self-observe there are two sub-process students can perform: self-monitoring and self-experimentation.

Self-monitoring, also referred to as metacognitive monitoring or self-supervision, compares what is being done against criteria that assess the quality of the processes being followed (Panadero & Alonso-Tapia, 2014; Winne & Hadwin, 1998; Zimmerman, 2000). Self-monitoring accuracy is a topic of great interest because accurate monitoring should lead to regular updating of one's task representations, more effective regulation of task activities and, ultimately, improved task performance (Jordano & Touron, 2018). In a study conducted by Ariel and Karpicke (2018), the authors state that learners' decisions about what material to learn are strongly influenced by their monitoring of their learning. There are a number of features of self-monitoring that can influence its effectiveness: the temporal proximity of self-feedback, the quality of self-monitoring as a response to performance feedback in addition to both the accuracy of self-observational judgements and the valence of these judgements. As a key component of self-regulated learning, students with ineffective or deficient monitoring skills resort to suboptimal *one and done* strategy use, rather than selecting more effective strategies such as repeatedly self-testing material that they believe that they already know (Ariel & Karpicke, 2018).

With such a broad range of self-monitoring sub-processes evident, all requiring mental effort, it is clear to see why the monitoring of one's own learning is difficult for some students (Baars & Wijnia, 2018). Mental effort is an indication of the amount of cognitive load that is invested, defined here as the cognitive capacity allocated to cope with the demands of a learning task. Working memory has a limited capacity and if the cognitive load of a task is high, then the demands of having to complete a learning task combined with the dual task of monitoring and regulating one's own learning may well be too demanding for a student's cognitive capacity (Baars & Wijnia, 2018). It is therefore easy to see how a cognitively demanding task might overload a student's working memory, therefore inhibiting their ability to self-monitor which can in turn undermine the entire cycle of self-regulated learning. However, there are clear links to both the forethought and self-reflection phase, one of which is the similarity drawn by authors to self-assessment in the self-reflection phase, only in that self-assessment happens once the task is complete and self-monitoring happens whilst the task is being undertaken (Panadero & Alonso-Tapia, 2013; Weinstein & Mayer, 1986; Winne & Hadwin, 1998).

The final sub-process of the forethought phase is self-experimentation, the systematic variation of students' functioning which is undertaken when self-observation of natural variations in behaviour does not yield decisive diagnostic information (Zimmerman, 2000; Zimmerman & Moylan, 2009). A form of metacognitive trial and error, students will make changes to their behaviour whilst self-observing and gaining feedback about how these changes impact upon the on-going performance. Zimmerman (2000) argues that this systematic self-observation can lead to greater personal understanding and better performance.

Although most models of self-regulated learning agree on the importance of self-monitoring and self-control (Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2008b), research has shown that without additional instructional support self-control and the regulation of study during the performance phase are difficult skills for students (Baars & Wijnia, 2018; Dunlosky & Rawson, 2012; Thiede et al., 2017). As such, self-monitoring and self-control have been studied at different levels. Firstly, at the item level, where learners typically monitor how well they have memorised a word or comprehended a text by predicting their performance on a future test, and deciding whether or not they would have to restudy that item or text (Raaijmakers, Baars, Schaap, et al., 2018). Secondly at the task or topic level, where learners typically monitor their understanding while they are engaged in a study task itself, for example deciding how long to spend on different parts of a task. And lastly at the task-sequence level, where learners typically monitor how well they performed a learning task after completing it (self-assessment), and then selecting a suitable next task (Raaijmakers, Baars, Schaap, et al., 2018).

Both self-monitoring and self-control need to be accurate for effective self-regulated learning, and this is problematic as research on each of the levels outlined shows that learners' self-monitoring and self-control are often inaccurate (item: Rawson & Dunlosky, 2007; task/topic: Bannert & Reimann, 2012; task-sequence: Kostons, van Gog, & Paas, 2010, 2012). Dunlosky and Rawson (2012) contend that without accurate monitoring it is unlikely that students would select subsequent tasks that are suitable for their level of knowledge or skill, thus undermining students' learning and retention (Bjork et al., 2013; Fernandez & Jamet, 2017).

One source of information for the on-going self-monitoring and self-control of learning is from feedback, whether external or self-generated, and forms a powerful instruction tool that has been shown to have a beneficial effect on learning (Fernandez & Jamet, 2017; Hattie & Timperley, 2007). Feedback provides students with information about their learning status and allows them to reconsider the learning task and their engagement and control processes in subsequent learning sessions (Butler & Winne, 1995; Fernandez & Jamet, 2017). A study conducted by Fernandez and Jamet (2017) yielded a large effect size where a practise testing intervention with simple corrective feedback was used to potentiate students' learning of new material. The combination of practise tests and corrective feedback led the students to undertake more accurate self-monitoring and therefore enhanced self-control. However, the authors note that this is only the case when the form of the practise tests is the same as that of the final test, so that the practise can reliably guide students (Fernandez & Jamet, 2017).

However, as Raaijmakers, Baars, Schaap, et al. (2018) highlight, improving self-monitoring accuracy would only aid self-control when students actually give thought to their monitoring judgements, such as a judgement of learning (JOL) when making study decisions. The accuracy of these self-monitoring judgements is analysed by comparing monitoring judgements to future test performance (i.e. prospectively) or to actual performance on the problem that was judged (i.e. retrospectively)(Baars et al., 2018). The accuracy of monitoring and control has been associated with better item recall, text comprehension and problem-solving performance and these skills tend to develop over time with 12 year-olds demonstrating better monitoring and control than 9 year-olds (Raaijmakers, Baars, Schaap, et al., 2018; Roebers et al., 2009).

The research cites two main criticisms of Zimmerman's model, namely the role of emotion in the performance phase and secondly time management (Panadero

& Alonso-Tapia, 2014). Kuhl's volitional model (2000) brings emotion to the forefront, asserting that state-oriented emotional control is necessary for the successful completion of the task. In this regard Kuhl contends that psychological processes linked to volition, such as attention control, motivational control, emotional control and failure control, effect changes to both self-regulated learning and motivation. In addition, there is the processing knowledge required to complete the task. However, in Zimmerman's model emotion is present in the background, only activated if students do not self-observe progress possibly due to deficient strategies selected during the forethought phase. When reflecting on this dichotomy, it can be argued that emotion is always present at the forefront of the performance phase; be it positive or negative. Nevertheless, as both models suggest it is vital to be able to control emotion, as in the worst-case scenario emotions can serve to halt accomplishment of the task.

The second criticism of the performance phase of Zimmerman's model is time management. It is argued that Zimmerman has presented an over-simplified model in terms of time management, supported by Meer et al. (2010) who published research that indicates that time management is comprised of more complex strategies than those outlined in Zimmerman's model. In addition to this, the use of more complex time management strategies is considered to be crucial for success (Meer et al., 2010; Panadero & Alonso-Tapia, 2014). Linking this to the rationale for this research, effective time management skills will be of significant use to today's learners when they move on from secondary education, as they will have to balance conflicting demands and pressures on their time, managing these demands in order to successfully complete tasks and projects.

2.3.3 Self-Reflection Phase

The self-reflection phase includes processes that occur after learning efforts, influencing a learner's reaction to that learning experience. During this phase the preceding behaviour is evaluated by causal attributions that explain (non-) achievement of a goal (Dörrenbächer & Perels, 2016a, 2016b). Bandura (1986) has identified two self-reflective processes that are closely related to self-observation: self-judgement and self-reaction. Self-judgement refers to self-evaluation of one's own performance and attributing causal significance to the learning results (Puustinen & Pulkkinen, 2001; Zimmerman, 2000). This self-evaluation of one's learning is relative to the complexity of the learning outcomes, as simple learning outcomes such as being able to ride a bike or recite the alphabet require only simplistic evaluation skills, whereas complex learning outcomes require high levels of expertise applied through the use of tightly refined criteria for judgement and evaluation.

Zimmerman (1989, 2000, 2001) categorises four distinctive criteria that people use to evaluate themselves: mastery, previous performance, normative and collaborative. Although mastery has been discussed extensively in the forethought phase with regard to motivational goal orientation, it has a slightly different context in the self-reflection phase as learners employ a graduated sequence of tests or scores to evaluate themselves and their relative position on the continuum of mastery. This links strongly to the second criteria, previous performance, where learners will make a comparison between their current performance and previous levels of learning behaviour. Normative criteria contrast strongly with both mastery and previous performance criteria of self-evaluation, as it involves social comparison with the performance of others. Learners who set outcome goals for themselves in the forethought phase are often predisposed to using normative criteria on which to base their self-evaluation judgements. However, there are a number of limitations to using normative criteria, namely the emphasis placed on the negative aspects of functioning which social comparison heightens, rather than reflecting on the progress and improvements made since previous performances. Although this social comparison is natural, especially given the sociocultural epistemological view that underpins this research project, it conflicts with the fostering of mastery goal orientation and narrows the learner's focus purely on the summative outcomes rather than the continued development of self-regulatory processes. The final criteria used in self-evaluation is collaborative which is generally used in team endeavours (Bandura, 1991). Within these common but more complex circumstances, success is defined as a learner's ability to fulfil a certain role within the team, with the ability to work cooperatively with other teammates becoming the ultimate criteria of success (Zimmerman, 2000, 2001).

Self-evaluative judgements are strongly linked to causal attributions about the results of learning, and these attributional judgements are thought to be pivotal to self-reflection. Drawing on the both work of Dweck (2000) and Weiner (1986, 1992), the attribution of errors to a fixed ability encourages learners to react negatively, discouraging them from adopting a positive motivational stance in the subsequent forethought phase of learning. Instead, attributing the success or failure in the learning task to the strategies selected in the forethought phase allows failures to be attributed to deficiencies in the strategy rather than deficiencies in ability. This is a subtle but important difference in the attributional judgement, emphasising the need for learners to foster a growth mindset where they will react positively to errors and retain a mastery goal orientation that will facilitate progress and improvement during the subsequent learning cycles (Dörrenbächer & Perels, 2016a). That said, it is challenging to achieve this as a classroom teacher within the context of contemporary secondary education where there is an ever-increasing emphasis on students' level of summative achievement, encouraging normative comparisons and an outcome goal orientation amongst students.

The second self-reflective process is self-reaction of which there are two key forms: self-satisfaction and adaptive inferences. Self-satisfaction is the perception of satisfaction or dissatisfaction and associated affect that is derived from the outcome of the learning experience. This is important because learners, much like all individuals, pursue courses of action that will result in satisfaction and positive affect, and will avoid courses that will produce dissatisfaction and negative affect (Bandura, 1991). Although this may well be obvious as it is part of human nature to want to pursue things that will provide us with positive affect, it has particular relevance to self-regulated learning as it is argued that a person's motivation stems from the self-evaluative reactions to behavioural outcomes, rather than from the goals themselves (Zimmerman, 2000). This point again highlights the interconnectedness of the three phases of self-regulated learning with self-reaction influencing the subsequent forethought phase as a result of the cyclic nature of self-regulated learning (Puustinen & Pulkkinen, 2001).

A study conducted by Gresch, Hasselhorn, and Bögeholz (2017) explored whether the application of decision-making strategies combined with reflections on the decision-making processes of others, enhances decision-making competence. In addition this study examined whether the decision-making process is supported by elements of self-regulated learning, more specifically self-reflection, regarding one's own performance and the setting of goals for subsequent tasks. The authors analysed the training effects on the students' performance as they reflected on the decision-making processes of others. These were evaluated through pairwise analyses of covariance of the post-test scores while controlling for pre-test scores. In the comparison with control group, training group two who were additionally treated to use self-regulated learning strategies, was found to be significantly superior. Contrary to training group one, which did not yield significantly higher scores on the reflection scale in the follow-up test, training group two was found to be significantly superior to the control group two months after the training as well.

Research conducted by Chen et al. (2017) further underlines the importance of the self-reflection phase of Zimmerman's model. Using undergraduate participants from a large midwestern university, the researchers designed and implemented a self-administered online intervention to two cohorts: a control group and treatment group. The students randomly assigned to the treatment group reported being more self-reflective about their learning throughout the class, they used their resources more effectively and outperformed students in the control condition by an average of one third of a letter grade in the class. In Study 1, students in the treatment condition performed an average of four percentage points higher on their final course grades than students in the control condition. This performance advantage was replicated in Study 2, where students in the treatment condition scored an average of four percentage points higher in the class than did the students in the control condition.

Panadero and Alonso-Tapia (2014) offer a critique of the self-reflection phase by drawing on the research of Kuhl (2000), who considers the affective response generated by students who fail and are state-oriented. It is argued that these students will circumvent learning how to find solutions to their failures, thus promoting a state of anxiety if they encounter the same task again to which they have yet to discover a solution. As a teacher, heavy emphasis is placed on the self-reflection phase, encouraging students to learn from their failures. The use of Directed Improvement and Reflection Time (DIRT) is one strategy that provides the learning space for students to reflect on their mistakes and grow in response to formative feedback. This process fosters a growth mindset amongst learners and discourages the adoption of a state-oriented approach. Failure is therefore viewed as an integral part of the learning process, hopefully inhibiting a negative affective response which then allows the student to feed-forward positively into the next self-regulated learning cycle.

2.4 Development of Self-Regulatory Skill

Self-regulatory processes can be developed from and sustained by social as well as self-sources of influence (Zimmerman, 2000). This emphasises the sociocultural dimension present in the development of self-regulatory skills. Table 2.4.1 shows Zimmerman's multi-level model (Zimmerman, 2013), who theorised that self-regulated learning, which is assumed to be context dependent, develops through four levels according to Social Cognitive Theory.

The first level relates to the vicarious induction of a skill through *observation* of the desired skill modelled by agents such as parents or teachers (Clark & Zimmerman, 2014). Even toddlers can acquire new skills by watching the performance of skills by adults or older siblings. At this level the learner simply observes, deducing the main features of the skill leading to internalisation and development of this skill. There is little debate that this vicarious action is a major building block in the construction of self-regulatory skills, however the actual performance of the strategy itself will help foster development and add this to one's behavioural repertoire. An example of this is learning to play a forehand in tennis, where a beginner can gain a huge amount of technical information from observing a good player execute the shot. However, the learner will be more proficient in their own execution of the shot if they were to imitate the shot themselves. This leads us to the second level of self-regulated learning, referred to as *emulation*, where learners mimic the performance of a modelled skill while receiving social feedback. Inevitably the learner will not copy the exact actions of the model, but with the support of an explicit set of performance requirements the observer can develop this skill. Kitsantas, Zimmerman and Cleary (2000) suggest that when a model takes on a teaching role, providing guidance, feedback and reinforcement, the observer's accurate performance of the skill can be improved significantly.

Table 2.4.1
Zimmerman's Multi-Level Model of Self-Regulated Learning Development (adapted from Zimmerman, 2013)

	Features of Regulation			
Levels of regulation	**Sources of regulation**	**Sources of motivation**	**Task Conditions**	**Performance indices**
1- Observation	Modelling	Vicarious reinforcement	Presence of models	Discrimination
2 – Emulation	Performance and social feedback	Direct/social reinforcement	Correspond to model's	Stylistic duplication
3 – Self-control	Representation of process standards	Self-reinforcement	Structured	Automatization
4 – Self-regulation	Performance outcomes	Self-efficacy beliefs	Dynamic	Adaptation

The first two levels of self-regulation reflect Bandura's (1986) Social Cognitive Theory where the development of skill and thinking are underpinned by social foundations (Zimmerman, 2000, 2013). Both the *observation* and *emulation* levels highlight the role of social guidance regarded as essential in the first two levels (Puustinen and Pulkkinen, 2001). Strong links can be drawn to Vygotsky's sociocultural theory in which a learner only develops mental functions as they participate in various forms of social interaction (Lourenço, 2012; Panadero, 2011).

Vygotsky (1978) states that all higher functions originate as actual relations between human individuals, stressing the sociocultural foundations of this theory that higher order mental functioning is developed through social interaction, thus supporting the importance of social guidance in the first two levels of self-regulated learning development.

The third level of self-regulated learning skill development is *self-control*. This corresponds to the successful application of the demonstrated strategy outside the presence of modeling or imitation. This level of development usually demands deliberate practise or performance of the strategy within a structured environment, leading to internalisation and development (Ericsson & Lehmann, 1996). The structure and support within the environment can be provided by a teacher or more capable peer, drawing strong parallels to the scaffolding of students' cognitive development into and through Vygotsky's zone of proximal development (Vygotsky, 1978). However, Van Oers (1996) argues that help should be gradually withdrawn so that students take ownership of functions they initially could not perform alone, thereby internalising the skill with which they are engaged. What is not clear is the timeframe over which support should be withdrawn. However, as self-regulated learning is context-dependent the timeframe over which support should be reduced will vary between students. This is as a result of the varying rates at which students improve in response to the bidirectional interaction of the person, the environment and their resulting behavior.

At the fourth level, *self-regulation*, learners are making adaptive use of different strategies according to changing conditions and outcomes (Puustinen & Pulkkinen, 2001). At this stage the student has automatised some aspects of the performance and is able to act strategically, adapting performance to contextual factors (Panadero & Alonso-Tapia, 2014). The nomenclature of this level might suggest that this is level of regulation is achieved independently, however learners may still employ support from social resources such as more capable models. The context-dependent regulation of strategies at this level may work to uncover deficiencies in learners' execution of these strategies, thus requiring additional socially founded learning experiences (Zimmerman, 2000). This resonates strongly as those learners who are perceived to possess the most developed self-regulatory skills can identify and acknowledge when assistance is required. These learners are often *feedback seekers*; students who actively pursue and request feedback in order to facilitate their successful completion of learning tasks.

In their recent paper exploring the role of direct strategy instruction and indirect activation of self-regulated learning, Dignath and Veenman (2020) draw on the work of Collins et al. (1991), who described the adaptive scaffolding for supporting the development of self-regulated learners as differentiating among four aspects of apprenticeship: *modeling, scaffolding, fading* and *coaching*. In *modeling,* the lowest level, students learn to use the strategy by watching the teacher using it (Bandura, 1986; Collins et al., 1991; Dignath & Veenman, 2020). In the second level, *scaffolding*, the teacher adapts their support in response to the needs of the student carrying out a task or attempting to use a strategy. In *fading*, the teacher slowly removes their support and in doing so, gives more responsibility to the student for the performance of the task or strategy. And lastly, *coaching* comprises the whole process of apprenticeship instruction, the focus of the article published by Collins et al. (1991), which includes the choice of task, providing hints, scaffolding as required, giving feedback and structuring the steps of the learning process (Dignath & Veenman, 2020). Given this description of Collins' and colleagues' model, it is clear that there are strong and clear links to the four stages of Zimmerman's (2013) multi-level model of self-regulated learning development, underpinned by Bandura's (1986) Social Cognitive Theory.

Despite the relative merits of these models, there are a number of limitations with regard to the four-level model of self-regulatory skill development. Firstly, although the models highlight the importance of support from adults or more capable peers throughout the development of self-regulatory skill, there is the danger that learners will become dependent on the social support, potentially inhibiting development of the self. McInnes et al. (2010) comment on how the presence of a teacher can actually shift control in the learning activity, with learners relinquishing ownership of the task to the teacher potentially resulting in a lack of confidence in learners' self-efficacious beliefs about their ability to complete the task. This argument encourages careful consideration of the structure of the intervention designed to enhance students' self-regulated learning skills, as provision of support could even work to suppress the development of self-regulated learning skills, confining students at the lower levels of self-regulated learning skill development. Advancing this argument, other research (e.g. Whitebread, 2007) has observed a decrease in behaviours displaying the regulation of cognition and motivation in the presence of teachers, and that adult presence can negatively influence childrens' persistence and risk-taking when tackling learning activities (Robson & Rowe, 2012). This observation gives rise to the need to give careful consideration to task design and both the frequency and form of cognitive scaffolding that is provided to the students during the intervention as they engage with learning activities designed to improve their self-regulated learning skills.

2.4.1 The Relative Influences of the Environment and Biology

Baker (2018) states that evidence on the developing brain shows that it actively organises itself and adapts to its environment. However, in terms of self-regulation, it develops through critical periods from infancy to adulthood in a non-linear and stage sequenced fashion, via a hierarchical, cascade process (Nigg, 2017). The development of self-regulation in adolescence (ages 12 to 19), the age range within which the participants of the present study fall, forms an important period in this process of development. More complex capabilities are assembled out of low-level capacities, congruently with development of physical and neural systems and the gradual internalisation of control during childhood (Nigg, 2017). Several factors have influence on the development of self-regulation. These include biological factors such as genetics, physiology, and neurophysiological maturation, in addition to situational components such as parenting, peer socialisation, exposure to a range of environmental stimuli and experience (Bell & Deater-Deckard, 2007; Edossa et al., 2018). This links strongly to the long-standing *nature v nurture* debate in developmental psychology as to whether early experiences produce any long-term, enduring effects in terms of the development of self-regulation.

Whilst there are some *factory settings*, brain plasticity in the early years, from infancy (4 weeks to 12 months) through to preschool age (2 to 5 years of age), allows for individuals to learn to respond to what happens to them (Baker, 2018). Bell and Deater-Deckard (2007) state that differential response and individual differences in self-regulation consisting of affective and cognitive control over emotion and behaviour, arise from complex transactions between genetic and non-genetic (environmental) influences (Blair & Diamond, 2008; Deater-Deckard, 2016). It is important to critically examine the two sides of the argument within the context of the development of self-regulation, setting the scene for literature review that follows focusing on self-regulated learning: the focus of the present study.

Whilst the *nature v nurture* debate continues play out in psychology and associated fields, there is agreement that the emergence of self-regulation occurs in complex ways that result in positive or negative *developmental cascades* (Vink et al., 2020). These cascades outline the cumulative consequences for the interactions between the developing self-regulatory systems and its surroundings. For example, low levels of self-regulation early on in life can significantly impede development of self-regulation later in life, with the opposite being true in that the development of high levels of self-regulation in early life and lead to further development later on (Vink et al., 2020). This not only emphasises the complexity inherent within this junction of educational research, however it also serves to highlight the importance of the development of strong self-regulatory skills early on in life, as these foundations are of fundamental importance for the further development of these skills throughout formal schooling (5 to 19 years of age) and into adulthood.

2.4.2 The Influence of Biology on the Development of Self-Regulation

Self-regulation develops in interaction with a maturing brain (Vink et al., 2020). Deater-Deckard (2016) states that cognitive self-regulation, including executive functions and other closely related behaviours such as attention, inhibitory control and working memory, comprise a major component of a broader self-regulation constellation of constructs spanning affective, cognitive, behavioural and biological domains. He contends that all of the aforementioned constructs include moderate to substantial genetic variance, providing an initial layer of evidence for the relative importance of biology in the development of self-regulation, adding that these constructs are important predictors of physical, behavioural and mental functions.

From a neurocognitive perspective, Vink et al. (2020) suggest that the state of the brain itself, for example the emergence of brain networks and the quality of their connections, dictates the possibilities and limits for self-regulation abilities at any given age; something explored in greater depth later in this section. This is further supported by Edossa et al. (2018) who contend that in response to the functional specialisation of the neural systems within the brain, the structure of self-regulation varies with age becoming more differentiated over time and development. Blair and Diamond (2008) offer a neurobiological perspective, emphasising the reciprocal effect created by the neural interconnectivity between the brain areas associated with emotional regulation (amygdala in the limbic system) and behavioural regulation (prefrontal cortex)(Edossa et al., 2018). Oppositely, learning and adapting to new experiences affects brain development too, and from a theoretical perspective the malleability of self-regulation can be epigenetically attributed to the neural connectivity plasticity in response to experience (Blair & Diamond, 2008; Edossa et al., 2018).

Further support for the influence of biology on the development of self-regulation can be found in research by Bell and Deater-Deckard (2007), who highlight the role of biological mechanisms in self-regulation. These include serotonin and dopamine neurotransmitter system genes, in addition to central and peripheral nervous system connectivity and activation, involving the prefrontal cortical and limbic regions of the brain. The authors argue that these biological mechanisms have a significant role in self-regulation, highlighting the role of nature in the development of self-regulation. Furthering this, Bell and Deater-Deckard (2007) argue for a position that psychophysiological processes of attention, cognition and emotion act as intermediaries between gene expression and complex psychological behaviours.

In their analysis of the origins of learning abilities and disabilities in early school years children (7 to 10 years of age), Kovas et al. (2007) make effective use of the Twins Early Development Study (TEDS) allowing the authors to conduct a detailed examination of the relative roles of genetics and the environment in the development of children's learning abilities. In terms of quantitative age differences, Kovas et al. (2007) state that genetic research on general cognitive ability has yielded two fascinating developmental trends. First, heritability, that is the proportion of phenotypic variance attributable to genetic variance, increases linearly from about 20% in infancy (4 weeks to 12 months), to about 40% in middle childhood (6 to 11 years of age), to about 50% in adolescence (12 to 19 years of age) and young adulthood (early twenties), and even higher in middle age (Boomsma, 1993; McGue, Bouchard, Jr., Iacono, & Lykken, 1993; Plomin, 1986). The authors state that whilst the cause of this developmental increase in heritability is not known, one possibility is that children move from experiencing environments largely created by other people to actively creating correlations between their genetic propensities and their own experiences (Plomin & DeFries, 1985). Second, shared environmental influence decreases sharply from about 30% middle in childhood (6 to 11 years of age) to near 0% in adolescence (12 to 19 years of age)(Kovas et al., 2007). In contrast to infancy (4 weeks to 12 months), early childhood or preschool age (2 to 5 years of age) and childhood (6 to 11 years of age), adolescents (12 to 19 years of age) increasingly live their lives outside their family, a large proportion of which is done so in schools, the sense of shared environmental influence has a much smaller influence ultimately decreasing to 0%. That said, one of the confounds of this work is the fact that parents with good self-regulation skills tend not only to pass on those skills through genetics, but also in the way they parent; something discussed at length in Section 2.4.3.

Linking to the research cited above by Kovas et al. (2007) highlighting the increasing function of genetic variance on the development of general cognitive ability, Rothbart et al. (2004) theorise the role of temperament in shaping the development of self-regulation. Temperament, innate individual differences in emotional, behavioural and biological responses to change in environment, plays a significant role in the development of self-regulation, underlining the influence of innate biological characteristics in self-regulation's developmental trajectory (Rothbart et al., 2004).

Brain maturation occurs in distinct developmental periods which can be distinguished by the onset or end of specific neural processes. Vink et al. (2020) state that in the first two years of life brain development is characterised by significant growth of both grey and white matter, then followed by periods of slower volume increase. Moving into adolescence (12 to 19 years of age), the pattern of brain development varies spatiotemporally across the brain, with subcortical regions relating to motivation maturing before prefrontal development, which serves to facilitate the type of skill acquisition that occurs in each developmental period. Drawing on the structure used in research published by Vink et al. (2020), the following paragraphs discuss the development of self-regulation from a neurocognitive perspective, framed by the developmental periods of infancy (4 weeks to 12 months) and early childhood or preschool years (2 to 5 years of age), childhood (6 to 11 years of age) and adolescence (12 to 19 years of age), in what is described by the authors as the most important set of brain maturation processes.

Vink et al. (2020) state that the study of self-regulated learning during infancy (4 week to 12 months) and early childhood or preschool years (2 to 5 years of age) builds heavily on the work of Rothbart and colleagues (Rothbart, 1981). These authors put forward the term *effortful control*, which refers to the child's volitional use of executive attention and involves the abilities of inhibitory control, detections of errors and planfulness (Bell & Deater-Deckard, 2007). It refers to the top-down control over bottom-up processes for purposes of self-regulation (Vink et al., 2020). During infancy, the parent initially acts as an external regulator, however there is consensus that self-regulation shifts from a pattern of reactive response to external stimuli, towards a more deliberate control of internal states in early childhood (Rothbart et al., 1990; Vink et al., 2020). This links strongly to the development of self-regulation during early childhood as outlined by (Kopp, 1982), who theorised self-regulated learning as progressing from externally to internally regulated behaviour, supported by maturation of attention, cognition and parental socialisation (Feng et al., 2017). However, this voluntary control of behaviours would not be possible without the neurophysiological development of an executive system within the frontal cortex (Calkins & Fox, 2002), emphasising the importance of the influence of biology in the development of self-regulation.

After initial developmental change around 10 months, attentional control associated with the orienting-attention network (Posner & Rothbart, 2018) and the executive attention network increases rapidly during the toddler (12 to 24 months) and preschool years (2 to 5 years of age)(Posner & Rothbart, 2007). This increase in attention control underpins the further development of *effortful control* (Bell & Deater-Deckard, 2007). Bell and Deater-Deckard (2007) state that from infancy through to the end of childhood (4 weeks to 11 years of age) significant improvement is observed in chldren's controlled attentional abilities and resultant effortful control skills associated with the executive attention network, continuing to develop well into early adulthood (early twenties)(Posner & Rothbart, 2007; Rueda et al., 2005; Vink et al., 2020). Within the context of Posner and Rothbart's (2007) executive attention network linked to the rise of more complex self-regulation, Vink et al. (2020) cite a number of cross-sectional imaging studies in infancy (4 weeks to 12 months) and early childhood (2 to 5 years of age) that report positive associations between measures of brain functional connectivity and precursors of self-regulation, such as object permanence, working memory, attentional control and inhibitory control, emphasising the influence of biology in the development of self-regulation. Pahigiannis and Glos (2020) state that in terms of the development of cognitive behaviours, it is clear that from early on in life, attentional control and working memory are not only coupled with each other, but also underlie many other aspects of cognitive performance associated with school readiness.

Linking this to the focus of this section, the relative influence of biology in the development of self-regulation, the research cited emphasises the importance of biology in this process, as without the neurophysiological development of the orienting-attention network and the executive attention network, improvements in children’s effortful control would not be observed. Further support for this line of argument is found in twin and adoption studies that have shown moderate to substantial heritable variance with respect to attention and effortful control over early and middle childhood (Braungart et al., 1992; Goldsmith et al., 1997; Lemery & Goldsmith, 2002; Manke et al., 2001) as well as in adulthood (Yamagata et al., 2005).

The next development period cited by Vink et al. (2020) is childhood (6 to 11 years of age), characterised by improvements in executive function. It is argued that in the earlier, but not later stages of development, self-regulation involves only effortful control and low-level executive functions fundamental to early life (Vink et al., 2020). Executive functions underlying self-regulation depend on sufficiently progressed brain development, and Garon et al. (2008) stress that high-level executive functions such as information processing, planning and problem solving will develop in-line with age-appropriate self-regulation. Emphasising the importance of executive functions, Vink et al. (2020) state that children need to develop and hone high-level executive functions such as planning, problem solving, information processing and cognitive flexibility (Rueda et al., 2005). The refinement in executive functions across childhood is paralleled by distinct neural changes throughout this development period, from the increasing volume of regions of the brain to more subtle changes. However, in terms of the shift from low-level executive functions developed in infancy (4 weeks to 12 months) and preschool years (2 to 5 years of age) to high-level executive functions, the myelination of the white-matter nerve fibres which accounts for the expansion of the brain, together with synaptic pruning, are of particular importance and combine to form efficient brain networks (Vink et al., 2020). Again, the neurophysiological changes detailed above highlight the influence of biology in the development of self-regulation, as without the myelination of the white-matter fibres in conjunction with synaptic pruning, high-level executive functions would not be able to be developed across the childhood development period (6 to 11 years of age).

During adolescence (12 to 19 years of age), the final developmental period cited in research by Vink et al. (2020), the various executive functions start to become integrated to support high-level strategic control. During this time, adolescents become more skilled in inhibitory control, developing proactive response strategies that allow for more efficient processing (Vink et al., 2014). It is therefore the effective integration and coordination of executive functions that supports the development of self-regulation (Vink et al., 2020; Zandbelt & Vink, 2010). The further development of the brain and the rise of strategic control is theorised to co-occur with the significant improvement in the quality of connections between cortical and subcortical regions (Casey et al., 2019; Vink et al., 2020), facilitated by the myelination of white-matter tracts connecting these regions which allows faster and more precise neural signalling (de Leeuw et al., 2017).

2.4.3 The Influence of the Environment on the Development of Self-regulation

Shifting to the second side of the *nature v nurture* debate, namely the influence of the environment on the development of self-regulation, Greenough et al. (1987) argue that brain development occurs in interaction with the environment and it seems likely that the association between parenting behaviours and child cognitive development is a result of the interplay between genetic factors, brain development and the social environment (De Bellis, 2005; Vink et al., 2020). An applied perspective recognizes self-regulation as the way in which individuals adapt to and influence their environment. Self-regulation is therefore not a fixed individual trait, but a state in which individuals must flexibly adjust behaviours and mental schemas to respond to situational demands (Blair & Diamond, 2008; Pahigiannis & Glos, 2020).

Furthering this, Diamond (2009) emphasises that early experience can and does have lifelong consequences at all levels, from the molecular to the behavioural. Most of the genes in each person are dormant, however experience affects which genes are turned on (and off), and when. Thus, the environment plays a significant role in shaping the expression of the genome (Diamond, 2009), and in turn the development of self-regulation. Rutter et al. (2006) contend that genes predispose to certain behavioural phenotypes through their effects on exposure to environments, rather than through direct mechanisms (Lee et al., 2018). The extent to which the environment commands the power to shape the expression of the genome is a contested area in the literature, however Diamond’s (2009) and Rutter and colleagues’ (2006) comments provide strong support for the *nurture* side of the debate, emphasising the prominent role of the environment in terms of the development of self-regulation. However, this line of argument is supported by research from a neurocognitive perspective by Vink et al. (2020), who cite the example of competitive interactions between neuronal connections. Those actively stimulated through environmental experiences are strengthened, whereas those not activated are eliminated forming an important part of brain development.

Furthering this argument, Kärtner et al. (2011) discuss the construct of *ecological imprint,* stating that most, if not all, cognitive and sociocognitive achievements are experienced-based, developing at different rates depending on the perceptions and experiences that infants (4 weeks to 12 months) and toddlers (12 months to 24 months) make in interactions with their social and non-social environment. Further support for the importance of nurture in the development of self-regulation can be found in more recent research by Edossa et al. (2018), who highlight how socio-economic status (SES) affects self-regulation and academic achievement through the material and psychological context of the family. Emphasising the importance of experience-based achievements and factors that shape the environment which children engage with, these lines of research serve to accentuate the relative importance of the environment in the development of self-regulation.

Revisiting one of confounds highlighted in the previous sub-sections in terms of the role of parenting in the development of self-regulation, Martinez-Pons (2002) cites four parental activities that support the development of self-regulatory behaviour on the part of the child: modelling, encouragement, facilitation and rewarding. It was hypothesised that parents who socially induced their children to use self-regulatory processes would, in turn, improve their children's development of self-regulatory skills. Path analysis showed that parental inducement of academic self-regulation predicted student self-regulatory behaviour, and student self-regulation in turn predicted academic achievement. Although the importance of parental support for children's self-regulatory development is emphasised, Martinez-Pons (2002) states that significant numbers of parents lack the time and skill to carry out these vital social learning activities with their children.

Linking this to school and children's' use of self-regulatory processes to learn and perform in this context, findings also indicated that parents' social impact on their children's academic attainment is mediated though the children's use of self-regulatory processes to learn effectively, emphasising the role of *nurture* in the development of self-regulation (Martinez-Pons, 2002). He alludes to the *hidden curriculum,* the help provided by parental modelling and social support in the completion of homework and other learning activities undertaken at home. However, one major limitation of the *hidden curriculum* is that given the range in parents' self-regulated learning skills and indeed their own time available, some children will receive this support in learning activities completed at home while others will not. This is also important to note within the context of the research setting for the present study, a co-educational boarding school, where students reside full-time during term, meaning that even more responsibility for the development of self-regulatory skills lies with the teachers and pastoral teams overseeing students' day-to-day well-being and schedules.

The above discussion of Martinez-Pons' (2002) research into parental influences into the development of self-regulation links strongly to the results of a meta-analysis conducted by Karreman et al. (2006) which shows an association between the way in which parents control their child and the development of self-regulation in preschool children (2 to 5 years if age). In short, the findings show a correlation between positive control and self-regulation, whereas negative control was inversely related to self-regulation. When parents use more positive guiding, teaching and encouragement towards their child, children seem to demonstrate higher levels of self-regulated learning (Vink et al., 2020). This aligns strongly with the evidence that parents play an important role in aiding their children to complete their homework during the primary school years (Martinez-Pons, 2002). Interestingly, the same results were found in adolescents (12 to 19 year olds) and results are also robust across gender and culture.

Linking to this, Lee et al. (2018) suggest that through parenting practices and mother-child interaction, mothers' consistent exercise of executive function skills over time may lead to epigenetic modifications of genes that produce changes in neural functioning, changes which influence executive function skills (Barrett & Fleming, 2011), skills highlighted in the previous sub-section underpinning the development of self-regulation during childhood. This research emphasises the relative balance between the two sides of the debate, nature and nurture, however the focus here lies with the epigenetic modification of genes through a child's interaction with the environment.

Remaining with parental influence, Feng et al. (2017) discuss maternal sensitivity, thought to be one of the most influential maternal characteristics, and its links with both compliance and self-regulation. Maternal sensitivity is theorised to promote self-regulation through a supportive response to children's emotions and behaviours, creating optimal levels of arousal in addition to the modelling of effective regulatory strategies (Feng et al., 2017). Linking to this, Nelson and Bloom (1997) highlight the synaptic pruning during the first two years of life, a process which is largely determined by the experience that parents provide during this period, again emphasising the importance of the environment in the development of executive function skills and, in turn, self-regulation.

The discussion of the relative influence of the environment in the development of self-regulation has so far focused on the role of parents, however it is also important to consider the role of peers as it is not only parents who account for the environment in which children are raised. Research by Pahigiannis and Glos (2020) suggests that infants as young as three and six months of age use self-soothing and attentional shifting to regulate their own emotions in response to a peers' cry, and at just nine months of age begin to differentiate their own emotions from that of their peers. Peer effects on self-regulation development are consistent with Vygotsky's (1978) social development theory, the epistemological lens through which this research is viewed, which suggests that children's problem solving and other skills benefit within meaningful social interactions with peers (Pahigiannis & Glos, 2020). Schools not only provide invaluable opportunities for children to engage with their peers, but also provide greater social assistance in the early years, support that is reduced as students advance through the year groups of formal education (Martinez-Pons, 2002). In the primary school years, teachers provide adult-directed learning environments with specific expectations and routines; little is expected of students outside of the classroom. However, over time and especially as students transition to secondary school, the setting for the present study, greater expectations in addition to an increasing complexity of task and subject content further supports the development of self-regulation, and within the context of academic study, self-regulated learning.

In summary, both biology and the environment have a significant influence on the development of self-regulation. Framed here as the *nature v nurture* debate that continues to play-out in developmental psychology, it is clear from the critical examination of the biological factors such as genetics, physiology, and neurophysiological maturation, in addition to situational components such as parenting, peer socialisation, exposure to a range of environmental stimuli and experience, that whilst biological components command significant control of the development of self-regulation, early experiences also have an important role in shaping the long-term, enduring effects of its development. Finally, considering this section within the context of the literature review and the thesis, this carries significant weight. Not only does it set the stage for the critical review of the literature relating to the development of self-regulated learning detailed in the following sections, but it also informs the research questions themselves outlined in Paper 4, Methods, as it serves to provide another layer of support to the justification for the age group studied and in turn, the interpretation of the findings themselves.

2.5 Self-Regulated Learning and Achievement

An increasing body of research literature on self-regulated learning states that self-regulated learning abilities have a major impact on a student's academic achievement across childhood and adolescence (Broadbent et al., 2020; Dent, 2013; Dent & Koenka, 2016; Kistner et al., 2010; Montague, 2007; Raaijmakers, Baars, Paas, et al., 2018; Raaijmakers, Baars, Schaap, et al., 2018; Schunk, 2008) and is an essential skill for lifelong learning (Boekaerts, 1999). Having grown significantly in terms of its popularity (Allen & Seaman, 2016), much of the more recently published research into self-regulated learning and achievement focuses on blended and online learning environments (e.g. Alonso-Mencía et al., 2020; Broadbent & Poon, 2015;

Broadbent, 2017; Jansen et al., 2017; Lim et al., 2020). As such, this literature review mainly focuses on self-regulated learning research relative to classroom-based learning environments, as will be the context for the intervention and methodological approach underpinning this research. However, in order to engage with the latest research in the field, relevant studies from online learning environments will also be critically analysed as part of this literature review.

In their meta-analysis of the relation between self-regulated learning and achievement, Dent and Koenka (2016) found that in primary and secondary school academic performance is significantly correlated with both the cognitive strategies and metacognitive processes of self-regulated learning. Interestingly, the meta-analysis identified the weakening of the correlation between self-regulated learning and achievement as students transition into secondary school where it might be students' first exposure to a departmentalised curriculum, academic tracking and monitoring in addition to other factors (Benner & Graham, 2009). However, the correlation then becomes significantly stronger in the Sixth Form (16-18 years old) where the nature of the academic tasks and indeed the assessment of them requires more adept self-regulated learning skills in order to improve performance (Dent & Koenka, 2016).

As outlined above, self-regulated learning's association with achievement is expected to become stronger across primary and secondary school, however this trend obscures a more complicated picture of how the school environment and the nature of the assessment influences self-regulated learning and academic achievement (Dent & Koenka, 2016). Dent and Koenka (2016) state that the association between self-regulated learning and achievement becomes significantly stronger in secondary school for two reasons. Firstly, self-regulated learning continues to develop during adolescence, with metacognitive monitoring and reflection improving significantly during this time (Keating, 1990; Ryan & Pintrich, 1997). This is because students have had more opportunities to observe strategy use and practise it, both of which are theorised to improve self-regulated learning skills (Schunk, 2001; Winne, 1997). In addition to the improvement in students' monitoring and reflection, the academic tasks at secondary school level are more complex, thus requiring more developed skills to successfully complete the tasks. Fuchs et al. (2003) theorised and demonstrated that performance on more complex tasks improves with more proficient self-regulated learning.

A meta-analysis conducted by Richardson et al. (2012) involving a review of 13 years of research into antecedents of university students' grade point average found that four information processing strategies that represent deep learning yielded small, significant, positive correlations with grade point average, namely metacognition, critical thinking, elaboration, and concentration. In terms of measures of behavioural self-regulation, time/study management, help seeking, and peer learning also yielded small positive correlates of grade point average. This research provides significant support to the association between self-regulated learning skills and academic achievement.

Remaining with university level study, Broadbent (2017) states that a high level of self-regulated learning skill is important for students if they are to achieve academic success at this level of study. In their research into the academic achievement of first year medical school students, Barbosa, Silva, Ferreira, and Severo (2018) found that self-regulated learning skills were positively associated with academic achievement, more specifically that measures of motivation, action to learn and self-directedness had significant direct and indirect effects on academic achievement. There is a strong link between Broadbent's and Barbosa et al.'s findings and the rationale for this research, which is rooted in the development of life-worthy learning skills, a toolkit of self-regulated learning skills and strategies students need to maximise their academic potential both at school and beyond. In terms of the latter, much of the recent research into the relationship between self-regulated learning and academic achievement is now within the context of online learning environments that many university courses have moved towards. This view is supported by Alonso-Mencía et al. (2020), who highlight the trend towards more online learning opportunities which require greater levels of autonomy and self-direction, providing further context for this research. Improved academic outcomes achieved through engagement with online learning environments have also been linked with enhanced self-regulated learning skills such as time management, metacognition, effort regulation and critical thinking (Broadbent & Poon, 2015; Broadbent et al., 2020).

Further support for the positive association between self-regulated learning and academic achievement can be found in research conducted by Barnard-Brak et al. (2010) who investigated the relationship between university students' ability to regulate their learning and academic achievement expressed in the form of grade point average. Results indicated that participants differed significantly in their grade point average according to their class or profile of self-regulated learning membership.

It is often assumed that highly intelligent and high achieving students know more about learning strategies and self-regulated learning than their peers, and that they optimally shape and regulate their learning process without outside help (Sontag & Stoeger, 2015). On average, highly intelligent and high-achieving students do seem to possess more metacognitive knowledge, however this does not mean that they actually use self-regulated learning strategies more often or more effectively than their peers (Sontag & Stoeger, 2015). In a study by Zimmerman and Martinez-Pons (1990), highly intelligent (top 1% in an intelligence test) high achievers from a school for academically gifted students reported using some strategies more than their peers, but there were no observed differences in the reported use of other strategies. This research was supported by the findings of a study conducted by Bouffard, Parent, and Lavirée (1993) that examined the behaviour of highly intelligent students (top 11% in a test of mental ability) and their peers of average intelligence in a learning task and found that the highly intelligent students outperformed their peers only in the use of some strategies, but not in the use of others (Sontag & Stoeger, 2015). However, research conducted by Zimmerman (2006) describes self-regulated learning as being indispensible to achieving excellence in a certain domain, thus supporting the notion that training self-regulated learning is relevant for highly intelligent and high-achieving students.

Furthering this, research conducted by Fischer (2008) found that academically gifted students who practiced self-regulated learning skills in small groups showed improvements in both strategy knowledge and academic performance across pre-test post-test comparisons to their peers. These findings are further substantiated by research conducted by Sontag and Stoeger (2015) whose results showed the general effectiveness of self-regulated learning training for all intelligence and achievement-based sub-groups with regard to preference for self-regulated learning and for all four subgroups. High-achieving students clearly benefited from the programme, demonstrating and increased preference for self-regulated learning immediately after training and a further increase in preference for self-regulated learning in the long-term, while students in the regular instruction group displayed the exact opposite pattern (Sontag & Stoeger, 2015). The evidence outlined in this section provides significant support for the notion that high achieving students will also benefit from a training intervention designed to support the development of students' self-regulated learning skills.

2.6 The Pedagogy of Self-Regulated Learning Interventions

Our understanding of self-regulated learning originates from the early 1970s when Simon (1979) proposed the information processing model of cognition as a way of conceptualising cognitive processes and products. Weinstein et al. (2000) state that within this new field of cognitive psychology there was an evolving focus on information processing research and models that emphasised that cognition was something that could be controlled through cognitive and metacognitive processes (Brown, 1978, 1981; Brown, Collins, & Duguid, 1989; Flavell, 1979; Pressley & McCormick, 1995), particularly in academic and learning contexts (Wang, 1983; Weinstein, 1978). In light of this, researchers questioned whether cognitive strategies were modifiable and if students could be taught to improve their repertoire of learning strategies (Weinstein et al., 2000). Through a six week training programme, Weinstein (1978) demonstrated that cognitive strategies could be modified through instruction. Since then, researchers in educational and (applied) cognitive psychology have been concerned with finding means to train self-regulated learning skills (Raaijmakers, Baars, Paas, et al., 2018), and although both meta-analyses and more recent research of self-regulation training programmes show that self-regulated learning skills can be improved through training programmes in both primary and secondary education (Dignath & Büttner, 2008; Hattie, Biggs, & Purdie, 1996; Raaijmakers, Baars, Paas, et al., 2018), many questions remain unanswered (Dignath & Büttner, 2018). There is, however, a great deal of research that suggests that explicit instruction in strategy training is necessary before any significant improvement in students' independent performance will be seen (Borkowski & Cavanaugh, 1981; Brown, Bransford, Ferrara, & Campione, 1983; Brown, Campione, & Day, 1981; Brown & Palincsar, 1985).

Brown and Palincsar (1985) argue that reciprocal teaching, where students receive instruction, modelling and practise of skills, gradually taking charge of their own learning, is a far better method than direct instruction or modelling on their own. In several studies focusing on the development of reading comprehension skills the authors observed large and reliable gains when students received the reciprocal teaching procedure compared with viable instructional alternatives (rising from less than 40% correct response up to 70% to 80% correct on reading comprehension tests). The authors also identify the need for *expert scaffolding*. Expert scaffolding refers to situations where an expert (a teacher, a peer, a parent, a master-craftsman) provides a supporting context in which students may gradually acquire skills (Brown & Palincsar, 1985). The notion of expert scaffolding resonates strongly with the notion of a more capable peer in Vygotsky's zone of proximal development (see Paper 1), but also in the underpinning principles of reciprocal teaching identified by Brown and Palinscar (1985): (a) the teacher should model the desired comprehension activities, thereby, making underlying processes overt, explicit, and concrete; (b) the teacher should model the activities in appropriate contexts, not as isolated decontextualized skills; (c) the students should be fully informed of the need for strategic intervention and the range of utility of a particular strategy; (d) students should realize that the use of strategies works for them; (e) the responsibility for the comprehension activities should be transferred to the students as soon as they can take charge of their own learning; (f) this transfer of responsibility should be gradual, presenting students with a comfortable challenge; and (g) feedback should be tailored to the students' existing levels, encouraging them to progress one more step toward competence.

In support of this, more recent research by Schünemann, Spörer, Völlinger, and Brunstein (2017) found significant differences between the reciprocal teaching plus self-regulated learning training group and the solely reciprocal teaching group with regard to teamwork quality. A more supportive interaction and task-oriented approach was observed in the reciprocal teaching plus self-regulated learning training group than solely the reciprocal teaching group. The same study also found the quality of feedback of the reciprocal teaching and self-regulated learning group to be significantly higher than that of the reciprocal teaching group too. The conclusions of this study are that through the integration of self-regulated learning procedures and monitoring devices, co-regulation processes in collaboration were fostered, leading to improved internalisation of regulatory processes and subsequently enhanced strategy-related task performance and reading comprehension.

However, the unique feature of the natural form of reciprocal teaching is the gradual transfer of control to the student, a transfer dictated not by a predetermined script but by the individual student's changing region of sensitivity to instruction. Linking this to the pedagogy of self-regulated learning interventions, Hofer et al. (1998) identify three broad issues regarding the teaching of self-regulated learning skills: (a) the components and design of an intervention; (b) integrated versus adjunct course design; and (c) the issue of transfer.

2.6.1 The Components and Design of an Intervention

The starting point for the design of an intervention is to give consideration to the definition of self-regulated learning and subsequent cognitive, metacognitive, motivational and behavioural components that might comprise the intervention (Hofer et al., 1998). As highlighted in Paper 2, there are a number of different definitions of self-regulated learning each with its own emphasis, and Simpson et al. (1997) argue that there is even more diversity in what self-regulated learning interventions have tried to teach students. Hofer et al. (1998) identify three key considerations from an intervention design standpoint: designers need to consider the *scope* of their programme, the *content* of the programme and lastly, the *timeframe* of the programme.

Scope refers to the number of different strategies that the intervention will focus on. Drawing on findings from the meta-analysis conducted by Hattie et al. (1996), uni-structural interventions which focused on the development of just a single strategy had the largest effect on student performance, whereas multi-strategy inventions had weaker, but still reasonable effect on performance. This presents a paradox – as the researching practitioner I must balance the desire to enhance numerous self-regulated learning skills with the knowledge that the greatest effect on student performance will come from a focus on just a small number of skills. Further perspective on the scope of the intervention is provided by Pressley and Woloshyn (1995) who highlight the importance of training and developing few skills at a time in order to learn how to use each self-regulated learning skill most effectively.

The timeframe of an intervention will determine the both the scope and content of the intervention. One major consideration here is the age of participants, as Pressley and Woloshyn (1995) argue that a few weeks or months is not long enough to develop cognitive strategies due to the complex nature of the skills being targeted. That said, their studies were based on primary school age students who are just developing their general self-regulatory capabilities and knowledge of cognition and metacognition, therefore it is easy to see why a longer timeframe will be required to observe development in these skills. At undergraduate level there is evidence that shorter courses are beneficial (e.g. McKeachie, Pintrich, & Lin, 1985; Pintrich, McKeachie, & Lin, 1987). Hattie et al.'s (1996) meta-analysis found that primary school students benefited more from interventions targeting the development of learning skills than undergraduate students. However, the meta-analysis does not indicate whether the results are due to developmental differences in the students or due to characteristics of the interventions at different age levels (Hofer et al., 1998). Nevertheless, this does give rise to the need to consider the timeframe of the intervention relative to the age and experience of the participants.

2.6.2 Integrated Versus Adjunct Course Design

The second major consideration is whether the intervention takes the form of an integrated, discipline-dependent programme embedded within the curriculum, or whether it the intervention takes the form of an adjunct, generic, standalone course that is independent from the curriculum (Simpson et al., 1997).

2.6.2.1 Discipline-Dependent Interventions. Many researchers developed integrated or discipline-dependent approaches to examining self-regulated learning (e.g. Boekaerts, 1997; Pintrich, Marx, & Boyle, 1993; Weinstein et al., 1997). This type of intervention aims to increase self-regulated learning skills and academic success by contextualising the content of the training within a specific content area, integrated within the delivery of the curriculum (Broadbent et al., 2020). The findings of research published by Becker (2013) and Olakanmi and Gumbo (2017) show that discipline-dependent training improves self-regulated learning behaviours and academic outcomes.

Perkins and Salomon (1989) contend that thinking at its most effective depends on specific context-bound skills and units of knowledge that have little application to other domains. Furthering this, Toulmin (2003) emphasises that although different domains share many structures of argument, they each bring with them somewhat different criteria for evidence founded in the unit of knowledge associated with different academic disciplines. Although this provides a strong argument for the integration of the self-regulated learning intervention within the different disciplines that comprise the curriculum, Hofer et al. (1998) argue that developmental differences between younger and older students make it both more productive and logistically easier to implement an integrated programme at primary school level. Primary school teachers teach content across all subject areas and spend up to six hours a day in the classroom with students, affording them the time to teach both content and learning skills. In addition to this practical consideration, Calderhead (1996) outlines the contrast between primary school teachers and secondary school teachers in terms of their beliefs about their role as teachers. Primary school teachers' belief about their role reflects an emphasis on teaching for learning and development whereas secondary school teachers perceive their main responsibility to be the teaching of subject-specific knowledge.

In terms of discipline-dependent interventions, findings published by Hattie et al. (1996) indicate an advantage of contextualising a self-regulated learning intervention within the context of a specific subject, mostly the case for younger, primary school-aged children (Dignath et al., 2008). This is of course in addition to the relevance of domain-specific self-regulated learning strategies delivered as part of the discipline-dependent intervention (Dörrenbächer & Perels, 2016a). Dignath et al. (2008) state that this is mostly the case for primary school children, as within the context of this level of education discipline-dependent strategies can be transferred to general problem solving in the specific subject e.g. Mathematics, reading or writing (Brunstein & Glaser, 2011; Dörrenbächer & Perels, 2016a; Fuchs et al., 2003; Souvignier & Mokhlesgerami, 2006). At university level, Dörrenbächer and Perels (2016) contend that self-regulated learning interventions are often linked to regular teaching within a specific field of study (discipline-dependent): business economics (Masui & De Corte, 2005); psychology (Nuckles et al., 2009; Wagner et al., 2010); Mathematics (Zimmerman, 2011); learning a foreign language (Henter, 2014).

In light of the findings of Hattie et al. (1996), Leidinger and Perels (2012) contend that direct instruction of self-regulated learning strategies ought to be linked to factual content in order to apply these strategies in a natural setting. This links to view held by Hessels-Schlatter et al. (2017) who state that fostering self-regulated learning should be fully integrated in on-going instruction in order to promote self-regulated learning in all students, whatever the domain or context. Students' observation and experience of the taught strategies within a natural setting will exemplify the relevance for their everyday learning, and in turn foster the transfer to and integration of self-regulated learning processes across domains and into their daily activities (Hessels-Schlatter et al., 2017). Remaining with the idea of transfer, Perels et al. (2009) state that in order to facilitate the transfer of trained self-regulated learning strategies, the instruction of self-regulated learning strategies should be included directly into subject-oriented education. However, the authors contend that within the context of Mathematics education, training that combines the teaching of self-regulated learning strategies and Mathematics mostly focuses on just cognitive strategies, that is mathematical problem solving, but rarely on metacognitive, self-regulatory strategies and learning skills (Perels et al., 2009a). The same authors cite the lack of transfer as justification for integrating interventions into the classroom, with these combined training sessions proven to be more efficient (Perels et al., 2009a).

Whilst this section has provided a detailed, research-informed view of discipline-dependent interventions citing many of the advantages, it is also imperative that it considers some of the more prosaic, practical pros and cons. The weight of the body of research evidence behind the implementation of discipline-independent interventions is clear to see, however in terms of practical considerations it is much easier for subject Heads of Department (HoDs) to lead on the delivery of interventions within the context of their own subject area. Effective communication and collaboration channels are already in situ between them and their teams, allowing the intervention to be appropriately administered in addition to on-going dialogue and reflection on its progress throughout the delivery of the intervention.

Notwithstanding the relative practical advantages of discipline-dependent interventions outlined above, one major limitation of this methodological approach is that rather than the intervention being delivered by me, the researching practitioner at the heart of the study, responsibility is devolved to subject Heads of Department who between themselves and their teams, may only have a primitive understanding and experience of self-regulated learning, not least the delivery of an intervention to support the development of these skills. This observation is supported by research published by Dignath and Büttner (2008) who state that self-regulation training was most successful when led by researchers and not students' teachers. Furthering this, the quality of the delivery of the intervention could also be undermined by the students' attention on the subject-specific content being taught in curriculum lessons, and not the self-regulated learning skills; the focus of the intervention. Lastly, within the context of the size and scope of this study in that it is just me working as the researching practitioner, balancing a demanding full-time role with part-time doctoral research, it wouldn't be practically viable to lead an intervention intended to be delivered to a whole cohort with the time and resources available.

2.6.2.2 Discipline-Independent Interventions. In adjunct or discipline-independent interventions the training is not tied to any particular course content, but instead focuses on learning strategies that can then be applied within any academic discipline (Broadbent et al., 2020; Dörrenbächer & Perels, 2016a). Discipline-independent training interventions have shown increases in long-term academic outcomes, as they foster several motivational, cognitive, metacognitive and resource management components of self-regulated learning (Bail et al., 2008; Broadbent et al., 2020; Dörrenbächer & Perels, 2016a; Schmitz & Wiese, 2006). Research findings suggest that these interventions are effective largely because of the optimisation of general learning habits and attitudes as well as the importance of learning to deal with problems encountered, irrespective of the subject studied (Bail et al., 2008; Dörrenbächer & Perels, 2016a; Hofer & Yu, 2003; Schmitz, 2001). Discipline-independent interventions also show a high economic benefit and considering the range of academic subjects that comprise a Year 9 student's curriculum, these interventions can be applied ubiquitously with all groups of students. My aim as a researching practitioner is to have the most impact across the largest number of students, and within the context of the present study this strength relative to discipline-dependent interventions is a major advantage.

Research by Lin (2001) highlighted a trend, moving self-regulated learning interventions away from a domain-specific strategy instruction approach and towards an approach rooted in the creation of social environments which support the development of metacognition. She also identifies a shift from training content that focuses either on domain-specific knowledge or on knowledge about learning strategies more generally, towards a more balanced training programme consisting of both kinds of knowledge (Dignath et al., 2008; Lin, 2001). Again, linking this to the setting for this study, this is a particular strength as any self-regulated learning skills developed through a discipline-independent intervention would be supported and reinforced through students' engagement with their curriculum subjects where subject-specialists are on-hand to instruct, guide and scaffold as required.

There are also several practical benefits to discipline independent interventions. Firstly, given that they are not *tied* to any one subject area or domain, they can be delivered to whole year groups at a time, potentially increasing the impact of the intervention. Another practical and methodological advantage is that the researcher can deliver the intervention, which as Dignath and Büttner (2008) states and as highlighted earlier, is likely to be more successful than if the intervention was delivered by subject teachers themselves.

Another advantage of discipline-independent interventions relates to the issue of transfer, with Leidinger and Perels (2012) arguing that after the intervention has been delivered independent of any one specific subject area, students should be given the opportunity to use these strategies in different contexts. They contend that as self-regulated learning strategies are transferrable to different situations and subject domains, and therefore the delivery of a discipline-independent intervention will not only serve to enhance students' self-regulated learning skills, but will also facilitate the transfer of these strategies across the curriculum assuming appropriate opportunities to practice and embed these strategies were provided across all subjects comprising a student's curriculum.

Hofer et al. (1998) conclude their discussion by stating that the decision to use integrated versus adjunct programmes is not a simple one. Designers must consider the age level of the students, the contextual constraints operating in the school or research setting, as well as the knowledge, skills, beliefs, and motivation for strategy instruction amongst practitioners. These considerations serve to support and reinforce the decisions that I have made in the design of the intervention to be used in this research.

2.6.3 The Issue of Transfer

The issue of transfer is an age old problem and one of the key goals of scaffolding or training self-regulated learning skills (Perkins & Salomon, 1989; Raaijmakers, Baars, Paas, et al., 2018). How do I, as a researching practitioner, facilitate the transfer of strategies across all contexts and domains? Willingham cites the work of Korthagen and Kessels (1999) who distinguish between *episteme* (broad general principles) and *phronesis* (situation-specific knowledge). Although the degree to which self-regulated learning processes exhibit *episteme* and are therefore domain-general has been discussed (Greene et al., 2015; Poitras & Lajoie, 2013), this issue has not been extensively addressed through empirical investigation (Alexander et al., 2011; Raaijmakers, Baars, Paas, et al., 2018). Hofer et al. (1998) argue that by using strategies in many different contexts and across different types of tasks and content areas, integrated programmes will increase the probability that transfer of strategies will occur (Perkins & Salomon, 1989; Simpson et al., 1997). Salomon and Perkins

(1989) describe this as a *low-road* manner, whereby students automatise their use of strategies through repeated practice across different tasks.

The greatest challenge of adjunct programmes is the that of transferring the learning skills and strategies developed during the adjunct course to other disciplinary courses (Hofer et al., 1998; Simpson et al., 1997). Meta-analyses conducted by Hattie et al. (1996) and Rosenshine, Meister, and Chapman (1996) concluded that the training of learning skills is effective to the extent that it makes students metacognitively aware of the self-regulation strategies that are in order in specific learning contexts. Furthering this, Veenman, Van Hout-Wolters, and Afflerbach (2006) argue that it is challenging to have adequate metacognitive knowledge of one's competencies in a domain without substantial (cognitive) domain-specific knowledge, such as knowledge about relevant concepts and theories in a domain, about intrinsic difficulties of a domain, and about what is irrelevant.

However, Simpson et al. (1997) suggest that transfer can be facilitated by making the declarative, procedural and conditional knowledge about strategy use explicit to students. Declarative knowledge is knowledge of the variety of strategies available (Paris et al., 1983). Procedural knowledge is knowing how to use these strategies, allowing students to perform tasks more automatically (Garner, 1990). Conditional knowledge refers to knowing when and why to use declarative and procedural knowledge (Garner, 1990), and it is argued that a good base of conditional knowledge provides the foundation for the transfer of strategy knowledge and skills to new situations (Garner, 1990; Paris et al., 1983; Weinstein et al., 2000). Furthermore, the practice and application of conditional knowledge on a wide variety of academic tasks from different content areas will support transfer. This *high-road* transfer occurs by intentional, mindful abstraction of a strategy from one context and application in a new one (Salomon & Perkins, 1989), and I would argue that this type of transfer requires students to be more metacognitively aware and reflective about their strategy use compared to low-road transfer where extensive, varied practice leads to the automatic triggering of well-learned behaviour in a new context. This approach may well yield success when considered in the relatively narrow context of external examination tasks, however it is the development of students' conditional knowledge and metacognition that will be of more use in the context of this research project, as the rationale calls for the development of life-worthy learning skills that will be of use in the rapidly changing world into which students will emerge at the end of secondary education.

Veenman, Elshout, and Meijer (1997) obtained strong support for the generality of metacognitive skills (Veenman et al., 2006). In light of this comprehensive analysis, Veenman and Spaans (2005) assert that metacognitive skills initially develop in separate domains, and later on become generalised across domains. Despite these findings, students often experience difficulties transferring learned skills to different domains (i.e. far transfer)(Donovan et al., 1999). Salomon and Perkins (1989) offer bridging as a reason for these difficulties, as successful transfer between domains requires learners to abstract the more general underlying principle of heuristic from the learning material whilst recognising similarities between the old and new contexts (Raaijmakers, Baars, Paas, et al., 2018). That said, in a study designed to enhance students' transfer of task selection skills through training, the authors found that students who had received self-assessment and task-selection training were better at selecting tasks in a different domain than students who did (Raaijmakers, Baars, Paas, et al., 2018). These findings are further supported by a similar study examining the transfer of self-assessment and task-selection skills in one domain (Biology) would transfer and be applied through self-regulated learning to a different domain (Mathematics)(Raaijmakers, Baars, Paas, et al., 2018).

2.6.4 Direct versus Indirect Instruction

Having discussed the three broad issues relating to the teaching of self-regulated learning skills identified by Hofer et al. (1998), I would like to add the debate over direct and indirect instruction of self-regulated learning skills to this section of the pedagogy of self-regulated learning skills. In-line with the epistemological lens through which this research is viewed, a classroom context that indirectly encourages students to self-regulate is one based on constructivist views of learning, which involves the acquisition of knowledge and skills through active, collaborative and authentic learning experiences (Dignath & Büttner, 2018). However, in contrast Schunk and Zimmerman (2007) argue that in order for students to acquire self-regulated learning skills they need to be explicitly taught the skills and have opportunities to practise these skills in context (Salter, 2012). This dichotomy summarises the two polarised views of the direct versus indirect instruction debate that exists in much of the literature relating to the instruction of self-regulated learning skills. Paris and Paris (2001) argue that direct and indirect promotion of self-regulated learning have to be combined in order to develop self-regulated learners. The rationale for this is that direct training of self-regulated learning strategies would be too abstract for students to understand, however indirect training along would overstrain students as they would be unable to cope with the autonomy without knowing strategies to act effectively (Dignath & Büttner, 2018; Pressley et al., 1992).

While student-centred and constructivist classroom practices are increasing, direct instruction of effective self-regulated learning strategies remains scarce (Kistner et al., 2010; OECD, 2009; Peeters et al., 2016). Direct instruction is defined as providing information that fully explains the concepts and procedures that students are required to learn as well as learning strategy support that is compatible with human cognitive architecture (Kirschner et al., 2006). Ariel and Karpicke (2018) outline two arguments for direct instruction: firstly, it will be more effective for initial strategy acquisition, especially for primary school students where strategies might be introduced for the first time, and secondly, direct instruction is effective for promoting the transfer of strategy use to new learning contexts (Ariel & Karpicke, 2018; McDaniel & Schlager, 1990). If students are both encouraged to employ a certain strategy and provided with explicit information about the significance of that strategy, the result should be an improvement in performance and the development of the ability to employ the strategy again when faced with a similar problem.

Brown et al. (1981) offer a distinction between explicit and implicit strategy instruction, differentiating three levels of strategy instruction. *Blind training* forming the lowest level, also corresponding with implicit strategy instruction, is where students are induced to use a strategy without providing them with any information about the significance of this activity (Dignath & Veenman, 2020). At an intermediate level, *informed training*, students are both induced to use a certain strategy in addition to being provided with some context surrounding its significance, for example its benefits and usefulness (Dignath & Veenman, 2020; Veenman, 2011). At the highest level corresponding with explicit instruction, *self-control training* combines *informed training* with the explicit instruction of how to manage, monitor, check and evaluate strategy application (Dignath & Veenman, 2020). Supporting students to execute and maintain metacognitive strategies, this type of training is argued to best facilitate the transfer of strategy application to different contexts (Brown et al., 1981; Veenman, 2018). Referred to as the *WWW&H* rule by Dignath & Veenman (2020), this type of explicit instruction informs the students What to do, When, Why, and How to do it, supporting the development of students' metacognitive knowledge (Dignath & Büttner, 2008; Ewijk et al., 2013; Veenman, 2013; Veenman et al., 2006).

Dignath and Büttner's (2018) paper on teachers' direct and indirect promotion of self-regulated learning in primary and secondary school Mathematics classes highlights that during their study hardly any explicit instruction of self-regulated learning strategies was observed. Although the authors note a word of caution in light of the low intercoder reliability generated, the results speak volumes about the lack of explicit instruction. Conclusions drawn from the findings of Dignath and Büttner's (2008) meta-analysis found that self-regulation training was most successful when led not by students' regular teachers but rather by researchers, a finding described as *alarming* by the authors because teachers play a crucial role as multipliers in supporting their students' self-regulation of learning. The authors state that teachers might not be receiving enough training on how to teach self-regulation strategies or might not be able to see the benefits of teaching self-regulated learning or the need to support it (see Section 2.7). Research by Dignath (2016) into the predictive impact of teachers' beliefs of instructing self-regulated learning, their own self-efficacy towards the promotion of self-regulated learning and also their epistemological beliefs regarding learning, supports conclusions drawn by Dignath and Büttner (2008). The amount in which teachers feel competent enough to foster their students' self-regulation depends on their beliefs, as well as on their knowledge, and the more they know about supporting their students' self-regulation, the more competent they feel with handling a learning environment conducive to self-regulation (Dignath, 2016). These findings underline the importance of having well-trained, competent and confident teachers with regard to fostering an environment that will facilitate the development of self-regulated learning skills.

Moreno (2004) concluded that there is a growing body of research showing that students learn more deeply from strongly guided learning than from discovery learning. In further support of the use of direct instruction over indirect, discovery leaning, Klahr and Nigam (2004) found that direct instruction involving considerable guidance, including examples, resulted in vastly more learning than discovery learning. Research examining the use of process worksheets to support guided instruction yielded positive effects on learning task performance, with learners who received the guidance through process worksheets outperformed those left to discover the appropriate procedures for themselves, having significant implications for the design of interventions targeting the development of students' self-regulated learning skills (Kirschner et al., 2006). To conclude this sub-section, I draw on the words of Paris and Winograd (1999) who describe 12 principles that teachers can use to design activities in classrooms that promote students' self-regulated learning:

1. Self-appraisal leads to a deeper understanding of learning.
   1.1. Analysing personal styles and strategies of learning, and comparing them with the strategies of others, increases personal awareness of different ways of learning.
   1.2. Evaluating what you know and what you do not know, as well as discerning your personal depth of understanding about key points, promotes efficient effort allocation.
   1.3. Periodic self-assessment of learning processes and outcomes is a useful habit to develop because it promotes monitoring of progress, stimulates repair strategies, and promotes feelings of self-efficacy.

2. Self-management of thinking, effort, and affect promotes flexible approaches to problems solving that are adaptive, persistent, self-controlled, strategic and goal oriented.
    2.1. Setting appropriate goals that are attainable yet challenging are most effective when chosen by the individual and when they embody a mastery orientation rather than a performance goal.
    2.2. Managing time and resources through effective planning and monitoring is essential to setting priorities, overcoming frustration, and persisting to task completion.
    2.3. Reviewing one's own learning, revising the approach, or even starting anew, may indicate self-monitoring and a personal commitment to high standards of performance.
3. Self-regulation can be taught in diverse ways.
    3.1. Self-regulation can be taught with explicit instruction and, directed reflection, metacognitive discussions, and participation in practises with experts.
    3.2. Self-regulation can be promoted indirectly by modelling and by activities that entail reflective analyses of learning.
    3.3. Self-regulation can be promoted by assessing, charting, and discussing evidence of personal growth.
4. Self-regulation is woven into the narrative experiences and the identity strivings of each individual.
    4.1. How individuals choose to appraise and monitor their own behaviour is usually consistent with their preferred or desired identity.
    4.2. Gaining and autobiographical perspective on education and learning provides a narrative framework that deepens personal awareness of self-regulation.

4.3. Participation in a reflective community enhances the frequency and depth of examination of one's self-regulation habits.

2.7 Teacher Training in Self-Regulation

Bakkenes et al. (2010) contend that teachers are the most important agents in shaping education for students and in bringing about change and innovation in educational practices. In terms of self-regulated learning, the roles that teachers need to fulfil to support its development in students is very different to that of more traditional, lecture-based teaching methods (Bakkenes et al., 2010). In teaching methods based on self-regulated learning, teachers are expected to fulfil roles such as diagnostician, challenger, model, and activator, and to monitor and reflect on students' learning processes (Bakkenes et al., 2010; Vermunt & Verloop, 1999). This contrasts with both the environment fostered and pedagogical methods to which current teachers and indeed student-teachers were educated themselves. In this traditional, lecture-based teaching environment the focus was very much on the delivery of subject-matter. Described as process-oriented teaching (Vermunt, 1998), this approach is aimed at achieving the integrated teaching of learning and thinking strategies on the one hand, and teaching domain-specific knowledge on the other (Bakkenes et al., 2010). Considering this, it is therefore important to consider the training that teachers are given to support the development of self-regulated learning in the students they teach. As such, this section provides a critical analysis of the literature relating to teacher training in self-regulation.

Teacher training is often viewed only as that which occurs at the start of a teacher's career on entry into the profession, as part of one of the many options of teacher training under the umbrella of Initial Teacher Education or Training (ITET) in the UK. This staging point at the very start of their careers is an important part of a teacher's development, where student-teachers are trained to teach across the diverse range of age groups, pathways, and curricula. That said, *teacher training* is not only that undertaken at the start of one's teaching career, and a thorough review of the relevant literature must also include training delivered as part of Continual Professional Development (CPD) processes that operate within schools as part of teachers' on-going professional development. In terms of research, Gan et al. (2020) state that researchers have paid relatively little attention to issues concerning the competence required for teachers to create self-regulated learning environments in classrooms, particularly in the practicum context. As such, this review will be structured using the two key areas of teacher training highlighted above, Initial Teacher Education and in-service training, preceded by a review of teacher's beliefs regarding self-regulated learning. As Bakkenes et al. (2010) state, changes in self-regulated learning classroom practice are preceded by changes in teachers' knowledge, attitudes, and beliefs.

2.7.1 Teacher Beliefs About Self-Regulated Learning

Teachers' instructional practices are influenced by many factors, one of which is teachers' beliefs (Rubie-Davies, 2014; Yan, 2018; Yan & Cheng, 2015). Linking this to self-regulated learning, research by Lombaerts et al. (2009) has demonstrated that teachers with positive beliefs about self-regulated learning are more likely to promote it in their teaching. More recent research by Cazan (2020) supports this, highlighting a strong relationship between teacher beliefs and instruction regarding self-regulated learning, further supported by Yan's (2018) findings which showed that teachers' beliefs about the benefits of self-regulated learning and student capacity in implementing self-regulated learning were positive and significant predictors of self-regulated learning instructional practices. That said, other studies by Dignath-van

Ewijk and van der Werf (2012) and Spruce and Bol (2015) report contrasting results. Although teachers expressed positive beliefs about self-regulated learning, they did not include self-regulated learning strategy instruction in their classroom teaching (Yan, 2018). Interestingly, gender was also a significant predictor of self-regulated learning instructional practices, with female teachers demonstrating higher levels of self-regulated learning instructional practices than their male counterparts (Yan, 2018).

Dignath-van Ewijk and van der Werf (2012) attribute this misalignment between beliefs and action to teachers' lack of thorough understanding of self-regulated learning, whereas Spruce and Bol (2015) suggested that teachers were reluctant to apply self-regulated learning strategy instruction because they themselves were not convinced of their students' capacity to implement these skills. Despite these contrasting attributions, it is clear that there is some ground to cover to support teachers' positive view of self-regulated learning, both in terms of their understanding of it and also with regard to their preception of their students' potential to successfully implement these strategies.

Moos and Ringdal (2012) highlight research that suggests that teachers should focus on their own self-regulated learning skills as it allows them to more deeply reflect on their own teaching practices, which can in turn lead to increased student performance. The authors argue that teachers who engage in self-regulation are better able to meet the demands of working in schools, where teachers are required to display innovation and adaptability in response to constant curriculum changes. These self-regulating teachers can balance a variety of professional demands, engage in reflective thinking, and embrace adaptation, meaning that they are better-placed to support the development of these self-regulated learning characteristics in their students (Moos & Ringdal, 2012).

Dignath's (2016) research highlights the importance of teachers' self-efficacy towards promoting self-regulated learning, having the strongest direct predictive value on self-reported teacher behaviour. Teacher beliefs were also found to have a strong direct and indirect impact on teacher behaviour via teacher self-efficacy and teacher knowledge. In terms of teacher knowledge specifically, it was found to have a direct and indirect effect via teacher self-efficacy; the more teachers have knowledge on how to foster self-regulated learning, the more they report to show teaching behaviour that supports the development of self-regulated learning (Dignath, 2016). This research and that cited above serves to emphasise the importance of teacher beliefs on the implementation of self-regulated learning in the classroom, setting the scene for the analysis that follows focusing on the role of initial teacher training and in-service training in the development of self-regulated learning.

2.7.2 Initial Teacher Education

Perels et al. (2009) argue that for self-regulated learning skills to have longevity in schools, the knowledge and skill of how to instruct self-regulated learning skills should fall within the scope of teacher training. When published in 2009, the authors emphasised that this is an area ripe for further research, especially in terms of how training is integrated into existing teacher training courses in addition to what methods could be used to evaluate the extent to which the transfer of training content is successful. Gan et al. (2020) highlight the need for teacher education programmes to provide student-teachers with opportunities and requirements for developing both an intellectual understanding of self-regulated learning and to demonstrate skills in the teaching of self-regulated learning.

Focusing on the first of the two avenues of further research highlighted by Perels et al. (2009), Yan (2018) contends that teacher education programmes should not only transmit subject-based and pedagogical knowledge, but also nurture teachers' positive beliefs about self-regulated learning. The teacher has the ability to create the opportunity for autonomous learning which supports the development of self-regulated learning through their approach to their teaching and the development of a learner-centred classroom environment; something fostered at the initial teacher training stage (Oates, 2019). However, subject teaching in schools experienced by student-teachers is likely to have been rather teacher-centred and didactic, whereas the instruction of self-regulated learning requires student-centred and constructivist classroom practices (Gan et al., 2020). Gan et al. (2020) suggest that trainee teachers might not even be able to distinguish implicit instruction from explicit instruction of self-regulated learning strategies. As such, they might not know how to encourage self-regulation in traditional classroom settings, the resulting low self-efficacy in integrating self-regulated learning in their classrooms could be a major barrier to student-teachers' implementation. Introducing more explicit teaching of self-regulatory practices, strategies, and skills would benefit student-teachers' development, both as self-regulated lifelong learners and as practitioners in schools where self-regulated learning skills and strategies support their teaching and in turn their students (Oates, 2019). In addition to this, Gan et al. (2020) state that it is imperative for both faculties and school-based mentors to scaffold student-teachers in self-regulated learning principles and strategies, especially while they engage in practice teaching in schools. There are also long-term effects in terms of teachers' self-regulated learning beliefs and instruction, with self-regulated learning elements in current teacher training programmes shown to positively effect student-teacher's own self-regulated learning expertise and experiences, but also that of their students taught across their careers (Lombaerts et al., 2009).

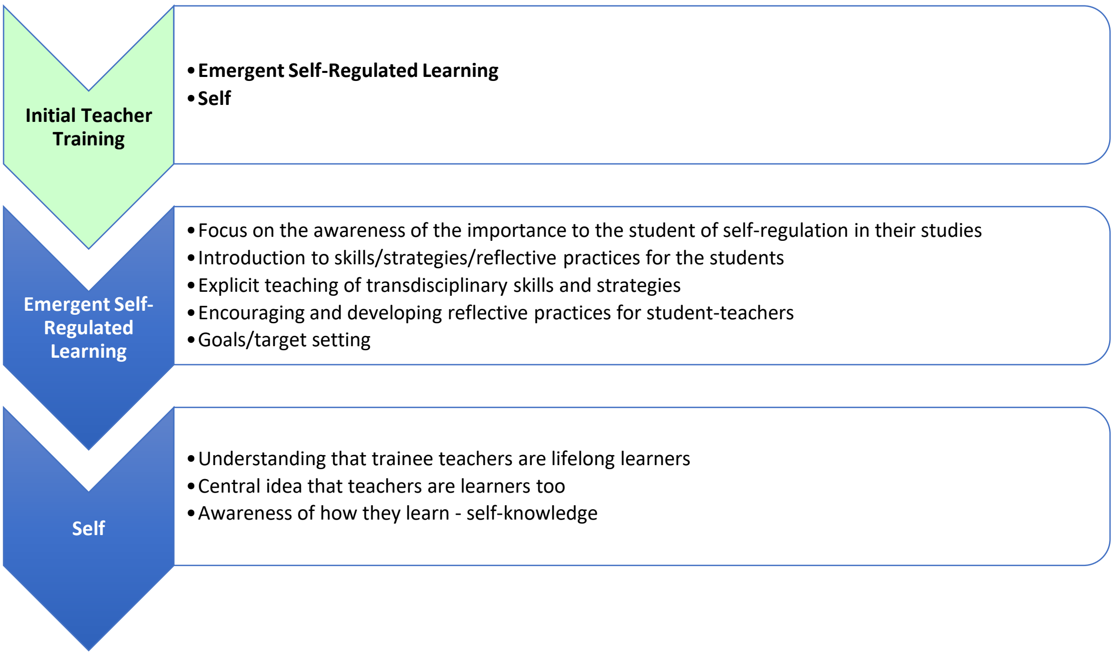
However, there is evidence that suggests that student-teachers find expertise in self-regulated learning difficult to acquire (e.g. Kramarski & Michalsky, 2010; Perry et al., 2007), in addition to questions over the effectiveness of teacher training programmes in adjusting teaching beliefs relative to the implementation of self-regulated learning (e.g. Kettle & Sellars, 1996). That said, Kramarski and Revach (2009) cited evidence that supports incorportating self-regulated learning training in teacher education programmes. Yan (2018) states that student-teachers' beliefs can be developed directly by altering teachers' conceptions of the benefits of self-regulated learning, or indirectly by rehearsing the empirical evidence of student improvement associated with self-regulated learning instruction. This is further supported by Oates (2019), who states that in initial teacher training the university faculty need to explicitly teach, model, and practice the relevant skills and strategies with student-teachers so that learners in schools are set onto a successful path of lifelong learning by self-regulated and autonomy-supportive teachers. In short, the goal should be the empowerment of teachers to develop self-regulated learners (Kramarski et al., 2013).

In terms of interventions designed to support the development of students' self-regulated learning skills, Souvignier and Mokhlesgerami (2006) argue that teacher-generated education should be favoured against using instructional scripts to support teacher's delivery of self-regulated learning interventions. To be impactful and of use, teachers must develop an integrated concept of strategy instruction with the aim of delivering both the subject-specific content and self-regulated learning strategies. That said, Brown et al. (1996) and Guthrie et al. (1998) state that this approach requires at least two years of staff development and training, with many opportunities for feedback and reflection on classroom learning to yield the desired impact (Souvignier & Mokhlesgerami, 2006). Whilst discussed within the initial teacher education section, this point serves to highlight the synergy needed between the foundations laid during initial teacher education, which are then reinforced and built upon through positive engagement with continual professional development during the early years after qualifying.

In Oates' (2019) recently published paper, she argues that student-teachers should be viewed as learning about self-regulation as lifelong learners themselves and that teacher practices in higher education need to change to reflect a more active and collaborative pedagogy in order to support the implementation of self-regulated learning by student-teachers. She outlined two developmental models (see Figure 2.7.2.1 and Figure 2.7.2.2), shaped by her adapted model of Boekaerts' (1999) framework. Boekaerts (1991, 1999) model of self-regulated learning offers a compelling alternative to the theoretical framework underpinning this study, Zimmerman's (2000) model of self-regulation. It contrasts to Zimmerman’s model of self-regulated learning in that it is a component model, founded on Kuhl's (1985) social action theory and Lazarus and Folkman's (1984) transactional stress theory, and unlike Zimmerman’s model is structural in nature where self-regulation is divided into six components. However, there are several direct comparisons between the two models, namely that the authors define them both as goal-oriented processes in additional to being characterised by three distinct phases. Notwithstanding the differences between the two models and given the context here in which Oates (2019) has used Boekaerts' (1999) framework, it provides a clear lens through which to consider self-regulated learning at initial teacher training level.

Figure 2.7.2.1

Oates' (2019) model framing initial teacher training, originally adapted from Boekaerts (1999)

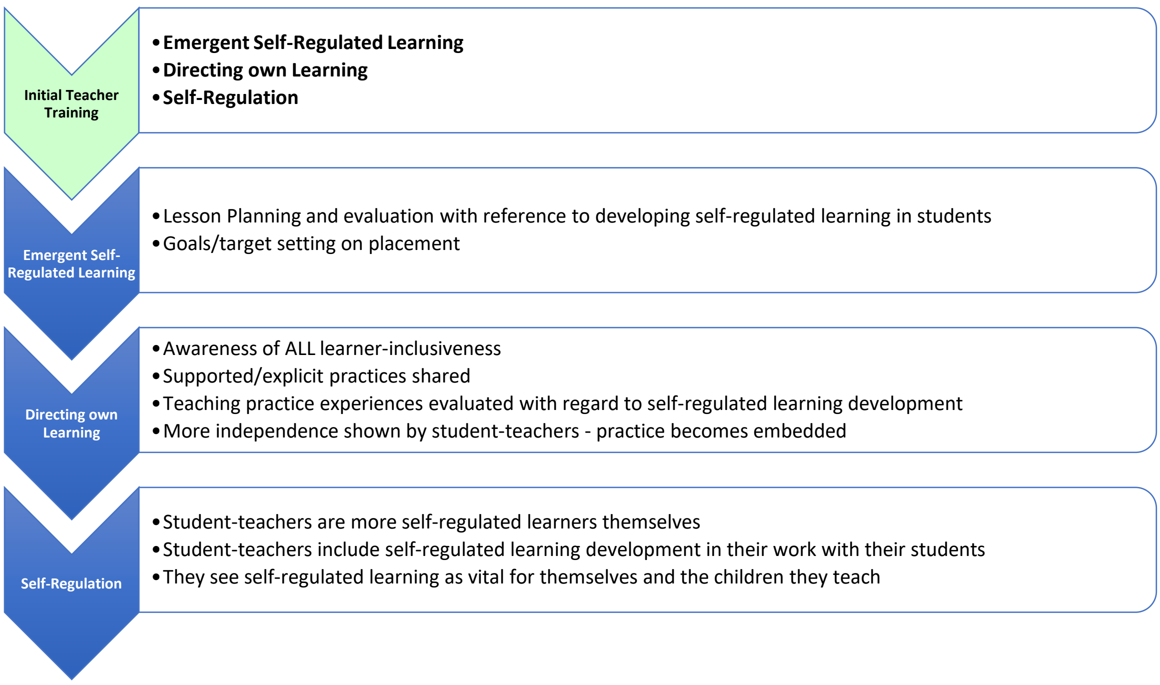


In terms of the development of self-regulated learning within the student-teachers themselves, Oates (2019) proposes two levels: (1) emergent self-regulated learning and (2) the self. Emergent self-regulated learning is developed by firstly enhancing students-teachers' awareness of the importance of self-regulation to their studies, achieved through the introduction to skills, strategies, and reflective practices for the student-teachers. Schön (1983) outlines two types of reflective practices for teachers; reflection-on-action and reflection-in-action. Reflection-on-action uses information from past experiences to inform one's next steps, whereas reflection-in-action requires the continual interpretation, creating a reflective conversation with oneself; a skill of significant importance when considered within the context of the classroom and a responsive teaching approach (Oates, 2019; Schön, 1983). This encouragement of reflective practices sits alongside the explicit teaching of transdisciplinary skills and strategies, in addition the use of goal and target setting.

The second level of self-regulated learning within the students-teachers themselves identified by Oates (2019) is the development of the self. Teaching is a dynamic and rapidly changing profession. Classroom teachers often have to change and evolve in response to both external changes (e.g. government policy, curriculum reforms, specification and assessment changes) and internal changes within the context of the school (e.g. new initiatives and approaches to learning, changes to the shape of the school day, changes in leadership and strategic development). As such, the student-teachers' understanding of themselves as lifelong learners relates strongly to this changing nature of teaching, as gaining a depth of individual self-knowledge of the way that they learn best supports them to develop the knowledge and skills to be outstanding teachers in the future (Oates, 2019). In this regard, the student-teachers will develop an understanding of the fact that teachers are learners too (Turner, 2017).

Figure 2.7.2.2

Oates' (2019) model framing students-teachers' self-regulated learning in schools, originally adapted from Boekaerts (1999)



Oates' (2019) model framing students-teachers' self-regulated learning in schools (Figure 2.7.2.2) comprises three layers: (1) emergent self-regulated learning; (2) directing own learning; and (3) self-regulation. In terms of emergent self-regulated learning, as student-teachers embark on their teaching practice placements they will begin taking theory and putting it into practice, starting with the planning, sequencing and evaluation of lessons for the classes they will be teaching. The deliberate and explicit reference to self-regulated learning in lesson plans is significant within the context of both their own evolving self-regulated learning skills, but also their ability to instruct self-regulated skills and strategies to the students they are teaching. Linking to this, the setting of targets and subsequent reflection on progress against these targets supports student-teachers' critical reflection on the development of their teaching practice.

The second level, directing own learning, supports the development of self-regulated learning in student-teachers by providing them with the opportunity to take responsibility and ownership of their learning, allowing them to independently discuss and analyse their individual experiences and observations on teaching practice (Oates, 2019).

2.7.3 In-Service Training

One of the recommendations of research by Nawastheen et al. (2020) is to incorporate knowledge and skills related to self-regulated learning in the in-service teacher training programmes that underpin teacher's Continual Professional Development. The authors comment that at present, there is more emphasis on students' learning rather than teaching. As self-regulated learning has been shown to support students to achieve more highly, teachers also should encourage students to use self-regulated learning strategies in their learning (Nawastheen et al., 2020).

However, this requires teachers to be made more aware of self-regulated learning and strategies that support the development of students' self-regulated learning practices. For this to be achieved, Nawastheen et al. (2020) contend that teachers require more knowledge and understanding of the strategies that support the development of self-regulated learning, achieved through improved training processes.

For example, Perry et al. (2007) elaborated the characteristics of classroom environments that promote academically effective forms of self-regulated learning:

1. The classroom should provide complex meaningful learning tasks (i.e. tasks that address multiple goals, extend over time, integrate cognitive processes, and allow for the creation of a variety of products).
2. Learners have opportunities to exercise some degree of control over their learning processes and products in ways that reflect metacognitive, motivated, and strategic behaviours, which are associated with self-regulated learning.
3. Provision of classroom tasks and practices that engage learners in evaluating their work.
4. Learners receive instrumental support from peers and teachers, which often takes the form of modelling and scaffolding attitudes and actions associated with self-regulated learning.

Smul et al. (2020) state that the implementation of self-regulated learning in classrooms requires a redefinition of the role of the teacher as it involves giving students more control and responsibility for their own learning (James & McCormick, 2009). This can be considered as a new way of thinking about learning and teaching, where the teacher takes on the role of a coach towards the students' learning process; a challenge for fledgling teachers and more experienced practitioners alike (Bolhuis & Voeten, 2001; Smul et al., 2020). As an example of educational innovation in schools, the implementation of self-regulated learning needs to be underpinned by a supportive school climate, one where change and professional development is actively encouraged and championed (Smul et al., 2020). Linking to this, research by Pedder (2006) and Peeters et al. (2014) stressed that the implementation of self-regulated learning is not the sole responsibility of the individual classroom teacher, but instead requires a school-wide approach where professional learning through positive engagement with Continual Professional Development opportunities is demanded by the school in order to foster the supportive school climate outlined above (Muijs et al., 2014). As such, school leadership plays a vital role in the creation of the *right* school climate to support the change in culture required to facilitate the successful implementation of self-regulated learning (Day et al., 2016). James and McCormick (2009) extends this by stating that in terms of providing opportunities for teachers to reflect on the implementation of self-regulated learning, school leaders have the responsibility to create a supportive school climate for this to happen through the provision of space and time to reflect on progress.

2.8 Paper 2 Summary

As a comprehensive review of the literature relevant to the present study, this paper offers a hugely significant contribution to this portfolio. The construct of self-regulated learning has been given context through the discussion of Bandura's (1986) Social Cognitive Theory, the theoretical perspective upon which Zimmerman's model of self-regulated learning (Zimmerman, 2000; 2001) is based; the theoretical framework for this study. The three phases and associated sub-processes of Zimmerman's model have been critically analysed, drawing on a wide range of research and data to support this analysis. Zimmerman's model is described as one of the most comprehensive (Panadero & Alonso-Tapia, 2014) and it forms the cornerstone of research into self-regulated learning (Dunn & Lo, 2015). The model has been used as the theoretical basis for many interventions as its many components are trainable via strategy instruction (Dörrenbächer & Perels, 2016a; Perels et al., 2009), forming persuasive justification for its use in this study. This paper also explores the development of self-regulated learning skills and the relative influences of the environment and biology, before examining the relationship between self-regulated learning and academic achievement. The pedagogy of self-regulated learning interventions has been extensively discussed, and finally the literature relating to teacher training in self-regulation has been critically analysed. Forming the *literature review*, this paper represents a significant part of the portfolio, underpinning the study and sections that follow.

Paper 3

Measuring Self-Regulated Learning

Having outlined and critically analysed the literature relevant to the theoretical perspective underpinning this study, this paper seeks to conduct the same depth of analysis for the measurement of self-regulated learning. Three waves of self-regulated learning measurement are delineated and discussed. This structure is then used to critically analyse the instruments used to measure self-regulated learning associated with each wave, instruments generated in response to evolving theoretical conceptualisations. This paper also justifies the adoption of a quantitative approach for this study, in addition to discussion of the research design and internal validity, providing strong context for the next paper of this portfolio: Paper 4, Methods.

Written March 2017, revised June 2021.

3.1 The Three Waves of Measuring Self-Regulated Learning

The past two decades have witnessed a proliferation in the volume of research on self-regulated learning (McCardle & Hadwin, 2015). This explosion of interest stems from the indisputable importance of self-regulated learning for the learning process (Eekelen et al., 2005; Roth et al., 2016), giving rise to considerable advancements in research and theoretical conceptualisations of self-regulated learning. Dent and Hoyle (2015) state that measures and models of self-regulated learning have reached a golden era of empirical advances. However, despite advancement debate continues about how to measure self-regulated learning (McCardle & Hadwin, 2015; Winne & Hadwin, 1998). The measurement of self-regulated learning is an important area of research and due to the complexity of this research field, the types of assessment methods are diverse (Panadero, Klug, & Järvelä, 2016; Roth et al., 2016). Denzin (1978) has likened self-regulated learning methods to a kaleidoscope; depending on how they are approached, held, and acted toward, different observations will be revealed.

A number of important and extensive discussion papers about the measurement of self-regulated learning have been published since the turn of the millennium (Boekaerts & Corno, 2005; Pintrich et al., 2000; Winne et al., 2002; Winne & Perry, 2000; Zeidner et al., 2000; Zimmerman, 2008). As an internal process, self-regulated learning cannot be directly accessed and therefore researchers need to find alternative ways of accessing it (Panadero et al., 2016). Differing conceptualisations of self-regulated learning have had a strong influence on the development of instruments for its assessment, and many researchers have proposed and discussed formal guidelines for measuring self-regulated learning (Roth et al., 2016). However, these guidelines have shifted and evolved over time as the sheer volume of research in this field has increased, resulting in the substantial variability in self-regulated learning assessment methods across empirical studies (Boekaerts & Corno, 2005). Rapid technological progress has transformed data collection, allowing for the acquisition of detailed information about self-regulated learning processes either in summary or as the processes unfold (Dent & Hoyle, 2015), signalling a movement away from more traditional assessment tools. In response to this, Panadero et al. (2016) contend that different waves of measuring self-regulated learning are identifiable, with a third wave now evident in research. Using these three *waves* as a structure for this paper, I will critically analyse the wide range of instruments used to assess students' self-regulated learning skills which will help to provide context for Paper 4: Methods. Table 3.1.1 provides an overview of the three waves in addition to examples of measures. The authors emphasise that it is important not to consider the three waves of self-regulated learning measurement as being closed or self-contained in nature, but rather interwoven with one another (Panadero et al., 2016).

Table 3.1.1

The Three Waves of Self-Regulated Learning Measurement (adapted from Panadero et al., 2016)

Wave number	Wave title	Characteristics	Examples of measures
First wave	Self-regulated learning through self-report lenses	• Characterised by more static conceptualisation of self-regulated learning assessment. • Emphasis placed on self-reporting and interviews, although teacher ratings have also been used (Winne & Perry, 2000; Zimmerman & Martinez-Pons, 1986).	• Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993). • Learning and Study Strategies Inventory (LASSI) (Weinstein, Schulte, & Palmer, 1987). • Self-Regulated Learning Interview Schedule (SRLIS) (Zimmerman & Martinez-Pons, 1986).
Second wave	The eruption of online measures	• Shift in self-regulated learning definition at the end of the 1990s from a trait-based definition to a process-based definition triggered a change in measurement to capture *process*. • Second wave online measures focus on following student activity during the learning tasks their situated regulatory processes.	Researchers rely on *event measures* (Winne & Perry, 2000), such as: • Thinking aloud protocols. • Error detection tasks. • Trace methodologies. • Observations of performance.
Third wave	A new conception of self-regulated learning measurement – *intervention + assessment*	• Characterised by methods and instruments that combine different features that promote self-regulated learning whilst measuring the progress of students' self-regulated learning.	• Learning diaries (Cazan, 2012; Schmitz & Perels, 2011; Schmitz & Wiese, 2006).

3.2 First Wave - Self-report

The first wave of self-regulated learning measurement is characterised by a more static conceptualisation of self-regulated learning assessment, one that gauges students' perspectives and beliefs (Panadero et al., 2016). In this wave the main source of information is from self-report measures such as questionnaires, surveys and interviews (Zimmerman, 2008b). These measures view self-regulated learning as an aptitude or disposition; a set of enduring learner attributes that predict future behaviour and can be assessed at any time (McCardle & Hadwin, 2015; Winne & Perry, 2000; Zimmerman, 2008b). Research theoretically framed by component models aims to assess all self-regulated learning components regardless of the learning situation or context.

Questionnaires are the dominant assessment method in self-regulated learning research and have yielded significant advances in the understanding of self-regulated learning (Patrick & Middleton, 2002; Winne et al., 2002). Well-known and commonly used examples of self-report questionnaires are the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993) and the Learning and Study Strategies Inventory (LASSI) (Weinstein et al., 1987). In support of the use of self-report questionnaires, McCardle and Hadwin (2015) state that learners' perceptions are central when the object of inquiry is self-regulated learning. Self-regulated learning is the capacity to respond adaptively during learning by using monitoring judgements as a basis for control and regulation (Bjork et al., 2013; Winne, 2010; Winne & Hadwin, 1998). As such, researchers must employ methods that allow us to understand learners' perceptions of the way they interpret and respond to tasks, set goals and monitor and adapt learning in the pursuit of these goals (McCardle & Hadwin, 2015).

Questions have been raised over the accuracy of students' reports when responding to offline or aptitude measures of self-regulated learning (Callan & Cleary, 2017; Winne, 2010;

Winne & Perry, 2000; Zusho, 2017), which include survey measures (e.g. MSLQ, LASSI) and structured interview schedules (e.g. SRLIS). Veenman (2011) emphasises how offline measures require students to pull information retrospectively from long-term memory, making them subject to memory failure, distortion and interpretive reconstruction. Despite the apparent inaccuracy of participants' perceptions when assessed through summative self-report instruments, self-perceptions are critical for understanding regulatory actions and decisions (McCardle & Hadwin, 2015). Winne and Perry (2000) also question the extent to which offline measures can adequately capture the contextual bases of self-regulated learning. Self-regulated learning is sensitive to context with learners adjusting their actions and how they study depending on task, self and context conditions (McCardle & Hadwin, 2015; Winne & Hadwin, 1998). As such, it can be argued that self-report instruments lack the situational specificity required to accurately measure self-regulated learning.

Another limitation of self-report instruments is that the internal consistency generated may vary with age (Garcia & Pintrich, 1996; Pintrich & de Groot, 1990; Wigfield & Eccles, 1992). Any self-report instrument is susceptible to questions over internal consistency as the instrument is entirely dependent on the participant and their interpretation of the items. In relation to the recognition of learning strategies in self-report questionnaires, Ley and Young (1998) argue that Likert-items may prompt participants who may not otherwise mention the strategy being surveyed. In support of this, Artelt (2000) demonstrated large discrepancies between participants' statements and observations of their actual learning behaviour (Roth et al., 2016). If used repeatedly across different data collection points, the participants could become familiar with the instrument, increasing the consistency over time but raising questions over data collected from the participants' first attempt at the survey. In terms of other limitations, the internal validity of self-report measures should also be examined due to the situation specificity of the instrument and by association, the theoretical framework.

Finally, it is also argued that the self-report nature of the measure trades some internal validity for external validity (Garcia & Pintrich, 1996; Nisbett & Wilson, 1977).

With regard to interviews, a major advantage relative to questionnaires is the ability to ask open-ended questions that allow participants to elaborate beyond the learning strategies explicitly mentioned in questionnaires. Instead of drawing on retrospective information identified as a limitation of questionnaires, the SRLIS (Zimmerman & Pons, 1986) requires prospective answers based on hypothetical learning contexts (Zimmerman, 2008b). However, an obvious limitation to interviews is the verbal communication skills of the participant, especially pertinent if an English as an Additional Language (EAL) student. Logistically they are challenging and expensive to implement (Lompscher, 1996), whilst the presence of an interviewer may also yield socially desirable responses.

3.2.1 Motivated Strategies for Learning Questionnaire

The MSLQ was developed using a social-cognitive view of motivation and learning strategies, therefore dovetailing perfectly with the present study both in terms of the theoretical framework used to define self-regulated learning and also that used to design the curriculum intervention. The MSLQ reflected the research on self-regulated learning at the time by emphasising the interface between motivation and cognition in the classroom (Duncan & McKeachie, 2005; Schunk & Zimmerman, 1998; Zimmerman, 2000). When compared to the Learning and Study Strategies Inventory (LASSI) (Weinstein et al., 1987), it is argued that the MSLQ takes a more detailed view of the motivational processes involved in self-regulated learning (Garcia & Pintrich, 1996). In terms of construct validity, the utility of the theoretical model and its operationalisation was tested using data gathered from 380 midwestern college students. Two confirmatory factor analyses were performed, one for the set of motivation items and another for the set of cognitive and metacognitive strategy items, from which results allowed for a quantitative test of the theoretical model. The correlations among the MSLQ scales suggest that the scales are valid measures of the motivational and cognitive constructs (Garcia & Pintrich, 1996).

As a representation of internal consistency and reliability, the calculation of coefficient alphas provided further support for the psychometric properties of the MSLQ. The coefficient alphas for the motivational scales were robust, demonstrating good internal consistency (Garcia & Pintrich, 1996; Pintrich et al., 1991, 1993). The alphas for the learning strategies scales are reasonable, with the coefficient alphas averaging above .7 (Garcia & Pintrich, 1996; Pintrich et al., 1993). Predictive validity was examined through the relations between the MSLQ and standardised course grades, with correlations being observed between final grade and both motivational and learning strategy subscales (Garcia & Pintrich, 1996; Pintrich et al., 1993). Multivariate analyses conducted by Pintrich and de Groot (1990) lend further support for the predictive validity of this instrument when compared to final course grades, with a subset of the variables tested accounting for 22% of the variance. The MSLQ represents a useful, reliable, and valid means for assessing students' motivation and use of learning strategies in the classroom (Garcia & Pintrich, 1996).

3.3 Second Wave – Online measures

More recent research methods have focused on the use of online or event measures such as think-aloud protocols (e.g. Azevedo, 2005), microanalyses (e.g. DiBenedetto & Zimmerman, 2013), classroom observation (e.g. Mykkänen, Perry, & Järvelä, 2017) and behavioural trace data (e.g. Hadwin et al., 2007)(Schunk & Zimmerman, 2011; Zusho, 2017). The development of this raft of measures was catalysed by the publication of the Self-Regulated Learning Handbook (Zeidner et al., 2000). This text signalled a switch in the conceptualisation of self-regulated learning towards a dynamic series of behavioural, cognitive, metacognitive, motivational, and emotional events (Panadero et al., 2016). The resulting shift in definition of self-regulated learning from trait-based to process-based in turn effected the measures required to capture the process. These measures address self-regulated learning within one specific situation, utilising open-ended questions and capturing students' real-time responses during learning tasks (Callan & Cleary, 2017). These *on-the-fly* measures focus on students' actual activity during learning tasks, capturing the students situated regulatory processes (Veenman, 2011).

Think-aloud protocols aim to assess strategy use during the actual learning process (Roth et al., 2016). In this method of data collection the participant is instructed to *think-aloud* about mental states approximately concurrently with their occurrences whilst completing a learning task (Winne, 2010). This data is then coded according to a category system (Azevedo, 2005). Boekaerts and Corno (2005) cite the main advantage of think-aloud protocols being that learning activities are made visible through the registering of participants' thoughts as they progress through the learning task. Although this methodology is promising (DiBenedetto & Zimmerman, 2013), Bandura (1986) raised concerns about measuring thoughts by means of verbal reports as people may intentionally or unintentionally misrepresent what they are thinking. Furthermore, Anders and Simon (1980) argue that participants' ability to verbalise their thoughts is reduced when working memory capacity is utilised for more sophisticated strategies. Tasks that require a large degree of cognitive processing can also negatively influence participants' ability to verbalise their learning during tasks (Branch, 2000). Lastly, the observation and coding of information is more difficult and labour-intensive at higher levels of education (e.g. Sixth Form, undergraduate), leading the authors to question how representative the think-aloud situation is of students' typical learning situations (Roth et al., 2016).

As an event measure, microanalysis asks highly contextualised, short questions posed at very specific times during task engagement. Due to the fact that respondents do not know the socially desirable responses, it is therefore less susceptible to response bias (Callan &

Cleary, 2017; Cleary et al., 2012). In response to his concerns over the use of think-aloud protocols, Bandura developed a microanalytic methodology which involves assessing the interrelation of thought and action using thought probes before, during and after efforts to learn (DiBenedetto & Zimmerman, 2013). In this regard microanalytic methodology differs from think-aloud protocols, as in the former the researcher asks specific questions that target well-established psychological processes at key times during the performance of learning (Kitsantas & Zimmerman, 2002). Whereas for think-aloud methodologies, students are asked to verbalise their thoughts without outside direction (Kitsantas & Zimmerman, 2002). As opposed to group-administered survey strategies, the separate observation of participants in microanalysis results in highly context-specific data that is then subject to intensive qualitative and quantitative analysis. However, this methodological strength also gives rise to microanalyses greatest limitation, which is that the separate observation of participants would require a whole team of researchers to collect data across the intended sample size for this research; something that is not practically viable in this study.

As a qualitative, *real world* measure of self-regulated learning (Nelson et al., 2017), classroom observation seeks to examine self-regulated learning within a natural context, strengthening ecological validity (DiBenedetto & Zimmerman, 2013). Observational research portrays learners' actions rather their recollections or beliefs, documenting how patterns of learning behaviour unfold over time (Patrick & Middleton, 2002). Nelson et al. (2017) argue that systematic classroom observations are critical for capturing specific learning-related behaviours, a view which corresponds strongly with the on-going discussion of the need to create more child-centred research methods (Hacking & Barratt, 2009; Whitebread et al., 2005, 2009). In spite of this, rigorous observational methods to assess learning behaviours in the classroom remain limited. The major limitations of classroom observations are that they are dependent on the skills of the participants and also that the presence of a researcher or video recording equipment changes the learning environment, thus influencing the participants' behaviour. With regard to the researcher, it is important to acknowledge the biases that they bring with them in addition to the significant amount of time required to analyse the data (Wolters et al., 2011). To overcome these limitations, Lichtinger and Kaplan, (2011) and Mykkänen et al. (2017) have combined classroom observations with student interviews to achieve triangulation through the use of multiple methods.

This final example of the second wave of self-regulated learning measures is behavioural trace data. Behavioural traces involve the analysis of observable representations of cognitive, metacognitive and motivational events, products that are considered the result of self-regulated learning processes (Winne, 2010; Winne et al., 2006). Trace data is generated by a learner that is approximately simultaneous with the cognitive operations the learner applies to information in working memory. For example a simple trace could be a learner's highlighting of words in a text. By highlighting, a learner traces metacognitively and a particular learning strategy – highlighting – in itself expresses metacognitive control (Winne, 2010). In doing so researchers are able to unobtrusively examine physical evidence of students' methods of learning (DiBenedetto & Zimmerman, 2013). As an event measure traces are considered to provide relative objectivity as student perceptions or self-distortions are minimised through the use of computer software to record trace logs (Callan & Cleary, 2017; Heath & Glen, 2005).

However, the use of online measures has muddied the self-regulated learning empirical waters resulting in a proliferation of self-regulated learning measures that exhibit variable relations with each other and with learning outcomes. Veenman (2011) presents a low correlation between online and offline measures. Significant correlations were not reported between self-report questionnaires and behavioural traces (Winne & Jamieson-Noel, 2002), nor between self-report questionnaires and microanalysis (Cleary et al., 2015). The methodological implication of the lack of statistical significance between measures is clear in that caution should be raised if giving consideration to using these measures in conjunction with one another.

That said, offline measures have clear practical advantages over online measures. Firstly, self-report questionnaires can be easily administered to a large sample sizes. Based on the scale and desired impact of this study it will not be practically viable to collect data using online measures. It can also be argued that gauging student perception is imperative to understanding students' regulatory decisions and actions. After all, completing a self-report survey is in itself encouraging the development of self-regulated learning skills, even if flawed in accuracy of judgement.

3.4 Third Wave – *Intervention + Assessment*

Panadero et al. (2016) argue that we are in the eruption of a third wave of self-regulated learning measurement. This wave is characterised by methods and instruments that combine different features that promote self-regulated learning, whilst measuring progress in the development of students' self-regulated learning skills. Although there are methodological issues that need to be taken into consideration, the authors posit that this third wave of self-regulated learning measurement holds great potential for increasing students' self-regulated learning skills.

An example of a self-regulated learning measurement and intervention combined is the use of learning diaries. Learning diaries have a long tradition with personality psychology, and Schmitz and Wiese (2006) suggest that this method should be more often applied in educational settings. Learning diaries enable researchers to measure daily or weekly learning strategies over a certain period of time (Schmitz et al., 2011). When applied to learning diaries, the use of time-series analysis allows researchers to acquire a strong representation of the development in learners' self-regulated learning skills (Schmitz &

Wiese, 2006; Zimmerman, 2008b). Boekaerts and Corno (2005) argue that students may be more open in diaries than in other forms of assessment. By completing the learning diaries in students' natural learning environments, Schmitz and Wiese (2006) emphasise the high ecological validity provided by these instruments that capture students' actual learning processes. However, it is important to distinguish between structured learning diaries and unstructured learning journals, as structured learning diaries indicate higher validity (Lopez, Nandagopal, Shavelson, Szu, & Penn, 2013; Nückles, Schwonke, Berthold, & Renkl, 2004; Roth et al., 2016). Structured learning diaries provide students with opportunities for systematic self-observation by responding questions repeatedly designed to promote formal self-monitoring (Schmitz et al., 2011). Unstructured learning journals are a self-guided way of writing that allows for elaboration and reflection on learning content, often associated with improved self-regulated learning capacities (Cazan, 2012).

In addition to being an assessment tool for self-regulated learning, learning diaries themselves can be regarded as self-regulated learning interventions (Dörrenbächer & Perels, 2016a). However, evidence concerning their beneficial effect without further training intervention is inconsistent. Some studies support the potential of learning diaries to foster self-regulated learning without training (Dignath-van Ewijk et al., 2015; Schmitz & Perels, 2011), however Dörrenbächer and Perels (2016a) identify the limitations of these studies, comparing learning diary groups to non-intervention groups but did not investigate the effects of supplementary self-regulated learning training. Studies that have investigated this (e.g. Dignath-van Ewijk et al., 2015), found an effect for the combined learning diary and university course on self-regulated learning group, but no effect for the learning diary alone. These findings are supported by research conducted by Dörrenbächer and Perels (2016a), which found a statistically significant multivariate three-way interaction Time x Training x Learning Diary. Additionally the change in self-regulated learning between the Control

Group and the Training Group was evaluated using *t*-tests, revealing no statistically significant changes for the Control Group and Learning Diary only group. However, analyses revealed statistically significant increases for Training Group and Combination Group (training and learning diary).

3.5 A Quantitative Approach – Context and Justification

As alluded to in the introduction to this paper, a quantitative research approach has been chosen for this research project. The central justification for this approach stems from the research questions (see Paper 4) in addition to the critical review of the literature relating to self-regulated learning measurement. As close-ended in nature, the research questions seek to test the theories deductively by examining the relationship between variables (Creswell, 2014). Jones (2011) suggests that questions of real importance can only be tackled with good quality extensive data and tools that can reveal pattern and guard against over-interpretation. Furthermore, Black (1999) argues that one should apply a scientific approach with sufficient rigour to produce valid conclusions, one that requires the collection of quantitative data and the use of statistical tools. Quantitative studies form the dominant approach to self-regulated learning research, and as a result of the rigour of creating and validating the instruments used to measure constructs, they are considered to be replicable and can be applied to different educational contexts whilst remaining valid and reliable (Creswell, 2014). A quantitative approach facilitates my attempt to achieve causality through the implementation of an intervention to improve students' self-regulatory skills. Control is required in order eliminate the simultaneous influence of other variables to provide unambiguous answers to specific and focused research questions (Burns, 2000).

Bryman (2012) states that there are three main reasons for the preoccupation with measurement in quantitative research, reasons which act as further justification for its use in this research, dovetailing with my comments on the need for controlled enquiry:

1. Measurement allows me to delineate fine differences between participants in terms of the self-regulated learning characteristics in question. Small differences are more difficult to detect and therefore require the tools and instruments needed to recognise finer distinctions.
2. Advancing point one, measurement through the use of an appropriate instrument provides a consistent device or yardstick for making these fine distinctions. Consistency is important and acts across two broad domains: consistency across time and consistency between researchers.
3. Lastly, quantitative measurement provides the basis for more precise estimates of the degree of relationship between variables, achieved through the use of sophisticated statistical testing and interpretation.

Whilst there are many strengths of a quantitative approach that support its use in this study, it is important to also acknowledge the limitations of this approach. One of the widely held strengths of a quantitative approach is that the researcher is not normally directly involved with the participants, however because of my stance as a teacher-researcher immersed within the research setting, this negates this strength and provides a limitation to its use (Gall et al., 2003). Jones (2011) states that too much quantitative work has been over-generalising and too atomistic, focusing on individuals and ignoring the context in which individuals find themselves. Additionally, it can be argued that such tightly structured and focused research design resulting from the control and relative restriction on variables leads to findings that cannot be applied to other contexts or settings (Burns, 2000). Lastly, an important limitation of a quantitative approach is that unless accompanied by graphs and diagrams providing a clear visual representation, the statistical analysis and language through which findings are communicated could be perceived to be impenetrable to teachers; the very people it’s designed to support.

3.6 Research Design and Internal Validity

Both the research questions and my stance as a teacher-researcher support the use of an action research framework. Action research is carried out by practitioners seeking to improve their understanding of events, situations and specific problems to increase the overall effectiveness of their practice (Johnson & Christensen, 2008; Lewin, 1946; McKernan, 2013; Stringer, 1996). Instead of being research *on* a social setting and the people within it, it is research from *inside* that setting carried out by either the participants themselves or the researchers working in collaboration with them (Somekh & Lewin, 2011). This aligns with comments made by McKernan (2013), who contends that those experiencing the problem first-hand in naturalistic settings are best placed to conduct the research. In doing so, this approach integrates practice with research, with action research described as learning that is integrated with working experience, where teacher-researchers seek to solve specific problems identified within their own settings (Askew, 1998; Johnson & Christensen, 2008). Moreover, Brown and Palincsar (1985) also note that any separation between theory, research and practice is artificial, with practice informing theory and vice versa. As such, in response to the problems identified by researching practitioners, an action research framework allows the researcher to develop, implement and examine the impact of pedagogical changes tailored to the setting (McIntyre, 2005).

However, action research is dismissed by some academics for lacking rigour and being too partisan in approach (Bryman, 2012). It is often characterised by several cycles that develop and evolve in response to the previous cycle's findings. Although this study uses the nomenclature of *phase*, both cycles one and two (see Paper 4) involve participants receiving the same intervention, forming a limitation of it's labelling as such. Bryman (2012) states that action research should not be confused with evaluation research, which is concerned with the evaluation and study of the impact of programmes or interventions. The principles of experimental research are entrenched within evaluation research, and can also be seen in this study as the participants are divided into two groups, each receiving the same intervention just in a delayed manner, with the overall aim of investigating whether a treatment influences an outcome (Creswell, 2014). As this research is rooted in the evaluation of a curriculum intervention, I would define this study as *evaluation research*.

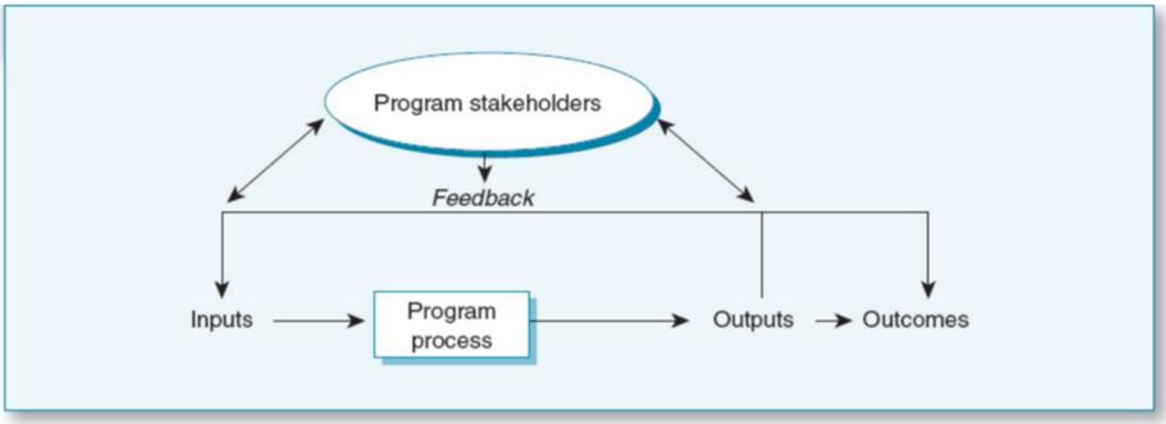
3.6.1 The Differences Between Quasi-Experimental Research and Evaluation Research

Research designs are often characterised in three ways; nonexperimental, experimental, or quasi-experimental. In nonexperimental research designs there is no intervention and therefore no sense of evaluation. Both experimental and quasi-experimental designs involve interventions, however whilst quasi-experiments share some characteristics of experimental designs, they do not fulfil all of the internal validity requirements (Bryman, 2012). In experimental designs participants are randomly assigned to either the intervention or control group, whereas in quasi-experimental designs participants are allocated to groups based on a non-random factor. Furthering this, Gopalan et al. (2020) state that quasi-experimental designs use nonexperimental or non-researcher-induced variation in the main independent variable of interest, essentially mimicking experimental conditions in which some subjects are exposed to treatment and others are not on a non-random basis. As a research design, quasi-experimental designs improve our understanding of the causal effects of various educational policies and interventions by focusing on internal validity. As Campbell (1957) suggests, quasi-experimental designs seek to find answers as to whether the policy or intervention being studied cause a significant change in the observed outcome, and if so by how much, thereby yielding an unbiased estimate of the average treatment effect (Gopalan et al., 2020).

At the end of Section 3.5, this study was characterised as *evaluation research.* Evaluation research is educational research that is conducted to investigate educational programmes (Check & Schutt, 2021). The principles of experimental research are entrenched within evaluation research, with the overall aim of investigating whether a treatment influences an outcome (Creswell, 2014). Outcomes can range from improved test scores or more highly qualified teachers to fewer unexcused absences or as in this research, enhanced self-regulated learning skills. Check and Schutt (2021) state that any educational programme is likely to have multiple outcomes, some intended and some unintended, some positive and others that are viewed as negative.

Powell (2006) states that evaluation research is usually employed for decision making, dealing with specific questions about a programme. In this regard, an evaluation research design offers a systematic approach to feedback, providing researchers with answers to their questions informing subsequent decisions and actions. Figure 3.6.1 emphasises the importance of feedback in evaluation research. The figure characterises evaluation research as a feedback loop, using the analyses of the programme operations and the outcomes to strengthen the feedback loop, providing feedback to the relevant stakeholders and subsequent inputs into the next iteration of the programme processes. Whilst evaluation research broadens this loop to include connections to parties that sit outside of the programme, the evaluation of the programme processes and feedback arising can be understood only in relation to the interests and perspective of programme stakeholders (Check & Schutt, 2021).

Figure 3.6.1
A Model of Evaluation (directly from Check & Schutt, 2021)



Through a feedback process, variation in both outputs and outcomes can be used to influence the inputs to the programme. Check and Schutt (2021) cited several examples of how the outputs and outcomes feedback into the programme, for example if not enough students are being served, recruitment of new students may increase. Secondly, if too many low reading scores are measured, a new reading programme may be limited or terminated. And lastly, if a school-based programme does not appear to lead to improved outcomes, then parents may choose to send their children elsewhere.

3.6.2 What Type of Study Was This?

Having defined this study as evaluation research, where the use of the principles of experimental research are entrenched within it (Bryman, 2012), further critical reflection, reading and research have led me to propose that the research design of this study is longitudinal research.

Ployhart and Vandenberg (2010) define longitudinal research as research emphasising the study of change, containing a minimum of three repeated observations on at least one of the substantive constructs of interest. Whereas cross-sectional research entails the collection of data at a single point in time, in longitudinal research a sample is surveyed and then surveyed again on at least one further occasion (Bryman, 2012), or as Ployhart and Vandenberg (2010), a minimum of twice more. Rajulton (2001) states that cross-sectional information deals with status, while longitudinal information concerns with progress and change in status. Longitudinal research therefore requires the repeated measurements of the same individuals over a time span long enough to encompass a detectable change in their developmental status (Rajulton, 2001). These changes are inherently socio-psycho-dynamic, and longitudinal studies seek to uncover that dynamism.

Nese et al. (2013) argue that there are two general objectives that are addressed by longitudinal research. The first is to examine how the outcome variable changes over time, describing the functional form of growth. The second is predicting or explaining differences in these changes, addressing the relationship between the trajectory and the independent variables of interest. Longitudinal information is necessary especially for causal studies on individual behaviour, as they can show the nature of growth and trace patterns of change, providing a detailed insight into complex social processes allowing stronger causal interpretations to be made (Rajulton, 2001).

Perhaps the most basic application of longitudinal data analysis in education is single subject research. In this type of experimental research individuals serve as their own control, meaning that comparisons are made to the individual's previous performance (Gast, 2009). Single-subject research is considered experimental because the design includes a baseline phase of data collection that provides repeated measurement prior to an intervention, as in this study, in order to establish a pattern that can be used to compare post-intervention change in performance (Gast, 2009). In general, the researcher is attempting to qualify the effectiveness of the intervention based on a comparison to baseline data, which can be done with one or multiple individuals.

3.7 Paper 3 Summary

Having scrutinised and critically analysed the theoretical perspective underpinning this research in Paper 2, this paper has focused on the measurement of self-regulated learning identifying three clear waves of self-regulated learning measurement. Each wave has been discussed, exemplified, and critically analysed, highlighting both the strengths and limitations of the measurements distinctive to each wave. Whilst acknowledging the limitations of approach, discourse on the adoption of a quantitative stance has also been offered. The paper finishes with a detailed discussion of the research design and internal validity, outlining the differences between quasi-experimental research, evaluation research and longitudinal research. The depth of analysis presented in Papers 2 and 3 sets the scene for Paper 4, where the research questions and proposed methodological approach are outlined and justified.

Paper 4

Methods

This paper contributes to this portfolio by providing a detailed discussion of my methodological approach to this research project. The methods chosen to collect and analyse data are accurately described and justified in response to the research questions stated at the start of this paper. Paper 4 is completed through the description of threats to the validity of findings in addition to the identification and discussion of the relevant ethical considerations pertinent to this research. As such, this paper forms an important contribution to this portfolio as it details my methods for formal data collection that began in September 2017.

Written January 2017, revised July 2020.

4.1 Current Project

In light of the points raised in Papers 1, 2 and 3 of this portfolio, I would like to contribute to the growing body of research into self-regulated learning by achieving the following aims:

- To better understand the construct of self-regulated learning and the development of self-regulated learning skills within the context of a co-educational boarding school.
- To further support the development of students' self-regulated learning skills.
- To investigate the relationship between self-regulated learning and achievement.
- To generate an impact on practice that will enhance the learning environment fostered.
- To make a significant contribution to the field of self-regulated learning research.

This study investigates the impact of a curriculum intervention designed to enhance students' self-regulated learning skills. To achieve the aims outlined above I will seek answers to the following research questions:

1. **To what extent can a curriculum intervention enhance students' self-regulated learning skills?**

Although self-regulated learning is considered to be an important factor for successful secondary education and for lifelong learning, explicit institutionalised opportunities to acquire and develop self-regulated learning strategies are rare (Dörrenbächer & Perels, 2016a). By posing this research question, this study seeks to further support the development of Year 9 students' (13-14 year olds) self-regulated learning skills through their engagement with a discipline-independent intervention, the skills from which can be applied across all curriculum areas. Linking strongly to the rationale for this research, the intervention will provide students with a holistic and highly transferable set of life-worthy learning skills that will be of great benefit when they progress from secondary education, in addition to supporting their academic achievement throughout their school careers. Instead of accentuating individual strategies from selected self-regulated learning models, the self-regulated learning training in this intervention is based on all three phases of Zimmerman's model of self-regulated learning (Zimmerman, 2000). The literature review has provided a cogent argument that the sub-processes that constitute Zimmerman's model are trainable and this model forms a cornerstone of research into self-regulated learning. Many of the samples from research cited in Paper 2 focus on students from either side of the age group sampled in this study (Year 9, aged 13-14), therefore offering an original contribution to the field. I hypothesise that the curriculum intervention will enhance students' self-regulated learning skills. This hypothesis is founded on the raft of research that has been cited in this portfolio that supports the development of students' self-regulated learning skills in response to training interventions. By making Zimmerman's model of self-regulated learning explicit to the students and leading them through the 10-week discipline-independent intervention, students acquire a sound understanding of the key processes and sub-processes of self-regulated learning and more importantly how to implement them in practical terms.

2. **Does students' mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict their mean test performance?**

This paper has drawn on a large body of research which suggests that students who exhibit stronger self-regulated learning skills achieve more highly in summative assessments. Although the rationale for the research focus and Research Question 1 are more altruistic in nature, it is important to relate the hypothesised changes in students' self-regulated learning skills to students' level of academic achievement. Ultimately students' academic achievement will be measured by external examinations on completion of the various curriculum pathways offered at the school and it is our duty as teachers to support the students toward achieving the best academic grades possible. As such, Research Question 2 plays a pivotal role in this research, as it will provide practice-specific and tangible context for the intervention's impact. I hypothesise that students' mean test performance will improve across timepoint and that self-regulated learning skills can be used to accurately predict changes in students' mean test performance. As with Research Question 1, this hypothesis is founded on the empirical evidence that has been presented in this portfolio that supports the notion that students with stronger self-regulated learning skills achieve more highly in summative assessments.

4.2 Participants

Participants were recruited from Year 9 (13-14 year olds), academic year 2017/18. This is the first year of entry at the school and constitutes the academic year across which two phases of evaluation research took place. The year group size or population was 132 students (M_{age} = 13.2, *SD* = 0.3, 85 boys (64%), 47 girls (36%)). Participants were recruited through the delivery of a year group assembly in week 2 of the school year, informing participants about the research and associated ethical considerations. Following this an online sign-up form was shared using the school's intranet through which all Year 9 students were offered the opportunity to participate in the research through the use of voluntary informed consent (see Section 4.7, Ethical Considerations, for further details). This platform is widely used and is considered common practice across the school. The benefit of using the school's intranet was that it allowed me to gain written consent from the participants whilst being highly time efficient. Using a quasi-experimental design, the participants were divided into two groups through convenient or purposeful sampling by way of their *Form* groups (Bryman, 2012). Because of the nature of both the school timetable and the Form group structure, truly random sampling simply wasn't viable. For the purposes of timetabling and the delivery of the curriculum, students are organised into Form groups that comprise between 20 and 23 students. Students attend timetabled lessons in these Form groups which facilitates their engagement with the academic curriculum across the course of the week. The only subjects to which this is an exception is Mathematics and the three separate sciences, namely Biology, Chemistry and Physics, where students are taught in streamed sets according to their ability in these subjects on entry to the school. One group was known as Group A, and the other as Group B. There are six Form groups in Year 9, thereby giving three Forms in Group A (66 students) and three Forms in Group B (66 students). Whilst the use of the Form group structure has significant practical and logistical benefits in terms of the delivery of the intervention and data collection, the use of this structure raises questions over reliability relating to intraclass-correlation as pre-existing groups are used. Notwithstanding this potential limitation, the use of Form groups offers the most rigorous sampling approach given all of the considerations raised by the dual stance of this study; research and practice.

A power analysis for *F*-tests was conducted using G*Power (Faul et al., 2007), indicating a minimum total sample size of 32 for ANOVA (effect size .4, α error probability .05, 1-β error probability .95), and 71 for MANOVA (effect size .4, α error probability .05, 1-β error probability .95); a sample size that was easily exceeded. Lastly, the expected attrition rate for this research was low – as the research does not deviate from the school's normal way of working and only in exceptional circumstances do students leave the school altogether.

4.3 Materials

As outlined in Paper 3, three waves of measures of self-regulated learning have been developed such as the structured interviews (e.g. SRLIS), questionnaires (e.g. MSLQ, LASSI), think aloud protocols, trace methodologies, observation of performance and learning diaries (Magno, 2011; Panadero et al., 2016). However, when self-regulated learning is measured in quantitative studies, as justified in Paper 3, it requires the use of a direct instrument that captures its conceptualisations, dispositions, and skills. As such, the following instruments were chosen.

4.3.1 Motivated Strategies for Learning Questionnaire (MSLQ)

The Motivated Strategies for Learning Questionnaire was developed by Pintrich, Smith, Garcia and McKeachie (1993). The roots of the instrument stem from the 1980s when self-report instruments were developed to evaluate the effectiveness of the *Learning to Learn* course offered at the University of Michigan, from which the version to be used in this research evolved, published in the autumn of 1993. It is an 81-item instrument scored on a 7-point Likert scale, from 1 (not true of me at all) to 7 (very true of me). The instrument was designed to be administered in class and takes approximately 20-30 minutes to complete. As a measure for self-regulated learning, it is composed of two sections: the motivation section and the learning strategy section. The motivational scales are based on a broad social-cognitive model of motivation that proposes three general motivational constructs: expectancy, value, and affect. The learning strategies section is also based on a broad social-cognitive model of learning and information processing and there are three general types of scales: cognitive, metacognitive, and resource management. In general, if students score above three on the questionnaire, then it means they are using effective learning strategies, conversely if students score less than three they are not using effective learning strategies (Magno, 2011; Pintrich et al., 1991). Confirmatory factor analyses yielded correlations among the MSLQ scales suggesting that the scales are valid measures of the motivational and cognitive constructs (Garcia & Pintrich, 1996). Coefficient alphas were also calculated as a representation of internal consistency and reliability. As stated in Paper 3, the coefficient alphas for the motivational scales were robust, while the alphas for the learning strategies scales are reasonable, with the coefficient alphas averaging above .7 demonstrating good internal consistency (Garcia & Pintrich, 1996; Pintrich et al., 1991, 1993). This supports Garcia and Pintrich's (1996) view that the MSLQ represents a useful, reliable, and valid means for assessing students' motivation and use of learning strategies in the classroom.

The MSLQ is held in the public domain of the Internet and the University of Michigan states that all are welcome to use it for valid research purposes. As such, formal permission did not have to be sought for its use in this research.

4.3.2 Self-Regulated Learning Experimental Design Survey (SRLEDS)

In addition to the MSLQ, I have developed my own measure tailored to this research. It is called the Self-Regulated Learning Experimental Design Survey (SRLEDS) and takes the form of a 30 item self-report instrument focused on the 10 key skills that comprise *The Teddies Curriculum 2.0* – three items for each of the 10 key skills (see Appendix A). I used items from pre-existing instruments (Dörrenbächer & Perels, 2016a; Leidinger & Perels, 2012; Pintrich et al., 1991), or I developed new items to cover the relevant skills. Each item is responded to on a four-point Likert scale (Strongly agree, agree, disagree, strongly disagree). As an original and tailored self-report instrument, the creation of the SRLEDS for this study represents a significant contribution to the field of self-regulated learning research.

4.3.3 The Teddies Curriculum 2.0

The Teddies Curriculum 2.0 is a practical representation of the school's desire to equip students with the skills and dispositions needed to be successful, not just in externally examined qualifications, but also beyond the bounds of secondary school. In its first incarnation, The Teddies Curriculum was visually presented as a Wordle shaped to fit the school's crest outlined by the words relating to five skills and five values that the school wanted to develop in students (see Figure 4.3.1). These skills and values were intended to underpin teachers' planning and delivery of the curriculum to Year 9 students to foster and enhance students' self-regulatory abilities, however the theoretical foundations for the development of this curriculum were weak and no research had been conducted to assess and evaluate its impact. It was also clear that the implementation of the first incarnation of The Teddies Curriculum which took place before I started teaching at the setting for this research varied hugely across the school, both within departments and between classrooms.

The design of *The Teddies Curriculum 2.0* and thus, the discipline-independent intervention for this study is theoretically founded on Zimmerman's model of self-regulated learning (see Section 2.3) in addition to the school's overarching philosophy and academic aims. The conflation of theory and practice is one of the underpinning principles of the Doctor of Education (EdD) course and it forms a pillar of strength of this research. The use of a curriculum-based intervention can be justified as it fits with normal school practice, it is manageable in terms of both the time and resources available, and lastly, as the researcher, I can control the quality of the implementation and delivery of the intervention, limiting this threat to internal validity.

Figure 4.3.1
Visual representation (Wordle) of the First Version of The Teddies Curriculum

The Teddies Curriculum 2.0 (see Appendix B) was designed in response to the consultation of teaching staff who volunteered to join a committee set up to evaluate the first incarnation of the original Teddies Curriculum. The first meeting was held in September 2016. My role as chair of this committee was initially to oversee the evaluation of the first incarnation of The Teddies Curriculum, before leading the development of version 2.0. Conversations in committee meetings were guided by the theoretical framework outlined in Paper 2. *The Teddies Curriculum 2.0* is designed to be a practical representation of Zimmerman's model of self-regulated learning that can be implemented through classroom practice, the language of which is accessible to staff and students alike. The 10 key skills forming the discipline-independent intervention dubbed *The Teddies 10*, are an evolution of the first version of The Teddies Curriculum introduced in 2013 (Figure 4.3.1). The evaluation and reflection on the first incarnation of The Teddies Curriculum in addition to Dignath and Büttner's (2008) findings that self-regulation training was most successful when led not by students' teachers, but by researchers, supports my decision to lead the intervention. The scheme of work for the 10-session intervention can be seen in Table 4.5.2.

4.3.4 Students' Test Performance Data

In order to generate data to answer Research Question 2, I worked closely with the Head of Science to align the Year 9 Science programme of assessment for academic year 2017/18 with the timeline of this research (see Figure 4.5.1). The programme of assessment for the Science Faculty covers the three separate sciences studied by all Year 9 students, namely Biology, Chemistry and Physics. By mapping the programme of assessment on to the timeline of the present study, test performance data was generated during the same weeks that students completed the two surveys across the three timepoints. Owing to the sheer volume of content within the exam board specifications, the Science Faculty runs a three-year Key Stage 4 GCSE starting in Year 9, and is therefore the only faculty to have maintained a programme of summative assessment. This programme of assessment takes the form of standardised block testing based on *bona fide* GCSE past paper questions, sat at the end of each topic within the specification. These topic tests are publicised to students in advance, affording them time to prepare thoroughly and revise for these important summative checkpoints along the Science GCSE journey. As is normal school practice, this data is uploaded and stored in the school's secure database, as it is used widely across the school to track and monitor student performance.

4.4 Pilot work

Pilot work was undertaken after the May half term in the Easter Term, 2017. A short presentation was given during a Year 9 assembly during which an explanation of the research, the associated ethical considerations and the notion of voluntary informed consent were outlined to students. Both the MSLQ and the SRLEDS were uploaded on to the school's intranet and set as a task for all Year 9 students. The students were instructed to complete both surveys within a week of the task being set, submitting their responses through the intranet. At the end of each survey an empty text box was provided into which students were encouraged to share their feedback on the survey including anything they didn't understand or any practical reflections. Many students made use of this opportunity and it yielded some incredibly useful insights. At the end of the one-week window, the data was exported and saved to a password protected and encrypted laptop to which only I have access. Out of a population of 132, 113 Year 9 participants completed both surveys. These data were then analysed using SPSS. As an original measure, Cronbach's alphas were calculated to show the reliability of the SRLEDS. Values ranged from .51 to .81 enabling me to use this instrument during formal data collection. In terms of the analysis of data, the full range of descriptive statistics (mean, upper and lower confidence interval (CI, 95%), standard deviation, median, variance, skewness and kurtosis) were calculated for both surveys which proved to be a hugely valuable experience in terms of my proficiency using SPSS. As data was collected at only one time point, I was unable to conduct the detailed statistical analysis that will be conducted in this research, including mixed ANOVAs, MANOVAs, ANCOVAs and associated *post hoc* tests.

With regard to the conclusions from pilot work and the implications for future data collection, these were mainly practical in nature. Although the surveys were successfully administered to participants using the school's intranet, outputting data in a form that can then be analysed using SPSS, Qualtrics, an online survey tool widely used at the University of Cambridge, was used as the platform through which the MSLQ and SRLEDS were administered to participants. Secondly, feedback gained from the text box at the end of the surveys suggested that I needed to edit and adapt some of the language of the MSLQ, as some items were confusing to participants. For the pilot work the measure was transcribed verbatim, using the original American language which caused some misunderstanding (e.g. use of the word *class)*. Also, in terms of the MSLQ, item 73 (*I attend class regularly*) was removed as it caused confusion to students given that lessons are not optional at the research setting, but a compulsory part of the formal lesson timetable making this question irrelevant to the present study. On a similar note, invaluable feedback from my Internal Assessor, Professor Jan Vermunt, who at registration advised that some items in the SRLEDS need to be shorter and more focused (e.g. item 23 and item 30). These were subsequently edited to provide greater clarity and focus to the items in question. The pilot work conducted encouraged the critical reflection on the methods to be used in this research, the procedure of which is outlined in the following section.

4.5 Procedure

The research followed a quasi-experimental design model. There are a wide range of quasi-experimental models used in educational research and this research included a *pre-test* *post-test non-equivalent group design* (Cohen et al., 2013). The experiment was founded on the introduction of a discipline-independent curriculum-based intervention (independent variable) to observe changes in participants' self-regulated learning abilities (dependent variable). Firstly, the *pre-test post-test non-equivalent group design* can be justified in practical terms as the participants who received the intervention first (Group A), were assigned non-randomly using their Form groups as a structure. This minimised disruption to school routines and also allowed me as the researcher to communicate effectively and efficiently with each of the Form groups. Secondly, the design is supported by the pre-test and post-test data collection points, which allowed me to measure changes in students' self-regulated learning skills and thus the impact of the curriculum-based intervention. Lastly, this design allowed me to collect data that facilitates a comprehensive but highly focused response to the research questions outlined at the start of this paper.

In terms of data collection timepoints for Phase 1 of this research, all participants (Group A and Group B) completed both the MSLQ and the SRLEDS in the week preceding the start of the intervention (week two of Michaelmas Term), and subsequently in the week immediately following the completion of the 10-session intervention (week 14). With regard to the intervention itself, as the researcher I led the weekly training sessions with all the participants in Group A on a Wednesday afternoon during Period 6 (15.30-16.25). These sessions began in week four of term and ran every Wednesday until week 14, 10 sessions in total. Each session took the form of a 55 minute *lesson* where students were guided through a series of learning activities which focused on a clearly defined learning objective; each of the key skills from *The Teddies Curriculum 2.0* in turn over the course of the 10 sessions. As justified previously, to ensure the quality of implementation and delivery of the intervention, as the researcher I led the delivery of these sessions. A full and comprehensive scheme of work was developed, an outline of which can be seen in Table 4.5.2. While Group A attended the intervention sessions during Period 6 on Wednesdays, Group B attended supervised *prep* sessions, as was normal practice for this year group during this lesson in the timetable.

Phase 2 began during week one of the Lent Term, January 2018. It followed the same structure as Phase 1 in terms of the 10-week intervention, however Group B received the same 10-session intervention given to Group A in Phase 1, while Group A attended supervised *prep* sessions. The MSLQ and SRLEDS were administered to both groups in the week immediately following the completion of the 10-session intervention (week 11 of term). Figure 4.5.1 shows a detailed timeline for Phase 1 and 2 of the procedure described above.

In addition to the self-report questionnaires, participants' key demographic data and test results for the three separate sciences (Biology, Chemistry and Physics) were drawn from the school's secure database. A register of student attendance was kept across both phases of research. Table 4.5.1 shows the number of students absent from each of the sessions across the intervention for Group A and B. Although not used as data in the write-up that follows, I also kept a journal for the duration of the data collection to record any reflections on the process and log any methodological issues that I encountered.

Table 4.5.1
The Number of Students Absent From Each Intervention Session

Session Number	Group A Absences	Group B Absences
1	0	0
2	0	0
3	0	1
4	1	1
5	0	2
6	2	1
7	1	0
8	0	1
9	0	2
10	1	1

Figure 4.5.1

Timeline of Phase 1 and 2, Academic Year 2017/18

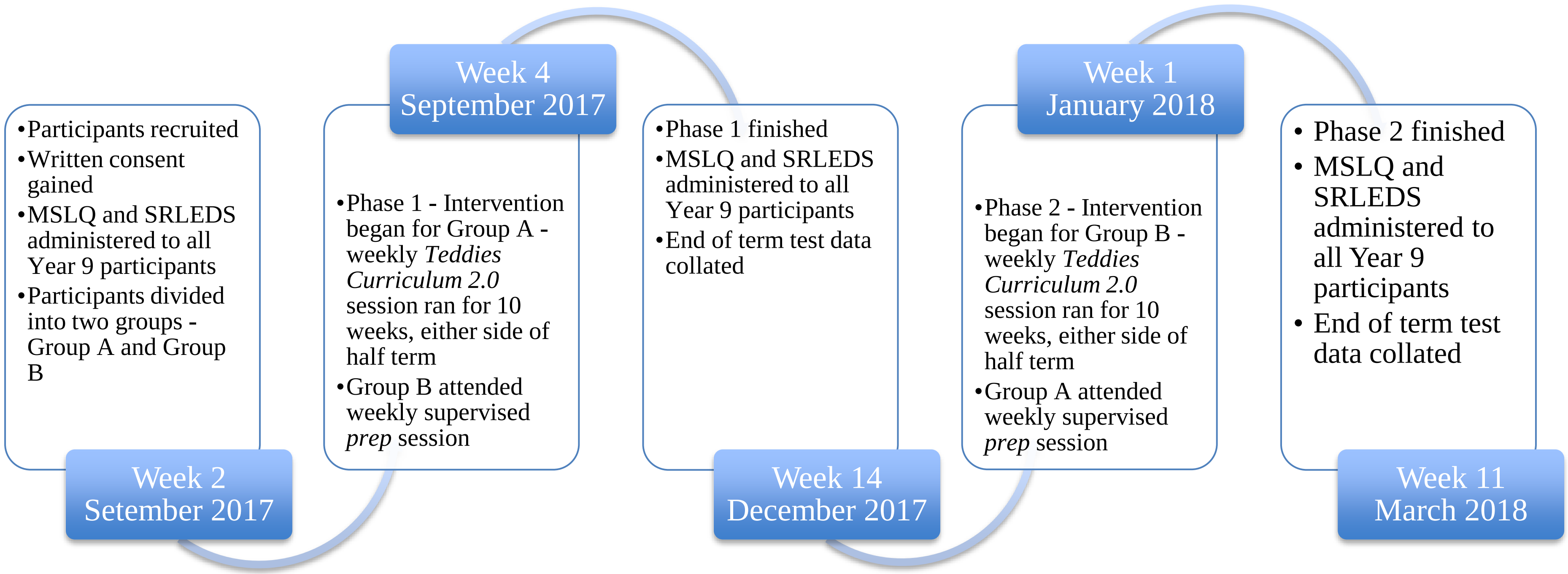


Table 4.5.2

Scheme of Work for The Teddies Curriculum 2.0 Intervention

Session No.	Session Focus	Learning Outcomes	Activities

1	What is *The Teddies Curriculum 2.0*?
	Goal setting and *Resourcefulness*
		1. To understand the usefulness of *goal setting* and how it can foster motivation to learn.
		2. To understand what is meant by being *resourceful* and to know what this looks like in practical terms.
			• Introduction to *The Teddies Curriculum 2.0*.
			• Partnership agreement.
			• Explanation of self-regulated learning and brief discussion of theory used in the construction of *The Teddies Curriculum 2.0.*
			• Goal setting – 5 Ws:
			  • *What* is a goal?
			  • *When* can you set them?
			  • In terms of learning, *where* are they most appropriate?
			  • *Why* do they support learning?
			  • *Who* should have ownership of the goal? *Who* can provide support?
			• Goal setting activity for the second half of the Michaelmas Term.
			• Resourcefulness concept map – what does it mean to be resourceful?
			• Plenary – recap on lesson, what actions will be taken.

2	*Planning and Organisation*	1. To develop an understanding of how *planning and organisation* can support learning. 2. To be able to share and implement practical strategies to improve *planning and organisation* of learning.	• Starter – recap and reflection on session 1. • Watch video clip and note down key ideas relating to planning and organisation. What helps? • Explanation of the *Four Quadrants of Planning and Organisation* given using supporting PowerPoint. • Students then complete their own four-quadrant table based on their current tasks/to-do lists. • Students answer structured questions on the organisation of the physical space in which they study. • Plenary – recap on content using triangle structure.

Table 4.5.2 Continued

Scheme of Work for The Teddies Curriculum 2.0 Intervention

Session No.	Session Focus	Learning Outcomes	Activities
3	*Resilience*	1. To understand what it means to display *resilience* in terms of learning. 2. To be aware of *The Pit* and to understand that challenging learning can be overcome through *resilience*.	• Starter – recap and reflection on session 2. • Application of idea – why is it important to be resilient when learning? • Watch clip on *grit* and answer the structured questions. • Grit scale completion – what does this mean? • Introduction to *The Pit* (Nottingham, 2013). • *The Pit* annotation activity. • Plenary – recap and reflection.
4	*Metacognition*	1. To understand what *metacognition* is. 2. To be able to apply practical strategies that will facilitate *metacognition* leading to more powerful learning.	• Starter – recap and reflection on session 3. • Students complete the *before learning* questions to activate what they know already about the session focus. • Watch YouTube clip outlining metacognition and create a concept map of key ideas. • Students complete survey examining their use of metacognitive strategies. • Students complete table of strengths and weaknesses/area for improvement based on survey. • Meta-plenary – students complete sentence stem questions.
5	*Collaboration*	1. To understand the usefulness of being able to *collaborate* effectively. 2. To be able to identify and self-evaluate the skills required to *collaborate* effectively.	• Starter – recap and reflection on session 4. • What is collaboration? Definition shared. • Students work together complete table of the benefits and challenges of collaboration. • Students study the 28 statements adapted from Dawes (2008) and discuss whether they agree or disagree with the statements. • Students work together to create 3-6 ground rules for effective collaboration. • Reflection questions answered to encourage reflection on the quality of collaboration in the session. • Plenary – characteristics of an effective collaborator.

Table 4.5.2 Continued

Scheme of Work for The Teddies Curriculum 2.0 Intervention

Session No.	Session Focus	Learning Outcomes	Activities
6	*Communication*	1. To understand the importance of being able to *communicate* effectively, both in verbal and written form. 2. To be able to identify and self-evaluate the skills required to *communicate* effectively.	• Starter – recap and reflection on session 5. • Discussion of verbal and written communication. • Identification of key skills/characteristics of effective communication. • Self-evaluation of verbal/written communication skills – fulfilment wheel activity. • What areas have you targeted for improvement? Discussion activity in pairs. • Plenary.
7	*Research*	1. To understand the importance of developing strong *research* skills. 2. To be aware of the different resources available that can facilitate effective *research.*	• Starter – recap and reflection on session 6. • Use PowerPoint to define *Research*. • School Librarian to share the research tools/resources available through the school's intranet pages. • Students given research task completed in pairs. • Research findings shared in groups – evaluation of research skills – How strong/reliable are the resources that they have found? What could they have done differently? • Plenary.
8	*Creativity*	1. To understand the usefulness of being able to think *creatively*. 2. To develop the ability to think both divergently and convergently in the generation of new ideas.	• Starter – recap and reflection on session 7. • Alternative uses test – 2 minutes to think of as many uses of a spoon as possible. Share ideas with peers. • Watch Ken Robinson's TED talk, *Do schools kill creativity?* • Torrance Test of Creative Thinking – 5 minutes. • Divergent and convergent thinking defined. • Students complete as many riddles as they can in 5 minutes – requires divergent and convergent thinking. • Plenary – Opportunities for creativity in different curriculum areas – discussion and concept map.

Table 4.5.2 Continued

Scheme of Work for The Teddies Curriculum 2.0 Intervention

Session No.	Session Focus	Learning Outcomes	Activities
9	*Critical Thinking*	1. To understand what is meant by *critical thinking.* 2. To be able to identify and exploit opportunities where *critical thinking* can support learning.	• Starter – recap and reflection on session 8. • Read article from Kadie Ragan, *6 benefits of Critical Thinking* • Create a concept map that summarises the benefits and usefulness of critical thinking. • Attempt 3 out of the 10 critical thinking activities from the IB Theory of Knowledge resources. • Plenary.
10	Bringing it all together - *Reflection*	1. To understand what is meant by *reflection* within the context of classroom learning. 2. To be able to *reflect* critically on progress across the 10-week intervention.	• Starter – recap on session 9. • Fulfilment wheel. • Goal setting for the Summer Term focusing on the development of the learning skills developed over the last 9 weeks. • Evaluation of the *The Teddies Curriculum 2.0* – what would you change?

4.6 Threats to Validity

In order to show a critical understanding of the relative strengths and weaknesses of this method, it is important to highlight the potential threats to validity that may influence my ability to conclude that the invention alone has positively influenced students' self-regulated learning skills and not other factors. Internal validity threats are experimental procedures or experiences of the participants that threaten my ability to draw correct inferences from the data about the sampled population (Shadish et al., 2002). External validity threats are threats that arise when I draw inferences from the sample data to other persons, schools and past or future situations (Creswell, 2014). Drawing on the work of Campbell (1957), Cook and Campbell (1979), Shadish et al. (2002), Tuckman (1999) and Bryman (2012), the pertinent threats to both internal and external validity can be seen in the following summary tables, Table 4.6.1 and Table 4.6.2.

Table 4.6.1
Threats to Internal Validity

Threat to Internal Validity	Description of Threat	Actions Taken by Researcher
Selection	As the two groups were selected non-randomly, variations between Group A and Group B could be attributed to pre-existing differences in their membership.	Worked with Head of Year/Timetabler to ensure even distribution of participants according to pre-test results, entrance exam results, house and gender.
Mortality	Participants dropped out during the research.	A large sample was used (a whole year group) which allowed for some participant mortality.
Diffusion of treatment	Participants in the control and experimental groups communicated with each other, potentially distorting participants' responses to questions in the two instruments.	The two groups were taught separately throughout the academic year, however due to the mixing of participants in boarding houses and other lessons, it was impossible to entirely eliminate the diffusion of the treatment between the two groups.
Compensatory/resentful demoralisation	The potential benefits of the experiment are unequal to the two groups of participants. This could have been resented by Group B who received the intervention second, leading to demoralisation of the participants in this group.	As Group B received the intervention later, and this made clear to the participants at the start, this should have limited the demoralisation of participants in this group.
Compensatory rivalry	As participants in Group B did not receive the intervention initially, they could have felt devalued compared to Group A.	As above, the researcher made it clear to the participants that Group B would receive the intervention after the second point of data collection.

Table 4.6.1 Continued
Threats to Internal Validity

Threat to Internal Validity	Description of Threat	Actions Taken by Researcher
Variation in the quality of intervention implementation	Due to the scale of the research in addition to the demands on my time as a full-time member of teaching staff and Head of Department, there was the potential for some variation in the quality of intervention implementation.	As the researcher I planned, resourced and led the weekly sessions in advance, ensuring quality of delivery implementation.
History	As time passes the participants experienced events that could have unduly influenced the outcome of the experiment.	The use of a control group allows for effects of history to affect both groups, validating the influence of the intervention.
Testing	Due to the repeated use of the instruments, participants became familiar with the questions thus posing a threat to the internal validity.	The instruments were used three times across the academic year, 10 teaching weeks apart. As such it was unlikely that the participants would remember their responses on the previous test, allowing them to respond based on their own judgement rather than experience/memory.
Demand Characteristics	Due to the relationship and perceived hierarchy between myself and the participants, there was the threat that participants were responding in a way that they felt I wanted them to respond.	Completing the two instruments anonymously removes the concern that I would be able to identify their individual responses, encouraging them to respond honestly.

Table 4.6.2
Threats to External Validity

Threat to External Validity	Description of Threat	Actions Taken by Researcher
Interaction of selection and treatment	This threat relates to the limitations of the generalizability of the findings, specifically the ages and socio-economic status of the participants.	As researcher I will restrict the claims about groups to which the results cannot be generalized.
Interaction of school and treatment	This threat raises questions over the generalizability of results to other schools.	As above, I will restrict the claims made about the extent to which the results can be applied to other schools.
Interactions of history and treatment	This threat raises the question of whether the findings can be generalized to the past and the future.	As a longitudinal study, the experiment was conducted over an academic year allowing for the results to be generalized to future cohorts within the school.
Interaction effects of pre-testing	Participants may have become sensitised to the experimental treatment as a result of pre-testing.	As both Group A and Group B were given the MSLQ and the SRLEDS as a pre-test before the intervention, the results are generalizable across between groups.
Reactive effects of experimental arrangements	Participants' awareness of their involvement in an experiment may have influenced how they responded to the intervention.	As the intervention took the form of a practice-based curriculum intervention, the results are, to the extent outlined above, generalizable. That said, I will restrict the claims to which it is generalizable due to the context-specific nature of the school.

4.7 Ethical Considerations

Educational research involves collecting data from people, about people, in an educational environment (Punch, 2013). Any research undertaken in situations which involve people interacting with each other will have an ethical dimension and there are a number of important ethical considerations that command increased attention today (Stutchbury & Fox, 2009; Creswell, 2014). Ethical dilemmas arise in research at both macro and micro levels and as a researcher I have a duty to act ethically in my management of these dilemmas, with respect to the participants, the integrity of the research itself and also transparency in the moral basis upon which decisions were made (Stutchbury & Fox, 2009).

All research was conducted in accordance with the ethical guidelines published by the British Educational Research Association (BERA, 2011), in addition to the Faculty of Education's Research Ethics Review Checklist (see Appendix D) completed in consultation with my supervisor and submitted at the time of registration (July 2017). This checklist is further supported by the completion of an ethical grid proposed by Stutchbury and Fox (2009), that provides a way of thinking about the ethical implications of this research in a logical and structured manner. This can be found in Appendix C. The Headmaster's permission was explicitly sought and granted, along with the permission of the Deputy Head (Academic), who acted as *gatekeeper* for the research. Participants were informed of the nature of the research project and written voluntary informed consent is the condition in which participants understand and agree to their participation without duress, prior to the research getting underway (BERA, 2011).

One of the primary ethical considerations pertinent to this research design was that of Group A receiving the intervention designed to enhance students' self-regulated learning skills and therefore may offer benefit to this group, whilst Group B did not. This is a major ethical consideration associated with a quasi-experimental research design, one highlighted by Kellett and Nind (2001), who state that to withhold or withdraw something of benefit in order to prove its effectiveness would be unethical and potentially damaging to the welfare of the research participants. A multiple-baseline interrupted time-series design (Cook & Campbell, 1979; Kellett & Nind, 2001; Nind, 1996) was selected to overcome this ethical issue, justified as the intervention is not withheld or withdrawn, rather delayed until Phase 2 of evaluation research. Whilst being robust in terms of research design as improvements observed can be attributed to the intervention, this approach can also be justified ethically and thus provided a workable compromise between experimental rigour and ethical considerations (Kellett & Nind, 2001).

The second major ethical consideration was that of the sampling of students to form Group A and Group B. As stated previously, convenient or purposeful sampling was employed in the selection of participants for the two groups based on the Forms into which all students are divided on entry to the school (Tashakkori & Teddlie, 2003; Teddlie & Yu, 2007). This can be justified ethically as the Form groups themselves are mixed in terms of both their demographics and ability, therefore eliminating bias. Rather than being selected randomly, the selection of Forms based on their *specific purpose* can be viewed as a methodological strength as it builds on the existing structures within the school, thus removing any potential disruption (Tashakkori & Teddlie, 2003). Furthering this point, the research methods are viewed by the school as being part of normal practice, thus providing additional ethical support for the methods chosen. As a researching practitioner I found myself at the centre of the data collection, and by making use of the existing organisational structures within the school for the sampling of participants, I was able to draw on the assets of both stances in the dynamic equilibrium between research and practice.

A third ethical consideration was that it was important to acknowledge the issue of power differentials between me, the researching practitioner, and the student-participants. As a result of this power differential it can be argued that students' freedom to participate or decline was not clearly definable, thus extending beyond a purely consent-based, ethical concern, into one that could have potentially undermined the validity of the data collected and in turn, the quality of the findings (Nolen & Putten, 2007). For the participants to have given their consent freely they must have felt no implicit pressure to participate and in order to abate the power differentials outlined above, I implemented the following recommendations made by Nolen and Putten (2007):

1. Revised consent process and documentation to repeatedly clarify that there was no penalty for refusing to participate and that student grades would not be affected by the decision to participate.
2. By being sensitive to the dual role of teacher and researcher and inviting other colleagues to support the intervention and evaluation research to minimise any possible coercion.
3. Revised materials to include a final *yes or no* response item stating, *Please include my answers in the study*, which unobtrusively provided students with the option to opt out of the study while appearing to have participated.

4.8 Paper 4 Summary

This paper has provided the reader with a detailed description and thorough justification of the methods used in this study. In response to the points raised in Papers 2 and 3, the aims and research questions for the present study have been made explicit and discussed, providing a clear focus for the research. Using the key methodological headings from Educational Psychology research as a structure for the paper, the participants, materials and procedure followed in this study have been comprehensively outlined and discussed. Both the threats to validity and ethical considerations have also been conveyed. This paper builds on the foundations laid in Papers 1, 2 and 3, by providing a clear, focused, and rigorous methodological approach to this research project.

Paper 5

Data Analytic Plan and Preliminary Analyses

This paper contributes to this portfolio by outlining the data analytic plan for this research before providing a detailed account of the preliminary analyses conducted. Although a departure from the traditional APA-formatted thesis, the preliminary analyses and associated results are documented here in Paper 5 to give greater emphasis to the results themselves (see Papers 6 and 7). By clearly delineating between the preliminary analyses and the results of the main parametric tests, this structure supports the reader's progress through this portfolio providing a detailed account of the preliminary analyses conducted for the present study, setting the scene for the results chapters that follow.

In terms of preliminary analyses, initially the data is checked to confirm it meets the assumptions for the Kaiser-Meyer-Olkin Measure of Sampling Adequacy, Bartlett's Test of Sphericity, correlation, multicollinearity and singularity, and lastly, normality. The rationale and execution of exploratory factor analysis is outlined, in addition to the steps taken to address the factorial non-invariance identified between the factor scores across timepoints. This process is described in detail, leading to the generation of weighted coefficients to be used in parametric tests to analyse these data. As the closing set of preliminary analyses of this paper, the SRLEDS is validated forming a significant contribution of this research to the field of self-regulated learning research. The final section of this paper provides the context and considerations surrounding the parametric tests used to analyse data in response to the research questions, setting the scene for the results of these analyses in Papers 6 and 7.

Written September 2019, revised June 2021.

5.1 Data Analytic Plan

This section provides a detailed overview of the analyses planned for this study. As stated in the introduction to this paper, the preliminary analyses and associated results are documented here in Paper 5 to give greater emphasis to the results of the parametric tests which serve to address the research questions (see Papers 6 and 7). Whilst a departure from the traditional, APA-formatted thesis, this structure not only supports the reader's progress through the portfolio, clearly delineating between the results of the preliminary analyses and the results of the parametric tests focused on the research questions, but it also complements the portfolio structure. All descriptive and group-difference analyses were conducted using IBM SPSS 26.

First every item for each set of survey data was re-coded and checked. SPSS was then used to determine whether the data met the following assumptions:

- Kaiser-Meyer-Olkin Measure of Sampling Adequacy
- Bartlett's Test of Sphericity
- Correlation, multicollinearity and singularity
- Assumption of normality

Exploratory Factor Analysis was then conducted to discover summary constructs for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS. In doing so, the data set was reduced to a more manageable size before parametric testing, retaining as much of the original information as possible (Field, 2013). Following this, internal consistency and scale reliability was calculated for all scales, sub-scales and items using Cronbach's alpha; the most widely used measure of scale reliability (Peterson, 1994). As the penultimate set of preliminary analyses, the present study makes use of a method outlined by Thurstone (1947) to overcome the violation of factorial invariance (see Section 5.4), to generate weighted coefficients or factors for each instrument at each timepoint. Lastly, the SRLEDS is validated through a bivariate two-tailed Pearson's *r* Correlation Coefficient test was run using the weighted factors for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS.

In terms of descriptive statistics, the usual analyses were conducted. This includes the mean and standard deviation for all items within each survey across all three timepoints. In addition to this, the minimum, maximum, skewness and kurtosis were calculated across timepoint, group and factor for each instrument (See Appendix F). In response to Research Question 1, *To what extent can a curriculum intervention enhance students' self-regulated learning skills?*, a mixed MANOVA was conducted on the influence of a single between-subjects variable (group) on the dependent, within-subject variables of students' self-regulated learning skills and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). As a follow-up to this set of analyses, the Games-Howell *post hoc* test was used to assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills ($p = .05$). A mixed ANOVA was also run, examining the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group. As part of this analysis, the assumption of sphericity was tested using Mauchly's Test. Lastly, a *t*-test was run using propensity scores calculated using data from timepoint 2 to examine the extent to which the intervention enhanced students' self-regulated learning skills. As with any *t*-test, the assumption of homogeneity of variances tested using Levene's Test.

In response to Research Question 2, *Does students' mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict their mean test performance?*, a two-way between-subjects mixed ANOVA was conducted to evaluate whether students' test performance improved over time and whether there is a difference between groups. In terms of the between-subjects variable, group consisted of two levels (Group A and Group B) and as a within-subjects variable, timepoint included three levels (1, 2 and 3). As a follow-up to this, to assess pairwise differences among the three levels of timepoint for the effect of students' test performance, the Games-Howell follow-up procedure (p = .05) was performed. To examine the relationship between students' self-regulated learning skills and test performance, Pearson's r Correlation Coefficient was calculated. Using both factors for each of the three instruments (MSLQ-Motivation, MSLQ-Cognitive and SRLEDS) correlations were run against students' test performance across each of the three timepoints. Lastly, using students' mean test performance as the dependent variable, an ANCOVA explored the effects of the between-subject manipulation of Group (Group A and Group B), with both factors of students' self-regulated learning skills at each timepoint as covariates. Table 5.1.1 provides a detailed summary of the data analysis techniques conducted as part of this research.

Table 5.1.1
Data Analytic Plan

	Analyses Planned
Assumptions	**Kaiser-Meyer-Olkin Measure of Sampling Adequacy** (Kaiser, 1970) • Represents the ratio of the squared correlation between variables to the squared partial correlation between variables. • This statistic varies between 0 and 1, with values closer to 1 indicating that patterns of correlation are relatively compact, and that subsequent factor analysis should yield distinct and reliable factors. **Bartlett's Test of Sphericity** • Indicates whether the correlation matrix is significantly different from the identify matrix. **Correlation, multicollinearity and singularity** • Whilst there should be some correlation between the items, it is important that items do not correlate too highly (multicollinearity, $r > .9$,) or are perfectly correlated (singularity, $r = 1$). **Assumption of normality** • Examines whether the distribution of scores deviates from a comparable normally distributed set of scores with the same mean and standard deviation. • If significance value is greater than .05, the data is normal. • Both the Kolmogorov-Smirnov test and the Shapiro-Wilk test were conducted. Shapiro-Wilk test is more appropriate for smaller samples, < 50 samples but can handle a sample size as large as 2000.
Exploratory Factor Analysis	• Exploratory Factor Analysis was used in the present study to discover summary constructs for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS. In doing so, the data set was reduced to a more manageable size before parametric testing, whilst retaining as much of the original information as possible (Field, 2013). • Principal Axis Factoring extraction technique was used with orthogonal (varimax) rotation and Kaiser normalisation (Fabrigar et al., 1999; Field, 2013; Floyd & Widaman, 1995; Osborne et al., 2008). • In light of the investigative and exploratory nature of these preliminary analyses, the number of factors was not initially constrained, instead extracted by Eigenvalues greater than 1. • Both a scree test and parallel analysis were performed to determine the number of factors to extract (Dunn et al., 2012; Reise et al., 2000).

Table 5.1.1 Continued
Data Analytic Plan

	Analyses Planned
Internal Consistency	• As the most widely used measure of scale reliability, Cronbach's alpha tests the extent to which interrelated items have a high proportion of common variance, or communalities, and low uniqueness (Peterson, 1994). • .8 is a generally accepted threshold for cognitive tests, however lower thresholds can still be used for exploratory research that is in the early stages of development and also when scales are based on few items (Gabrielsson & Politis, 2011). • Cronbach’s alpha calculated for all scales (MSLQ-Motivation, MSLQ-Cognitive and SRLEDS), sub-scales and items.
Weighted Factor Loadings	• To overcome the violation of factorial invariance highlighted in Section 5.4 of this paper, the present study makes use of a method outlined by Thurstone (1947) to generate weighted coefficients or factors for each instrument at each timepoint.
Validating the SRLEDS	• To confirm the validity of the SRLEDS, a bivariate two-tailed Pearson’s *r* Correlation Coefficient test was run using the weighted factors for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS.
Descriptive statistics	• The mean and standard deviation were calculated for every item across all three timepoints. • In addition to this, the minimum, maximum, skewness and kurtosis was calculated across timepoint, group and factor for each instrument.

Table 5.1.1 Continued

Data Analytic Plan

	Analyses Planned
Research Question 1 To what extent can a curriculum intervention enhance students' self-regulated learning skills?	**Mixed MANOVA** • Conducted on the influence of the between-subject variable of group on the dependent, within-subject variables of students' self-regulated learning skills and timepoint. • Group consisted of two levels (Group A and Group B) and timepoint includes three levels (1, 2 and 3). **Games-Howell *Post Hoc* Test** • To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure (p = .05) was performed. **Mixed ANOVA** • Assumption of sphericity tested using Mauchly's Test. • The effects of the within-subject manipulation of timepoint and students' self-regulated learning skills, and between-subjects manipulation of group were examined. ***T* Test Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills** • Propensity scores calculated using data from timepoint 2. • Assumption of homogeneity of variances tested using Levene's Test.
Research Question 2 Does students' mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict their mean test performance?	**Mixed ANOVA** • A two-way between-subjects mixed ANOVA was conducted to evaluate whether students' test performance improved over time and whether there is a difference between groups. • In terms of the between-subjects variable, group consisted of two levels (Group A and Group B), and the within-subjects variable of timepoint included three levels (1, 2 and 3). **Games-Howell *Post Hoc* Test** • To assess pairwise differences among the three levels of timepoint for the effect of students' test performance, the Games-Howell follow-up procedure (p = .05) was performed. **Pearson's *r* Correlation Coefficient** • To examine the relationship between students' self-regulated learning skills and test performance, Pearson's r Correlation Coefficient was calculated. • Using both factors of each instrument (MSLQ-Motivation, MSLQ-Cognitive and SRLEDS), these were correlated against students' test performance across all three timepoints. **ANCOVA** • Using students' mean test performance as the dependent variable, this test explored the effects of the between-subject manipulation of Group (Group A and Group B), with both factors of students' self-regulated learning skills at each timepoint as covariates.

5.2 Assumptions

5.2.1 Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (Kaiser, 1970), represents the ratio of the squared correlation between variables to the squared partial correlation between variables. This statistic varies between 0 and 1, with values closer to 1 indicating that patterns of correlation are relatively compact and that subsequent factor analysis should yield distinct and reliable factors (Field, 2013). Generally, values greater than .5 should be accepted (Kaiser, 1974) with values in the .7s described as middling (Hutcheson and Sofroniou, 1999) and values in the .8s as meritorious (Field, 2013). Hutcheson and Sofroniou (1999) suggested that values over .6 are needed to proceed with factor analysis. The Kaiser-Meyer-Olkin values for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS across all three timepoints are above these thresholds (see Table 5.2.1).

Table 5.2.1
Results of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy for MSLQ-Motivation, MSLQ-Cognitive and SRLEDS at Timepoints 1, 2 and 3

Timepoint	MSLQ-Motivation Q1-31	MSLQ-Cognitive Q32-80	SRLEDS
1	.78	.70	.71
2	.86	.78	.71
3	.84	.76	.74

Note. Q denotes question number.

5.2.2 Bartlett's Test of Sphericity

Bartlett's test of sphericity indicates whether the correlation matrix is significantly different from the identify matrix. In doing so, it tests the null hypothesis, *the original correlation matrix is an identity matrix* (Field, 2000). If it is significant, then it means that the correlation between variables are significantly different from zero (Field, 2013). Given the fact that significance depends on sample size, Bartlett's test is almost always significant, however despite this it is important to calculate as an additional layer of evidence in advance of moving to factor analysis. The results of Bartlett's test of sphericity for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS across all three timepoints can be seen in Table 5.2.2. As the table shows, all nine tests are statistically significant meaning that factor analysis is appropriate.

Table 5.2.2
Results of Bartlett's Test for Sphericity for MSLQ-Motivation, MSLQ-Cognitive and SRLEDS at Timepoints 1, 2 and 3

Timepoint	**Instrument**	**Sub-scale**	**Chi-Square**	***df***	***p***
1	**MSLQ**	Motivation	1376.02	406	< .001
		Cognitive	2412.29	1081	< .001
	SRLEDS		886.65	435	< .001
2	**MSLQ**	Motivation	1570.29	406	< .001
		Cognitive	2842.86	1081	< .001
	SRLEDS		847.70	435	< .001
3	**MSLQ**	Motivation	1518.60	406	< .001
		Cognitive	2961.92	1081	< .001
	SRLEDS		732.00	435	< .001

Note. *df* denotes degrees of freedom.

5.2.3 Correlation Matrices

The penultimate step before performing factor analysis is to examine the correlation matrices for each of the instruments across all three timepoints. Whilst there should be some correlation between the items, it is important that items do not correlate too highly (multicollinearity, $r > .9$), or are perfectly correlated (singularity, $r = 1$) (Field, 2013). Multicollinearity causes problems because each item should make a unique contribution to the factor solution and it becomes difficult to determine the contribution of items if they are highly correlated (Field, 2013; Netemeyer, Bearden, & Sharma, 2003). To check the pattern of the relationships, first the significance values were checked to see if any item had the majority of values greater than .05. Next the correlation coefficients themselves were checked to ensure that none of them had a value greater than .9 (Field, 2013). In terms of collinearity diagnostics, variance inflation factor was calculated in addition to the tolerance statistic (1/variance inflation factor). As the largest variance inflation factor is not greater than 10 and the average variance inflation factor is not substantially greater than 1, there is no cause for concern (Bowerman & O'Connell, 1990; Myers, 1990). All items in the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS correlate well across all three timepoints, and therefore no items were eliminated at this stage. The correlation matrices for the MSLQ (all items) and the SRLEDS for all three timepoints can be found in Appendix G and H respectively.

Having checked the matrices for correlation and singularity, and yielded significant Bartlett's tests for both instruments across all three timepoints, the determinant of the *R*-matrix can be used to detect multicollinearity through the simple heuristic that the determinant should be greater than .1 $x10^{-4}$ (Field, 2000, 2013; Netemeyer et al., 2003). As seen in Table 5.2.3, the *R*-matrix values for both the MSLQ-Motivation and the SRLEDS across all three timepoints exceed .1 $x10^{-4}$, indicating no multicollinearity within these items. However, the *R*-matrix values for the MSLQ-Cognitive across all three timepoints is less than .1 $x10^{-4}$, indicating multicollinearity within these data. Notwithstanding these findings, no items were eliminated at this stage, but instead after factor analysis and the calculation of Cronbach's alphas. As Bowerman and O'Connell (1990) state, although the obvious solution is to omit one of the variables, there is no way of knowing which one to omit as well as there being no statistical grounds for omitting one variable over another in this instance. Field (2013) states that the safest, although unsatisfactory remedy is to acknowledge the unreliability of the model, as noted here, and continue to factor analysis.

Table 5.2.3
Determinants of the R-Matrix for MSLQ-Motivation, MSLQ-Cognitive and SRLEDS at Timepoints 1, 2 and 3

Timepoint	Instrument	Sub-scale	Determinants of the *R*-Matrix
1	**MSLQ**	Motivation	4.06 $\times10^{-5}$
		Cognitive	1.06 $\times10^{-11}$
	SRLEDS		2.66 $\times10^{-4}$
2	**MSLQ**	Motivation	7.23 $\times10^{-5}$
		Cognitive	1.60 $\times10^{-14}$
	SRLEDS		8.26 $\times10^{-5}$
3	**MSLQ**	Motivation	2.35 $\times10^{-5}$
		Cognitive	1.75 $\times10^{-14}$
	SRLEDS		1.74 $\times10^{-5}$

5.2.4 Assumption of Normality

Many data analysis methods depend on the assumption that data were sampled from a normal distribution and, as *normal* data is an underlying assumption in the parametric testing to be used in this research, assessing the normality of the data is a prerequisite before any sort of statistical testing (Öztuna et al., 2006). Ghasemi and Zahediasl (2012) state that assumption of normality should be taken seriously, as when these assumptions do not hold it is impossible to draw accurate and reliable conclusions. Field (2000, 2013) identifies the confusion surrounding the *assumption of normality*, with many people taking it to mean that the data need to be normally distributed. This is, however, not the case, explained by central limit theorem whereby there are a variety of situations in which we can assume normality regardless of the shape of the sample data (Field, 2013; Lumley, Diehr, Emerson, & Chen, 2002).

Whilst graphical methods provide some visual information about the shape of the distribution, this approach is considered to be unreliable as it does not guarantee that the distribution is normal and does not actually test whether the difference between the normal distribution and the sample distribution is significant (Altman & Bland, 1995; Öztuna et al., 2006). As such, both visual analysis and normality tests were conducted.

Both the Kolmogorov-Smirnov test and the Shapiro-Wilk test examine whether the distribution of scores deviates from a comparable normally distributed set of scores with the same mean and standard deviation. The null hypothesis is, *sample distribution is normal*. If the test is significant ($p > .05$), then the null hypothesis is rejected and the sample distribution is significantly different to from a normal distribution, i.e. it is non-normal. As seen in Appendix I and J, the *p*-values for both the Kolmogorov-Smirnov test and the Shapiro-Wilk test are less than .05, therefore the distribution of these data is non-normal.

In light of this, Altman and Bland (1995) cogently argue that it is not necessary for the distribution of the observed data to be normal, but rather the sample values should be compatible with the population which they represent, having a normal distribution. Examples of this within this research would be question 10 (Course importance) and question 68 (Ask for help) from the MSLQ-Motivation and MSLQ-Cognitive respectively, as for these items I would not expect a normal distribution of responses given the question focus. Furthering this, the violation of the assumption of normality should not cause major problems when the sample size is large enough (> 30 or 40), as the sampling distribution tends to be normal, regardless of the shape of the data (Elliott & Woodward, 2007; Pallant, 2013). For large sample sizes, statistically significant results would be derived even in the case of a small deviation from normality although this small deviation will not affect the results of a parametric test (Field, 2013; Field, 2000; Ghasemi & Zahediasl, 2012; Öztuna et al., 2006).

5.3 Generating Summary Constructs - Exploratory Factor Analysis

Factor analysis has a long tradition in classical measurement theory, first introduced by Pearson (1901) and Spearman (1904), with later refinement by Thurstone (1931, 1947) and Hotelling (1933). Described by Nunnally (1978) as being critical for measuring psychological constructs, it is a widely used multivariate statistical procedure in educational and psychological research (Goldberg & Velicer, 2006; Grice, 2001; Nunnally & Bernstein, 2006). The main aim of factor analysis is to parsimoniously reduce a set of variables into a smaller set of dimensions or factors that summarise the relations among the variables (Goldberg & Velicer, 2006). The major justification for this is as a means to reduce a data set to a more manageable size before conducting parametric tests, while retaining as much of the original information as possible (Field, 2013). There are several methods for unearthing factors in data, and Tinsley and Tinsley (1987) state that there are two broad options to consider. Firstly, if one already has a theory about the structure of a set of variables, the extent to which that theory accounts for the relations among variables in a sample of data can be investigated, and therefore *confirmatory factor analysis* is used (Goldberg & Velicer, 2006). However, if the factor analysis is to be used to discover summary constructs when their nature is unknown, as in this research, then *exploratory factor analysis* is appropriate.

Exploratory factor analysis is one of the most widely used statistical procedures in psychological research (Fabrigar et al., 1999). The primary goal of exploratory factor analysis is to identify latent factors that explain covariation among a set of measured variables (Kahn, 2016). Fabrigar et al. (1999) contend that more than any other statistical method, exploratory factor analysis requires a researcher to make a number of important decisions, of which they argue that there are five. First, decisions must be made surrounding what variables to include in the study in addition to the size and nature of the sample. Secondly, given the goals of the research project, it should be determined whether exploratory factor analysis is the most appropriate form of analysis. Thirdly, a specific procedure to fit the model to the data must be chosen. Fourth, important decisions must be made about the number of factors to include in the model. And finally, to allow the final solution to be readily interpreted, an appropriate method for rotating the model must be selected. Whilst the first consideration outlined by Fabrigar et al. (1999) was discussed at the methodological stage (see Paper 4), the other four considerations will be covered in the discussion that follows, with decisions rooted in supporting literature.

Generally, exploratory factor analysis requires large sample sizes (Dunn et al., 2012). Guilford (1954) suggests that a minimum sample size of 200 is required to recover consistent factors, with later research recommending more than 500 participants' responses when conducting exploratory factor analysis (Comrey & Lee, 1992). More recently though, a number of studies have extensively researched the required minimum sample needed to yield reliable factor recovery (de Winter et al., 2009; Gagne & Hancock, 2006; Jackson et al., 2013; Jung & Lee, 2011; Preacher & MacCallum, 2002), and although the suggested minimum sample size varies from study to study, MacCallum, Widaman, Preacher, and Hong (2001) and MacCallum, Widaman, Zhang, and Hong (1999) suggest that the overall theoretical framework supports that to yield reliable results one must only require a sample size of 60; a number easily exceeded in this research.

If an appropriate factor extraction method is not selected, potential problems may arise due to violations of the assumptions of multivariate normality (Dunn et al., 2012). In light of this, a Principal Axis Factoring extraction technique was used with orthogonal (varimax) rotation and Kaiser normalisation (Fabrigar et al., 1999; Field, 2013; Floyd & Widaman, 1995; Osborne et al., 2008). Varimax rotation was selected here because it maximises the dispersion of loading within factors, therefore loading a smaller number of variables highly on each factor and simplifying the interpretation of factors. Because of the investigative and exploratory nature of these preliminary analyses, the number of factors was not initially constrained, instead extracted by Eigenvalues greater than 1. However, following the recommendation of Reise, Waller, and Comrey (2000), both a scree test and parallel analysis were performed to determine the number of factors to extract (Dunn et al., 2012).

5.3.1 Exploratory Factor Analysis for the MSLQ

For the MSLQ, initially the exploratory factor analysis was performed for all 80 items, including motivational items (Questions 1-31: MSLQ-Motivation) and the cognitive and metacognitive items (Questions 32-80: MSLQ-Cognitive). However, both practical and statistical considerations combined to inform the decision to perform subsequent exploratory factor analyses on each of the two sections separately. This also aligns with the approach of the original questionnaire (Pintrich et al., 1991, 1993). In terms of extraction, the decision regarding the number of factors to retain is important, not least because of the conceptual and empirical evidence that specifying either too few or too many factors are substantial errors that can affect results (Hayton et al., 2004). Therefore to support extraction from the initial exploratory factor analysis for the MSLQ-Motivation both the scree test (Cattell, 1966) and parallel analysis (Horn, 1965) were performed. As suggested by Cattell (1966), the point of inflexion where the gradient of the scree plot changes dramatically was used as the cut-off for retaining factors. This aligned positively with the results of the parallel analysis (Horn, 1965), viewed as the strongest method of extraction by Zwick and Velicer (1986), which also indicated a clear two-factor solution. When the exploratory factor analysis was performed for a second time, constraining a two-factor solution, neither question 24 (Assignment choice) nor 25 (Understanding attribution) loaded on to either Factor 1 or Factor 2. As a response to this, Cronbach's alphas (see Section 5.3.3, Internal Consistency) were calculated for the MSLQ-Motivation items both before and after removing questions 24 and 25. With the removal of questions 24 and 25, the overall scale reliability rose from α = .86 (*M* = 148.2, *SD* = 19.1) to α = .87 (*M* = 140.8, *SD* = 18.4); a robust level. The exploratory factor analysis was then repeated for a third and final time omitting questions 24 and 25, the results of which can be seen in Table 5.3.1.1. In terms of naming the two factors, Factor 1 was renamed *Course Approach* and Factor 2 was renamed *Affective Response;* names to be used henceforth in this research.

Table 5.3.1.1

Results of the Exploratory Factor Analysis Showing the Rotated Factor Loadings for MSLQ-Motivation Items at Timepoint 1, Questions 1 -31 (Questions 24 and 25 Omitted)

		Factor	
	Question summary	**1**	**2**
Q1	Challenging material	**.50**	
Q2	Appropriate study	**.57**	.34
Q3	Test comparison		.36
Q4	Other courses	.36	**.40**
Q5	Excellent grade	**.63**	
Q6	Difficult material	**.59**	
Q7	Good grade	**.44**	
Q8	Test questions		.34
Q9	Blame	.38	**.44**
Q10	Course importance	.38	**.42**
Q11	Improving grade	.40	**.41**
Q12	Confidence in basics		**.40**
Q13	Student comparison	**.40**	.32
Q14	Failing test		.38
Q15	Confidence in complex	**.67**	
Q16	Curiosity	.33	
Q17	Course interest	**.63**	
Q18	Try hard	**.56**	
Q19	Exam feeling		**.62**
Q20	Confidence in tests	**.66**	
Q21	Expectations	**.66**	
Q22	Satisfaction	**.45**	
Q23	Course usefulness	.39	**.49**
Q26	Subject matter	**.41**	
Q27	Understanding importance	.42	**.46**
Q28	Exam anxiety		**.49**
Q29	Skills mastery	**.54**	
Q30	Demonstrate ability	.34	**.46**
Q31	Expectation difficulty	**.70**	

Note. Q denotes question number. Nil entries in the factor columns are a result of a lack of loading on to either Factor 1 or Factor 2.

The same iterative process as outlined for the MSLQ-Motivation items was also followed for the MSLQ-Cognitive items at timepoint 1, questions 32-80. Analysis of the scree test (Cattell, 1966) and parallel analysis (Horn, 1965) indicated a clear two-factor solution, on to which questions 40 (Individual work) and 45 (Change reading) did not load on to either factor. Cronbach's alphas were calculated, which after questions 40 (Individual work) and 45 (Change reading) were removed, overall reliability improved from $\alpha = .91$ ($M = 215.8$, $SD = 32.2$) to $\alpha = .92$ ($M = 206.9$, $SD = 32.0$); also a robust level. As for the MSLQ-Motivation items, the exploratory factor analysis was then repeated omitting questions 40 and 45, the results of which can be seen in Table 5.3.1.2. In terms of naming the two factors, Factor 1 was renamed *Cognitive Control* and Factor 2 was renamed *Self-Management;* names to be used henceforth in this research.

Although results indicate a clear two-factor solution, when the current latent structures are compared to that of the original model, there is some mis-alignment between the current results and the original results. Pintrich et al. (1991, 1993) performed a confirmatory factor analysis to quantitatively test the theory underpinning the development of the MSLQ, stipulating which items (indicators) should load onto which factors (latent variables) (Pintrich et al., 1991, 1993). The 31 MSLQ-Motivation items were tested to see how well they fit six latent variables, whereas the MSLQ-Cognitive items were tested to see how well they fit nine latent variables. As such, the difference in the methods used to produce the factors inhibits any direct comparison between the current results and the original results. That said, the factor structures are sound given that face validity (Bornstein, 1996; Nevo, 1985) is strong, there are few cross-loadings (primary loading should be at least .2 greater than secondary loading) and lastly, almost all loadings have an absolute value greater than .4 (Stevens, 2012). Therefore, one can reasonably claim factor validity for both the MSLQ-Motivation items and the MSLQ-Cognitive items.

Table 5.3.1.2
Results of the Exploratory Factor Analysis Showing the Rotated Factor Loadings for MSLQ-Cognitive at Timepoint 1, Questions 32-60 (Questions 40 and 45 Omitted)

		Factor	
	Question summary	**1**	**2**
Q32	Reading outline	**.46**	.41
Q33R	Lesson distraction		**.67**
Q34	Explain material	.32	.30
Q35	Study place	.24	**.58**
Q36	Reading questions	**.65**	
Q37R	Bored and quit		**.64**
Q38	Questioning	**.43**	
Q39	Self-talk	**.52**	
Q41	Confusion response	.33	**.41**
Q42	Key ideas	**.46**	.29
Q43	Use of time	.20	**.52**
Q44	Change reading	.38	
Q46	Re-read notes	.35	.23
Q47	Supporting evidence	**.45**	.24
Q48	Hard work	.29	**.49**
Q49	Visual material	.39	.27
Q50	Material discussion	.28	
Q51	Starting point	**.58**	.24
Q52R	Study schedule		**.41**
Q53	Different sources	**.46**	.31
Q54	Skim before	**.41**	
Q55	Self-questioning	**.54**	.27
Q56	Change approach	.29	.29
Q57R	Reading knowledge		.30
Q58	Concept clarify		**.47**
Q59	Key words	**.48**	
Q60R	Course difficulty		**.53**

Note. Q denotes question number. Nil entries in the factor columns are a result of a lack of loading on to either Factor 1 or Factor 2.

Table 5.3.1.2 Continued

Results of the Exploratory Factor Analysis Showing the Rotated Factor Loadings for MSLQ-Cognitive at Timepoint 1, Questions 61-80.

		Factor	
	Question summary	**1**	**2**
Q61	Topic learning	**.53**	
Q62	Relate ideas	**.49**	
Q63	Important concepts	**.55**	.37
Q64	Relate material	.32	**.40**
Q65	Study place	.26	.38
Q66	Play with ideas	**.60**	-.25
Q67	Idea summaries	.35	.34
Q68	Ask for help		**.52**
Q69	Making connections	**.55**	.30
Q70	Keep up		**.61**
Q71	Alternative ideas	**.46**	-.25
Q72	Memorise lists	**.52**	.24
Q73	Lesson attendance		**.45**
Q74	Keep working	.24	.22
Q75	Help from peers	.27	
Q76R	Concept understanding		**.54**
Q77	Other activities	.43	**.53**
Q78	Goal setting	.23	**.54**
Q79R	Note taking		.36
Q80	Note review	**.46**	

Note. Q denotes question number. Nil entries in the factor columns are a result of a lack of loading on to either Factor 1 or Factor 2.

5.3.2 Exploratory Factor Analysis for the SRLEDS

As an original instrument, Cronbach's alphas were calculated for all items of the SRLEDS to examine the instrument's reliability. Initial analysis yielded an acceptable scale reliability (α = .72, M = 82.7, SD = 6.7). That said, as shown in Table 5.3.2.1 there are a number of items which if removed, would significantly increase the scale reliability; questions 2 (Further research), 7 (Plan before study), 14 (Struggle to communicate), 16 (Individual work) and 17 (Prefer peer work). An exploratory factor analysis was then performed using the same method as outlined for the MSLQ-

Motivation and MSLQ-Cognitive, which yielded a 10-factor solution with Eigenvalues greater than 1. However, as for both sub-sections of the MSLQ, when the scree test (Cattell, 1966) and parallel analysis (Horn, 1965) were performed, a clear two-factor solution as evident. A second exploratory factor analysis was performed constraining the number of factors to be extracted to just two, for which questions, 2 (Further research), 5 (Achieve in studies), 16 (Individual work), 17 (Prefer peer work), 21 (Incorrect work) and 23 (Check theories) did not load on to either factor. In light of both this and the results of the initial test of reliability, questions 2 (Further research), 5 (Achieve in studies), 7 (Plan before study), 14 (Struggle to communicate), 16 (Individual work), 17 (Prefer peer work), 18 (Better learning with peers), 21 (Incorrect work) and 23 (Check theories) were removed. The exploratory factor analysis was performed for a third and final time, the results of which can be seen in Table 5.3.2.2. Cronbach's alphas were also calculated again with these items removed, with reliability rising from $\alpha = .72$ to $\alpha = .83$ ($M = 58.4$, $SD = 6.6$). See Table 5.3.2.3 for the item total reliability statistics. As is the case for the MSLQ-Motivation and the MSLQ-Cognitive, the factor structures of the SRLEDS are sound given the face validity (Bornstein, 1996; Nevo, 1985), the fact that there are only two instances of cross-loadings and lastly, almost all loadings have an absolute value greater than .3 (Stevens, 2012); acceptable given the original nature of the instrument. In terms of naming the two factors, Factor 1 was renamed *Motivation and Control* and Factor 2 was renamed *Communication and Forethought;* names to be used henceforth in this research.

Table 5.3.2.1

Item-Total Reliability Statistics for SRLEDS at Timepoint 1, Before Items Were Omitted

	Question summary	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	Use of resources	79.7	42.81	.36	.71
Q2	Further research	80.4	46.87	-.21	.74
Q3	Different sources	79.7	42.75	.31	.71
Q4	Goal setting	80.0	40.51	.49	.70
Q5	Achieve in studies	79.6	42.74	.27	.71
Q6	Before test	79.8	41.28	.32	.71
Q7	Plan before study	80.2	47.10	-.22	.75
Q8	Careful consideration	79.7	40.58	.56	.70
Q9	Effective planning	79.8	41.31	.44	.70
Q10	Enjoy studying	80.2	41.92	.29	.71
Q11	Keep working	79.7	42.21	.33	.71
Q12	Try hard	79.6	42.76	.29	.71
Q13	Communicate in	79.8	42.86	.26	.71
Q14	Struggle to	80.3	46.28	-.14	.74
Q15	Verbal communication	79.9	42.73	.21	.72
Q16	Individual work	80.2	44.49	.03	.73
Q17	Prefer peer work	79.7	46.08	-.12	.74
Q18	Better learning with	79.7	44.13	.06	.73
Q19	Solutions to problems	80.0	41.64	.39	.71
Q20	New strategies	80.2	41.71	.37	.71
Q21	Incorrect ideas	79.8	45.06	-.02	.73
Q22	Identify problems	79.8	43.10	.26	.71
Q23	Check theory	79.9	41.82	.36	.71
Q24	Evidence to justify	79.6	43.11	.32	.71
Q25	Check steps	79.8	42.22	.34	.71
Q26	Avoid distractions	80.4	41.08	.37	.71
Q27	Monitor strategies	80.0	41.81	.42	.71
Q28	Goal achievement	80.0	40.83	.51	.70
Q29	Task improvement	80.0	40.81	.51	.70
Q30	Engage with feedback	79.7	42.50	.30	.71

Note. Q denotes question number.

Table 5.3.2.2

Results of the Exploratory Factor Analysis Showing the Rotated Factor Loadings for SRLEDS at Timepoint 1 (Questions 2, 5, 7, 14, 16, 17, 18, 21 and 23 Omitted)

		Factor	
	Question summary	**1**	**2**
Q1	Use of resources		**.48**
Q3	Different sources	**.45**	
Q4	Goal setting	**.52**	
Q6	Before test		**.32**
Q8	Careful consideration	.44	**.47**
Q9	Effective planning		**.68**
Q10	Enjoy studying	**.37**	
Q11	Keep working	**.33**	
Q12	Try hard		**.51**
Q13	Communicate in writing		**.30**
Q15	Verbal communication		**.41**
Q19	Solutions to problems	**.51**	
Q20	New strategies	**.40**	
Q22	Identify problems		**.39**
Q24	Evidence to justify		**.41**
Q25	Check steps	**.61**	
Q26	Avoid distractions	**.57**	
Q27	Monitor strategies	**.66**	
Q28	Goal achievement	**.56**	
Q29	Task improvement	**.61**	
Q30	Engage with feedback	.33	**.39**

Note. Q denotes question number.

Table 5.3.2.3

Item-Total Reliability Statistics for SRLEDS at Timepoint 1 (Questions 2, 5, 7, 14, 16, 17, 18, 21 and 23 Omitted)

	Question summary	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	Use of resources	55.5	40.80	.46	.83
Q3	Different sources	55.4	40.56	.42	.83
Q4	Goal setting	55.8	39.07	.49	.82
Q6	Before test	55.6	39.68	.34	.83
Q8	Careful consideration	55.5	39.18	.57	.82
Q9	Effective planning	55.6	39.24	.52	.82
Q10	Enjoy studying	56.0	39.37	.41	.83
Q11	Keep working	55.5	40.63	.35	.83
Q12	Try hard	55.3	41.46	.27	.83
Q13	Communicate in writing	55.6	41.23	.29	.83
Q15	Verbal communication	55.7	41.53	.19	.84
Q19	Solutions to problems	55.8	39.93	.43	.83
Q20	New strategies	56.0	39.86	.42	.83
Q22	Identify problems	55.5	41.51	.28	.83
Q24	Evidence to justify	55.3	41.76	.30	.83
Q25	Check steps	55.6	40.98	.31	.83
Q26	Avoid distractions	56.2	39.05	.43	.83
Q27	Monitor strategies	55.8	39.99	.48	.82
Q28	Goal achievement	55.8	39.51	.50	.82
Q29	Task improvement	55.7	38.88	.58	.82
Q30	Engage with feedback	55.4	39.87	.45	.82

Note. Q denotes question number.

5.3.3 Internal Consistency

Internal consistency examines the reliability of the data by investigating the degree of interrelatedness among variables within a given construct (Krebbers, 2015). Cronbach's alpha is a measure of internal consistency and remains the most widely used measure of scale reliability, testing the extent to which interrelated items have a high proportion of common variance, or communalities, and low uniqueness (Peterson, 1994). That is, how closely related items are as a group. The proportion of common variance among items is compared to the total variance. Higher Cronbach's alpha scores indicate higher interrelated reliability (Netemeyer et al., 2003). Kline (2013) states that although the .8 is an accepted value for cognitive tests, lower thresholds can still be used for exploratory research that is in the early stages of development (Gabrielsson & Politis, 2011). Cronbach's alpha scores are dependent on the scale length and can be a weak indicator of reliability when only a few items are included (Nete-meyer et al., 2003; Politis et al., 2012). Generally, lower alphas are accepted when scales are based on few items (Gabrielsson & Politis, 2011), like in this research.

5.3.3.1 Internal Consistency of MSLQ-Motivation Items.

Table 5.3.3.1.1
Cronbach's Alphas for Two Factors of the MSLQ-Motivation at Timepoint 1, 2 and 3 (Questions 24 and 24 Omitted)

Timepoint	Course Approach	Affective Response
1	.87	.77
2	.90	.76
3	.89	.70

Table 5.3.3.1.1. shows the Cronbach's alphas calculated for the two factors of the MSLQ-Motivation (Questions 1-31). These alphas were calculated using the raw data at each timepoint in conjunction with the respective loadings on to each of the factors as shown in Table 5.3.1.1. It is clear there is stability in the alphas across timepoint, ranging from .87 to .90 for Course Approach items, and from .70 to. .77 for Affective Response items. Table 5.3.3.1.2 shows the Cronbach's alphas calculated for each sub-scale of the MSLQ-Motivation (Questions 1-31) across all three timepoints, along with the alphas published by Pintrich et al. (1991) in the original manual for the use of the MSLQ. Although there is some variation across the three timepoints, alphas

are broadly in-line with the original reliabilities as calculated by Pintrich et al. (1991), with some sub-scales even exceeding the original alphas (Extrinsic Goal Orientation T1, T2 and T3, Control of Learning Beliefs T1 and T3). The range of calculated alphas ranges from α = .50 up to α = .90, providing robust reliability.

Table 5.3.3.1.2
Cronbach's Alphas for MSLQ-Motivation Sub-Scales at Timepoint 1, 2 and 3 (Questions 24 and 24 Omitted)

		Cronbach's alpha			
Sub-scale	**Items**	**Original**	**T1**	**T2**	**T3**
Intrinsic Goal Orientation	1, 16, 22	.74	.50	.64	.68
Extrinsic Goal Orientation	7, 11, 13, 30	.62	.73	.72	.73
Task Value	4, 10, 17, 23, 26, 27	.90	.73	.81	.75
Control of Learning Beliefs	2, 9, 18	.68	.70	.60	.77
Self-efficacy for Learning and Performance	5, 6, 12, 15, 20, 21, 29, 31	.93	.81	.90	.86
Test Anxiety	3, 8, 14, 19, 28	.80	.65	.65	.68

Note. T denotes timepoint.

5.3.3.2 Internal Consistency of MSLQ-Cognitive Items. Table 5.3.3.2.1. shows the Cronbach's alphas calculated for the two factors of the MSLQ-Motivation (Questions 1-31). As for the MSLQ-Motivation, these alphas were calculated using the raw data at each timepoint in conjunction with the respective loadings on to each of the factors as shown in Table 5.3.1.2. The alphas for the Cognitive Control items range from .88 to .91 across timepoint, and the alphas calculated for the Self-Management items rage from .75 to .87. Table 5.3.3.2.2 shows the Cronbach's alphas calculated for each sub-scale of the MSLQ-Cognitive (Questions 32-80) across all three timepoints, along with the alphas published by Pintrich et al. (1991) in the original manual for the use of the MSLQ. Again, whilst there is some variation across the three timepoints, alphas are broadly in-line with the original reliabilities as calculated by Pintrich et al. (1991), with some sub-scales again exceeding the original alphas (Elaboration T2, Organisation T1 and T2, Metacognitive Self-Regulation T2, Effort Regulation T1, Help Seeking, T1, T2 and T3). The range of calculated alphas ranges from α = .26 up to α = .82.

Table 5.3.3.2.1
Cronbach's Alphas for Two Factors of the MSLQ-Cognitive at Timepoint 1, 2 and 3 (Questions 40 and 45 Omitted)

Timepoint	Cognitive Control	Self-Management
1	.88	.87
2	.91	.78
3	.90	.75

Table 5.3.3.2.2
Cronbach's Alphas for MSLQ-Cognitive Sub-Scales at Timepoint 1, 2 and 3 (Questions 40 and 45 Omitted)

		Cronbach's alpha			
Sub-scale	**Items**	**Original**	**T1**	**T2**	**T3**
Rehearsal	39, 46, 59, 72	.69	.60	.55	.60
Elaboration	53, 62, 64, 67, 69, 80	.76	.67	.77	.72
Organisation	32, 42, 49, 63	.64	.66	.74	.56
Critical Thinking	38, 47, 51, 66, 71	.80	.67	.80	.77
Metacognitive Self-Regulation	33, 36, 41, 44, 54, 55, 56, 57, 61, 75, 77, 78	.79	.77	.82	.78
Time and Study Environment	35, 43, 52, 65, 70, 76, 79	.76	.69	.57	.46
Effort Regulation	37, 48, 60, 73	.69	.70	.44	.26
Peer Learning	34, 50	.76	.56	.70	.62
Help Seeking	58, 68, 74	.52	.63	.66	.57

Note. T denotes timepoint.

5.3.3.3 Internal Consistency of SRLEDS. Table 5.3.3.3 shows the Cronbach's alphas calculated for each sub-scale of the SRLEDS across all three timepoints. As an original scale with a maximum of three items within each sub-scale, there is some variation in the alphas across the three timepoints. That said, there are some robust reliabilities across the nine sub-scales that remain following some items being omitted. The range of calculated alphas ranges from α = .13 up to α = .62.

Table 5.3.3.3
Cronbach's Alphas for SRLEDS Sub-Scales at Timepoints 1, 2 and 3 (Questions 2, 5. 7, 14, 16, 17, 18, 21 and 23 Omitted)

Sub-scale	Items	T1	T2	T3
Resourcefulness and Research	1, 3	.25	.41	.36
Goal Setting	4, 6	.39	.13	.48
Planning and Organisation	8, 9	.63	.41	.25
Self-motivation and Resilience	10, 11, 12	.40	.26	.62
Communication	13, 15	.37	.17	.29
Creativity	19, 20	.45	.30	.48
Critical Thinking	22, 24	.45	.42	.34
Metacognition	25, 26, 27	.60	.41	.54
Self-evaluation	28, 29, 30	.62	.47	.62

Note. T denotes timepoint.

5.4 Factor Analysis – Inconsistencies Across Timepoints

Described as an empiric issue of fundamental importance (Meredith & Teresi, 2006), factorial invariance is a concept applied in the context of the analysis of psychometric questionnaires across both multiple groups and repeated measures. Factorial invariance is that within a population and its subgroups, there exists an invariant factor loading pattern matrix where the factor scores from a questionnaire used either by multiple groups or by the same group over time as in this research, should be identical across groups (Byrne et al., 1989; Mulaik, 1971; Nolte & Elsworth, 2014). This view is developed by Van De Schoot et al. (2015) who state that if factor scores are to be compared in a meaningful and unbiased way, the measurement structures and their survey items should be stable or invariant. Meredith and Teresi (2006) contend that the failure for invariance to hold is, in most situations, *prima facie* evidence that the manifest variables fail to measure the same latent attributes (students' self-regulated learning skills) in the same way in different situations. That is if the pattern invariance fails then meaningful comparison across timepoints and groups based on the manifest variates cannot be made. The only exception to this rule is in the case of partial pattern invariance, with relatively few departures from invariance (Byrne et al., 1989; Meredith & Teresi, 2006). However, in this instance the items that exhibit invariance failure should not be used in the comparison across groups (Meredith & Teresi, 2006).

In terms of a hierarchy of factorial invariance, weak factorial invariance is where corresponding factor loadings are equivalent across groups. Strong factorial invariance requires that corresponding factor means are identical across groups. The highest level of factorial invariance, strict factorial invariance, requires that in addition to all factor means being identical across groups, their corresponding residuals are equivalent across groups. It follows, therefore, that for either strong or strict factorial invariance to characterise a set of groups, their union will be described by a factor model with the same number of factors and the same invariant pattern matrix that describes the groups (Meredith, 1993; Meredith & Teresi, 2006).

Linking to this, the concept of measurement invariance proposed by Mellenbergh (1989) requires that the association between the items and the latent factors of participants should not depend on group membership or timepoint. That is to say that the test should be measurement invariant with respect to group membership, allowing the differences in test scores across groups and timepoints to be attributed to differences in the constructs that were intended to be measured (Jak, 2014); students' self-regulated learning skills in this research. Van De Schoot et al. (2015) contend that if items are normally distributed, conditional on the factor scores generated, then the expected values, the covariances between items, and the unexplained variance unrelated to the factors should be equal across groups. Whilst the assumptions of measurement invariance are hard to meet in educational research in strictest terms, the potential bias caused by measurement non-invariance obstructs the comparison of factor scores generated through factor analysis (Meredith, 1993; Millsap, 2012; Van De Schoot et al., 2015). Furthering this, Lommen et al. (2014) state that the aim of comparing latent mean scores over time is to capture true latent score changes (i.e., alpha change; Brown, 2015). However, it is important to note that increases or decreases in latent mean scores may also reflect changes in the construct being measured (gamma change) or indeed changes in the measurement proportions of the indicators (beta change) (Lommen et al., 2014). This is an area that will be revisited in Paper 8, Discussion.

The factor scores generated using the procedure and considerations outlined in Section 5.3 for the MSLQ-Motivation, the MSLQ-Cognitive and the SRLEDS at timepoints 2 and 3 violated the concept of factorial invariance, in that they were not identical across time. Linking to the earlier discussion about the importance of factorial and measurement invariance, Van De Schoot et al. (2015) state that the measurement structures and their survey items should be stable or invariant if factor scores are to be compared in a meaningful and unbiased way across groups and timepoints. In light of this, the non-invariance observed in factor scores across the three timepoints for all three instruments renders comparison inappropriate.

To address this problem, this research makes effective use of a process outlined by Thurstone (1947), who proposed a *coarse* factor scoring method to overcome factorial invariance by manually calculating the weighted coefficients (factors) for each instrument at each timepoint, thus enabling the same parametric tests to be performed and analysed as outlined in Table 5.4.1. An attractive feature of this coarse factor scoring method, also known as a *weighted average*, is its stability across independent samples of observations, as in this research across timepoints (Grice, 2001; Grice & Harris, 1998; Wackwitz & Horn, 1971). In research published by Grice (2001), coarse factor scores that were generated based on the factor score coefficients as in the following method, revealed superior levels of validity, univocality and correlation accuracy compared with original scores based on structure coefficients.

Using the factor loadings generated at timepoint 1 for the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS as shown in Tables 5.3.1.1, 5.3.1.2 and 5.3.2.2, the procedure detailed in Tables 5.4.1 and 5.4.2 was undertaken.

Table 5.4.1
Part 1 - Steps Followed to Calculate the Weighted Factor Loadings Using the Rotated Factors Generated at Timepoint 1

Step Number	Explanation
1	Square each of the rotated factor loadings generated for each item at timepoint 1.
2	Calculate the sum of all of the squared factor loadings.
3	For each item, divide the squared factor loading by the sum of the squared factor loadings, giving the weighted factor loading.

Table 5.4.2

Part 2 – Steps Followed to Calculate the New Factor Scores for Timepoints 2 and 3

Step Number	Explanation
1	Using the Factor 1 rotated factor loadings generated for each item at timepoint 1, omit the items that either had a larger loading on to Factor 2 or did not load at all onto Factor 1. This aligns with the advice of Meredith & Teresi (2006) who state that the items that exhibit invariance failure contributing to the factorial non-invariance should not be used in the comparison across groups and are therefore omitted.
2	Apply the same process from step 1 to Factor 2, omitting the items that had a larger loading on to Factor 1 or did not load at all onto Factor 2.
3	Using the raw data from the remaining items from step 1, apply the weighted average formula to the weighted factor loading calculated in Part 1 to create a new factor score for each participant's response. This was calculated as follows: - *New factor score = (Item 1 response x WFL1) + (Item 2 response x WFL2)…… + (Item n response x WFLn)* Where *n* is the number of items in each instrument.
4	Using the raw data from the remaining items from step 2, repeat the process outlined in step 3 for Factor 2.
5	Repeat steps 3 and 4 for the raw data from the remaining items for all participants' responses in Group A and B across all three instruments, both the motivation items and cognitive and metacognitive items of the MSLQ in addition to the SRLEDS.
6	Repeat step 5 for the raw data from the remaining items for all participants' responses in Groups A and B across all instruments as measured at timepoint 3.

The calculations of the weighted coefficients for the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS can be found in Appendix K, L and M respectively. These weighted coefficients were then used alongside the original factors for timepoint 1 shown in Tables 5.3.1.1, 5.3.1.2 and 5.3.1.3, to perform the parametric tests documented in Paper 6.

5.5 Validating the SRLEDS

When self-regulated learning is measured in quantitative studies, Magno (2011) states that it requires the use of a direct instrument that captures its conceptualisations, dispositions and skills. The MSLQ is one of the most common measures of self-regulated learning used in literature reviews and research within the field of education (Magno, 2011), with Garcia and Pintrich (1996) holding the view that the MSLQ represents a useful, reliable, and valid means for assessing students' motivation and use of learning strategies in the classroom. As highlighted in Section 5.3.3.1 Section and 5.3.3.2, the scale is reliable having Cronbach's alpha values published in the original manual by Pintrich et al. (1991) ranging from α = .52 up to α = .93. For the present study, the alphas were calculated separately for each of the two component parts of the MSLQ, the MSLQ-Motivation and MSLQ-Cognitive. The range of calculated alphas for the present study range from α = .50 up to α = .90 for the MSLQ-Motivation, and α = .26 up to α = .82 for the MSLQ-Cognitive.

As outlined in Paper 4, I developed my own measure tailored to this research to be used alongside the MSLQ; the Self-Regulated Learning Experimental Design Survey (SRLEDS). As highlighted in Section 5.3.3.3, there is some variation in alphas across the three timepoints, with reliabilities across the sub-scales ranging from α = .13 up to α = .62. Gabrielsson & Politis (2011) state that lower thresholds of acceptability can be used for exploratory research that is in the early stages of development, as in this research, with lower alphas accepted when scales are based on few items.

To confirm the validity of the SRLEDS, a bivariate two-tailed Pearson's *r* Correlation Coefficient test (see Section 5.6.4 for more detail) was run between all of the weighted scores across both parts of the MSLQ (MSLQ-Motivation and MSLQ-

Cognitive) and the SRLEDS generated using Thurstone's method. The resulting correlation matrix can be seen in Table 5.5.1.

In terms of the correlation matrix run using weighted scores (see Table 5.5.1), the SRLEDS Motivation and Control Items correlate strongly with all four factors of the MSLQ, with correlations ranging from $r(303) = .68$, $p < .001$, to $r(303) = .56$, $p < .001$. For the SRLEDS Communication and Forethought items, these also correlate well with all four factors of the MSLQ, ranging from $r(303) = .62$, $p < .001$, to $r(303) = .56$, $p < .001$. It is also noteworthy that the two factors of the SRLEDS correlated strongly with each other, $r(303) = .64$, $p < .001$.

The findings of the correlations run using the weighted scores support the validation of the SRLEDS as a reliable, valid and original scale used to measure self-regulated learning. As such, this forms a significant contribution to the field, something to be highlighted in Paper 8, Discussion.

Table 5.5.1
Pearson's r Correlation Matrix for all Factors of the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS Using Weighted Scores

	MSLQ-Motivation Course Approach	MSLQ-Motivation Affective Response	MSLQ-Cognitive Cognitive Control	MSLQ-Cognitive Self-Management	SRLEDS Motivation and Control
MSLQ-Motivation Course Approach					
MSLQ-Motivation Affective Response	.71***				
MSLQ-Cognitive Cognitive Control	.88***	.67***			
MSLQ-Cognitive Self-Management	.86***	.78***	.79***		
SRLEDS Motivation and Control	.68***	.56***	.63***	.63***	
SRLEDS Communication and Forethought	.62***	.56***	.60***	.58***	.64***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$ (2-tailed). $N = 323$ for six correlations run between both factors of the MSLQ-Motivation and MSLQ-Cognitive. $N = 303$ for nine correlations run between four factors of the MSLQ and both factors of the SRLEDS.

5.6 Parametric Tests – Context and Considerations

As the final section of this paper, its purpose is to provide context to the parametric tests highlighted in the Data Analytic Plan (see Section 5.1), and in doing so setting the scene for the results that follow in Papers 6 and 7. The following tests serve to provide results that will support my discussion relative to each of the two research questions, focusing on the extent to which the discipline-independent intervention influences students' self-regulated learning skills and test performance. Each test is clearly outlined along with any specific considerations justified by drawing on relevant research literature. As shown in Table 5.1.1, the analyses conducted have been structured in response to the two research questions of the present study, also informing the structure of Papers 6 and 7.

5.6.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills

A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of one independent between-subjects variable (group) on the dependent, within-subject variables of students' self-regulated learning skills and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). In terms of the interpretation of the mixed MANOVA results, there are four test statistics to choose from; Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root. When the hypothesis degrees of freedom is one, all four test statistics will yield identical results. Whilst the tests will usually provide the same result when the degrees of freedom are greater than one, when they do not Pillai's Trace is more robust to departures from assumptions that the other three, with Wilks' Lambda often more powerful than Pillai's Trace (Tabachnick, Fidell, & Ullman, 2007). In terms of its robustness, Pillai's Trace's substantial advantage is that it does not require extreme violations of assumptions, however with unequal group sizes, as in this research, the homogeneity of covariance matrices should be checked (Field, 2013). The rule of thumb is that if they appear homogenous and if the assumption of multivariate normality is acceptable, then Pillai's trace is taken to be accurate. To check this, the Box's Test of Equality of Covariance Matrices confirms the assumption of covariance across the groups. Using $p < .001$ as a criterion, it tests the null hypothesis, *the observed covariance matrices of the dependent variables are equal across the groups*. If the result is not significant and the assumption is not violated, Wilks' Lambda is appropriate to use, however if significant and assumptions are violated, Pillai's Trace should be used. Also, as groups in this research differ on more than one variate, Pillai's trace is considered to be the most powerful, followed by Wilk's Lambda (Olson, 1974, 1976, 1979). As such, given the lines of argument outlined above, *Box's M* result will be used to inform which of the two test statistics will be used to for each of the subsequent mixed MANOVA analyses that follows; Pillai's Trace or Wilks' Lambda.

5.6.2 Games-Howell Post Hoc Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint

Whilst the mixed MANOVA shows whether there is an overall difference in students' self-regulated learning skills across timepoint, it does not state which specific timepoints differ. As such, it is necessary to carry out further analyses to uncover specific differences across timepoint (Field, 2013). The challenge of this though, is to contrast the different timepoints without inflating the Type I error rate. The two options available to achieve this goal are planned comparisons, where there is a specific, pre-determined hypothesis is to be tested, and *post hoc* tests, when there are no specific hypotheses to be tested. Given both the nature of the results that follow in Paper 6 and the lack of *a priori* predictions, *post hoc* tests are most appropriate.

Post hoc stems from the Latin *after this*, and refers to a set of tests consisting of pairwise comparisons that are designed to compare all different combinations of the treatment groups (Field, 2013). As the name suggests, these tests are run retrospectively, specified after the data were seen. Whilst some critics of *post hoc* tests see these statistical analyses as a form of *p-hacking* or *data dredging*, the familywise error is controlled by the pairwise comparison by correcting the level of significance for each test such that the overall Type I error across all comparisons remains at .05 (Field, 2013). As such, they form an important additional layer of statistical testing to support the rigorous analysis of this study's data.

There are a number of different *post hoc* tests and it is imperative that the right one is chosen. Field (2013) states that there are three criteria that determine which *post hoc* test performs best:

1. Does the test control the Type I error rate?
2. Does the test control the Type II error rate having good statistical power?
3. Is the test reliable, even when parametric assumptions have been violated?

As the Type I error rate and the statistical power of a test are linked, there is a trade-off to make which informs the choice of test. For example, if a test is conservative, that is the probability of a Type I error is small, then it is likely to lack statistical power. Allied to that is the need to consider whether the group sizes are equal, in addition to the sample size itself. Given all of these considerations, the Games-Howell *post hoc* test is the most appropriate as: (a) the assumption of the homogeneity of variance has been violated (significant Levene's test); (b) there are unequal group sizes; (c) it is the most powerful *post hoc* test that corrects for heterogeneous data; and lastly, (d) it is regarded as a good test for repeated measures (within-subjects) designs where sphericity is not violated.

5.6.3 Mixed ANOVAs to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills and the Extent to Which Students' Mean Test Performance Changed Over Time

To evaluate whether students' self-regulated learning skills have improved over time and whether there is the difference between groups and factor, a mixed analysis of variance (ANOVA) was performed examining the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. In addition to this, a two-way between-subjects mixed ANOVA was conducted to evaluate whether students' test performance improved over time and whether there is a difference between groups. In terms of the between-subjects variable, group consisted of two levels (Group A and Group B) and the within-subjects variable of timepoint included three levels (1, 2 and 3). As a mixed ANOVA is an extension of the linear model, all sources of potential bias are assumed in addition to the assumption of sphericity, tested using Mauchly's Test. In order to assume sphericity, Mauchly's Test which tests the hypothesis that the variances of the differences between conditions are equal, should be non-significant. For some data in this study the significance value (p = .05) is less than the critical value, therefore indicating that the assumption of sphericity has been violated for these data. Whilst the assumption of sphericity has been violated, yielding an F-ratio that doesn't possess a typical F-distribution and sphericity that creates a loss of power, both Mendoza, Toothaker, and Crain (1976) and Rouanet and Lépine (1970) argue the validity of the F-ratio in these situations. As the Greenhouse-Geisser (Greenhouse & Geisser, 1959) results are at least .1 from the lower bound (apart from for the interaction between timepoint and factor), this estimate can be used to correct the degrees of freedom for the F-ratio in the following analyses (Field, 2000, 2013). As group, factor and the interaction between group and factor each have less than three conditions, sphericity is not an issue for these variables.

5.6.4 T-Tests Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills

Propensity score matching provides an alternative to multivariate analysis by attempting to mimic an experimental design after data has been collected. It is a procedure often used in evaluation research which creates the balance that a randomised experiment is expected to create among the groups of interest through statistical matching (Harris & Horst, 2019; Thoemmes, 2012). It does this by matching participants from the control group to participants from the intervention group by selecting subjects with very similar estimated propensity scores (Hughes et al., 2010; Thoemmes, 2012; Thoemmes & West, 2011). The propensity score is defined as the probability of being in the intervention group and uses measured covariates as a base for the calculation (Dörrenbächer, 2017). A single variable is calculated, the propensity score, which captures how differences in these variables contribute to a subject's statistical probability of being in one group or another. This adjustment is important as pre-test differences between groups invalidate their post-test difference as treatment effect estimator (Van Breukelen, 2006). Propensity score matching therefore affords educational researchers the ability to render a more precise estimate of the effects of the intervention (Harris & Horst, 2019).

In the present study, the baseline values of self-regulated learning as measured by the MSLQ and the SRLEDS at timepoint 1 were found to differ in terms of group, that is participants that received the intervention and those that did not. As such, propensity score matching was conducted using this treatment variable, with the two factors of the MSLQ and SRLEDS as covariates. By balancing the covariates which have been identified to differ at timepoint 1 (pre-test), this helps to rule them out as a confounder of the treatment effect (Dörrenbächer, 2017). Harris and Horst (2019) state that the process of conducting propensity score matching involves a series of six steps. First, the covariates to be used in the model need to be selected, already identified as the two factors of the MSLQ and SRLEDS.

Secondly, the model for creating propensity scores is chosen to create a multivariate composite of the covariates, in this instance logistic regression. Once the propensity scores have been computed, the third step is to create balanced intervention and comparison groups by nearest neighbour matching, so that a single participant from the treatment group is matched to a single participant from the control group (Dörrenbächer, 2017; Harris & Horst, 2019). Having made these decisions, the fourth step is to create the matches using the program 'psmatching' for SPSS which uses an SPSS R plug-in to run the analyses in R. The penultimate step is to assess the quality of the matches in order to ensure that the control group has a distribution of propensity scores similar to that of the intervention group (Harris & Horst, 2019). The final step is to estimate the effects of the intervention, in this instance by running a *t*-test to examine the differences between the means of the propensity scores for the intervention group and the control group.

5.6.5 Pearson's r Correlation Coefficient to Examine the Relationship Between Students' Self-Regulated Learning Skills and Test Performance

To examine the relationship between students' self-regulated learning skills and test performance, Pearson's *r* Correlation Coefficient was calculated. The variables used in these analyses were both factors of each instrument (MSLQ-Motivation, MSLQ-Cognitive and SRLEDS) and students' test performance across all three timepoints. Pearson's *r* Correlation Coefficient is a measure of the strength of a linear association between two variables. Field (2013) states that the starting point for any correlation analyses is studying scatterplots of the variables measured to visually check for linearity, in addition to checking for normality (already complete for these data, see Section 5.2.4). In Pearson's *r* the covariance of each of the two variables is standardised creating a value that lies between +1 and -1. An *r*-value of +1 implies a perfect positive linear correlation between the two variables, whereas -1 implies a perfect negative linear correlation. An *r*-value of 0 implies there is no correlation between the variables.

5.6.6 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance

To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoints 1, 2 and 3, an analysis of covariance (ANCOVA) was performed for each timepoint. Using students' mean test performance as the dependent variable, calculated from block tests conducted in the three separate Sciences (Biology, Chemistry, Physics) at each timepoint, this parametric test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills from the SRLEDS (Motivation and Control items and Communication and Forethought items) as covariates. As with the mixed ANOVA outlined in Section 5.5.3, the same applies for an ANCOVA in that all sources of potential bias are assumed in addition to the assumption of homogeneity of variances, tested using Levene's Test. In terms of Levene's Test, Field (2013) states that whilst it the assumption of homogeneity of variances can be checked, there are two important additional considerations. Firstly, ANCOVA assumes linearity, and therefore there should be a straight-line relationship between the covariate and the dependent variable. Described as appropriate for fundamental assessment of linearity by Johnson (2016), both bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity.

The second important consideration is the assumption of the homogeneity of regression slopes. As a linear model, an ANCOVA looks at the overall relationship between the dependent variable and the covariate, in doing so a regression line is fitted to the entire data set, ignoring to which group a person belongs. In fitting this overall model, it is assumed that the overall relationship is true of all groups of participants (Field, 2013). When the assumption is not met, the resulting *F*-statistic cannot be assumed to have the corresponding *F*-distribution. As such, the Type I error rate is inflated and the power to detect effects is inhibited (Field, 2013; Hollingsworth, 2016). Hamilton (1977) states that this is especially true when group sizes are unequal, as in this research. To test the assumption of the homogeneity of regressions slopes the ANCOVA was re-run, using a customised model specifying a model that includes the interaction between the covariate and independent variable, which in this research is students' self-regulated learning skills as the covariates (Motivation and Control items and Communication and Forethought items) and group as the independent variable. If the effect of these interactions is not significant ($p > .05$) then the assumption of homogeneity of regressions slopes is tenable.

5.7 Paper 5 Summary

By providing a detailed account of both the Data Analytic Plan, the preliminary analyses conducted and the rationale for the decisions taken, this paper has set the scene for the results of the parametric tests that follow in Papers 6 and 7. As Hayton et al. (2004) state, decisions made in these important early stages of analysis will have a significant effect on results down the line, and therefore for the benefit of the reader it is important to provide clear justification for the decisions made relative to the analyses conducted. For the most part, all assumptions have been met, however in the small minority of cases any violations to these assumptions have been justified by drawing on relevant literature to support detailed explanation. An important section of this paper within the context of the overall study was the discussion of the rationale and execution of exploratory factor analysis for the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS. The identification of factorial non-invariance across timepoints has been described, in addition to the steps taken to address this issue in terms of the calculation of weighted scores using a process originally outlined by Thurstone (1947). Forming a significant contribution of this research to the field, the weighted scores were then used to validate the SRLEDS using the MSLQ. The final section of this paper provides context to each of the parametric tests conducted, clearly outlining their use along with any specific considerations justified with support from relevant research literature. By detailing the preliminary analyses and associated results here in this paper, this not only supports the reader’s navigation through this portfolio but also serves to place greater emphasis on the results that follow in Papers 6 and 7 structured relative to each of the research questions.

Paper 6

Results

This paper contributes to this portfolio by providing a detailed account of the results from the raft of parametric testing conducted for this research project relative to the following research questions:

1. To what extent can a curriculum intervention enhance students' self-regulated learning skills?
2. Does students' mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict changes in their mean test performance?

To help guide the reader through this lengthy and comprehensive paper, it has been organised using the two research questions to provide a clear structure, within which the results relative to the three measurement components (MSLQ-Motivation, MSLQ-Cognitive and SRLEDS) will be presented.

As a reminder to the reader, the results detailed in this paper were analysed in response to data collected from the quasi-experimental design model, specifically a pre-test post-test non-equivalent group design (Cohen et al., 2013). The dependent variable for this design was students' self-regulated learning skills as measured through the self-report instruments of the MSLQ and the SRLEDS. These instruments were each completed across the three timepoints comprising the study; timepoint 1 – before the first phase of intervention; timepoint 2 – at the end of the first phase; and timepoint 3 – at the end of the second phase of intervention. Timepoint is therefore the first of two independent variables, the second being group from which students were sampled using existing Form groups as a structure: Group A and B. In terms of the non-equivalent group design, Group A received the 10-week intervention first during the Michaelmas Term, the Year 9 participants' first term at the school, and Group B received the 10-week intervention during the Lent Term.

Written September 2019, revised June 2021.

6.1 Data Analytic Plan

Further to the Data Analytic Plan outlined in Section 5.1, the below table provides a summary of the parametric tests conducted to help answer each of the two research questions of this study, the results from which are detailed in this paper.

Table 6.1
Summary Table of the Parametric Tests Run Yielding the Results Detailed in Paper 6

Descriptive statistics	• The mean and standard deviation were calculated for every item across all three timepoints. • In addition to this, the minimum, maximum, skewness and kurtosis was calculated across timepoint, group and factor for each instrument.
Research Question 1 To what extent can a curriculum intervention enhance students' self-regulated learning skills?	**Mixed MANOVA** • Conducted on the influence of the between-subjects variable of group on the within-subjects variables of students' self-regulated learning skills and timepoint. • Timepoint included three levels (1, 2 and 3) and group consisted of two levels (Group A and Group B). **Games-Howell *Post Hoc* Test** • To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure (p = .05) was performed. **Mixed ANOVA to see the extent to which the intervention enhanced students' self-regulated learning skills** • Assumption of sphericity tested using Mauchly's Test. • The effects of the within-subject manipulation of timepoint and students' self-regulated learning skills and between-subjects manipulation of group were examined. ***T* Test Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills** • Propensity scores calculated using data from timepoint 2. • Assumption of homogeneity of variances tested using Levene's Test.
Research Question 2 Does students' mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict their mean test performance?	**Mixed ANOVA** • A two-way between subjects mixed ANOVA was conducted to evaluate whether students' test performance improved over time and whether there is a difference between groups. • In terms of the between-subjects variable, group consisted of two levels (Group A and Group B) and for the within-subjects variable, timepoint included three levels (1, 2 and 3). **Games-Howell *Post Hoc* Test** • To assess pairwise differences among the three levels of timepoint for the effect of students' test performance, the Games-Howell follow-up procedure (p = .05) was performed. **Pearson's *r* Correlation Coefficient** • To examine the relationship between students' self-regulated learning skills and test performance, Pearson's r Correlation Coefficient was calculated for both factors for MSLQ-Motivation, MSLQ-Cognitive and SRLEDS, and students' test performance. **ANCOVA** • Using students' mean test performance as the dependent variable, this test explored the effects of the between-subject manipulation of Group (Group A and Group B), with both factors of students' self-regulated learning skills at each timepoint as covariates.

6.2 Descriptive Statistics

The means and standard deviations for all items from both the MSLQ and the SRLEDS are shown in Table 6.2.1 and Table 6.2.2, respectively.

Table 6.2.1
Summary Table of Descriptive Statistics for MSLQ Across Timepoints 1, 2 and 3

	Question summary	**Timepoint 1 (*N*=105)**		**Timepoint 2 (*N*=107)**		**Timepoint 3 (*N*=111)**	
		M	***SD***	***M***	***SD***	***M***	***SD***
Q1	Challenging material	4.6	1.4	4.5	1.4	4.8	1.3
Q2	Appropriate study	5.4	1.0	5.4	1.1	5.5	1.2
Q3	Test comparison	3.9	1.8	4.3	1.6	4.2	1.5
Q4	Other courses	5.0	1.3	4.8	1.4	4.6	1.5
Q5	Excellent grade	4.6	1.1	4.7	1.1	4.6	1.1
Q6	Difficult material	4.1	1.3	4.5	1.3	4.6	1.4
Q7	Good grade	5.0	1.5	4.8	1.4	4.8	1.5
Q8	Test questions	4.6	1.6	4.7	1.4	4.5	1.5
Q9	Blame	4.8	1.6	4.5	1.5	4.6	1.5
Q10	Course importance	5.7	1.2	5.4	1.3	5.5	1.2
Q11	Improving grade	5.4	1.2	5.1	1.2	5.1	1.3
Q12	Confidence in basics	5.4	1.1	5.4	1.2	5.6	1.1
Q13	Student comparison	5.4	1.5	5.3	1.6	5.5	1.2
Q14	Failing test	4.3	1.7	4.8	1.7	4.7	1.5
Q15	Confidence in complex	4.0	1.2	4.4	1.3	4.5	1.3
Q16	Curiosity	5.3	1.5	5.0	1.5	5.4	1.3
Q17	Course interest	4.8	1.2	4.6	1.2	4.8	1.2
Q18	Try hard	5.4	1.3	5.5	1.4	5.3	1.4
Q19	Exam feeling	4.0	1.7	4.4	1.6	4.1	1.8
Q20	Confidence in tests	4.6	1.1	4.7	1.1	4.9	1.2

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Q1 refers to Question 1, Q2 to Question 2, etc. *N* denotes the sample size. Likert scale range 1 to 7.

Table 6.2.1 continued

Summary Table of Descriptive Statistics for MSLQ Across Timepoints 1, 2 and 3

	Question summary	Timepoint		Timepoint 2		Timepoint 3	
		M	***SD***	***M***	***SD***	***M***	***SD***
Q21	Expectations	5.0	1.1	5.0	1.2	5.1	1.1
Q22	Satisfaction	4.6	1.4	4.6	1.9	4.8	1.3
Q23	Course usefulness	5.3	1.1	4.8	1.2	4.9	1.4
Q24	Assignment choice	4.0	1.5	4.3	1.2	4.4	1.3
Q25	Understanding attribution	3.4	1.4	3.9	1.5	3.9	1.4
Q26	Subject matter	4.4	1.3	4.2	1.4	4.3	1.5
Q27	Understanding	5.7	1.1	5.3	1.2	5.4	1.2
Q28	Exam anxiety	4.5	1.7	4.5	1.7	4.4	1.8
Q29	Skills mastery	4.8	1.2	4.8	1.3	4.9	1.3
Q30	Demonstrate ability	5.5	1.6	5.4	1.5	5.4	1.5
Q31	Expectation difficulty	4.8	1.1	4.9	1.1	5.0	1.1
Q32	Reading outline	4.3	1.4	4.5	1.5	4.9	1.3
Q33R	Lesson distraction	4.4	1.7	4.2	1.6	4.0	1.4
Q34	Explain material	4.0	1.5	4.2	1.6	4.6	1.3
Q35	Study place	5.2	1.5	4.7	1.6	5.4	1.3
Q36	Reading questions	3.4	1.6	4.1	1.6	4.2	1.5
Q37R	Bored and quit	4.4	1.6	4.2	1.5	3.8	1.5
Q38	Questioning	4.2	1.5	4.4	1.3	4.7	1.3
Q39	Self-talk	4.1	1.6	4.6	1.4	4.5	1.5
Q40R	Individual work	4.2	1.8	4.2	1.4	4.2	1.5
Q41	Confusion response	4.8	1.4	5.0	1.2	5.0	1.3
Q42	Key ideas	4.8	1.4	4.9	1.3	4.9	1.4
Q43	Use of time	5.2	1.3	5.2	1.2	5.1	1.3
Q44	Change reading	4.1	1.5	4.4	1.2	4.7	1.3
Q45	Collaboration	4.7	1.6	4.8	1.4	5.0	1.4
Q46	Re-read notes	3.7	1.5	4.3	1.6	4.1	1.5
Q47	Supporting evidence	4.3	1.3	4.6	1.4	4.7	1.3
Q48	Hard work	4.9	1.3	4.7	1.2	4.9	1.3
Q49	Visual material	3.9	1.8	4.0	1.5	4.2	1.6
Q50	Material discussion	3.5	1.7	4.0	1.6	4.1	1.5

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Q1 refers to Question 1, Q2 to Question 2, etc. R refers to a reversed question. *N* denotes the sample size. Likert scale range 1 to 7.

Table 6.2.1 continued

Summary Table of Descriptive Statistics for MSLQ Across Timepoints 1, 2 and 3

	Question summary	Timepoint 1 (*N*=105)		Timepoint 2 (*N*=107)		Timepoint 3 (*N*=111)	
		M	***SD***	***M***	***SD***	***M***	***SD***
Q51	Starting point	4.0	1.3	4.4	1.3	4.4	1.3
Q52R	Study schedule	4.2	1.7	4.1	1.6	4.1	1.7
Q53	Different sources	4.5	1.4	4.8	1.3	4.9	1.2
Q54	Skim before	4.1	1.6	4.3	1.4	4.4	1.5
Q55	Self-questioning	3.9	1.5	4.4	1.4	4.6	1.4
Q56	Change approach	3.7	1.6	4.1	1.4	4.3	1.3
Q57R	Reading knowledge	4.2	1.7	4.1	1.3	4.2	1.4
Q58	Concept clarify	4.9	1.4	5.0	1.4	5.0	1.4
Q59	Key words	4.4	1.5	4.9	1.3	4.9	1.3
Q60R	Course difficulty	5.0	1.4	3.4	1.3	3.5	1.5
Q61	Topic learning	4.2	1.2	4.3	1.2	4.5	1.3
Q62	Relate ideas	4.1	1.3	4.4	1.3	4.7	1.4
Q63	Important concepts	4.3	1.5	4.8	1.4	4.7	1.3
Q64	Relate material	4.7	1.2	4.9	1.2	5.1	1.1
Q65	Study place	4.7	1.8	4.7	1.5	4.9	1.5
Q66	Play with ideas	4.3	1.4	4.4	1.4	4.6	1.2
Q67	Idea summaries	3.7	1.6	4.2	1.4	4.5	1.6
Q68	Ask for help	5.4	1.5	5.3	1.2	5.4	1.3
Q69	Making connections	4.2	1.2	4.5	1.3	4.7	1.2
Q70	Keep up	5.7	1.4	5.4	1.2	5.6	1.4
Q71	Alternative ideas	4.1	1.2	4.5	1.2	4.6	1.2
Q72	Memorise lists	4.1	1.6	4.4	1.4	4.6	1.5
Q73	Lesson attendance	4.6	1.5	4.6	1.4	4.6	1.2
Q74	Keep working	5.2	1.4	5.4	1.3	5.2	1.3
Q75	Help from peers	4.9	1.1	4.8	1.2	4.9	1.3
Q76R	Concept understanding	4.5	1.5	4.1	1.5	4.0	1.5
Q77	Other activities	4.5	1.5	4.6	1.6	4.8	1.5
Q78	Goal setting	4.5	1.5	4.5	1.6	4.5	1.4
Q79R	Note taking	4.5	1.6	4.4	1.4	3.9	1.6
Q80	Note review	4.5	1.4	4.6	1.4	5.0	1.2
Scale		**4.5**	**1.4**	**4.6**	**1.4**	**4.7**	**1.4**

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Q1 refers to Question 1, Q2 to Question 2, etc. R refers to a reversed question. *N* denotes the sample size. Likert scale range 1 to 7.

Table 6.2.2

Summary Table of Descriptive Statistics for SRLEDS Across Timepoints 1, 2 and 3

	Question summary	Timepoint 1 (*N*=97)		Timepoint 2 (*N*=101)		Timepoint 3 (*N*=103)	
		M	***SD***	***M***	***SD***	***M***	***SD***
Q1	Use of resources	2.9	0.5	2.9	0.5	3.1	0.5
Q2	Further research	2.3	0.7	2.4	0.7	2.4	0.7
Q3	Different sources	3.0	0.6	2.9	0.6	3.1	0.7
Q4	Goal setting	2.7	0.7	2.9	0.7	2.8	0.8
Q5	Achieve in studies	3.0	0.6	3.2	0.6	3.0	0.8
Q6	Before test	2.9	0.8	2.8	0.8	2.7	0.8
Q7	Plan before study	2.5	0.7	2.5	0.5	2.4	0.8
Q8	Careful consideration	2.9	0.6	3.0	0.5	3.0	0.7
Q9	Effective planning	2.8	0.7	2.9	0.6	3.0	0.6
Q10	Enjoy studying	2.4	0.8	2.5	0.8	2.5	0.8
Q11	Keep working	3.0	0.7	2.9	0.6	2.8	0.6
Q12	Try hard	3.1	0.6	3.0	0.6	3.2	0.7
Q13	Communicate in writing	2.8	0.6	2.9	0.7	3.0	0.7
Q14	Struggle to communicate	2.4	0.7	2.5	0.7	2.5	0.7
Q15	Verbal communication	2.7	0.8	2.8	0.8	2.9	0.8
Q16	Individual work	2.5	0.8	2.5	0.7	2.6	0.7
Q17	Prefer peer work	3.0	0.7	3.0	0.8	3.0	0.8
Q18	Better learning with peers	3.0	0.8	3.0	0.7	3.0	0.8
Q19	Solutions to problems	2.7	0.7	2.8	0.6	2.8	0.6
Q20	New strategies	2.5	0.7	2.6	0.7	2.6	0.7
Q21	Incorrect ideas	2.9	0.7	2.9	0.7	2.7	0.8
Q22	Identify problems	2.9	0.6	2.8	0.6	2.9	0.6
Q23	Check theory	2.8	0.7	2.8	0.6	2.8	0.7
Q24	Evidence to justify	3.0	0.5	3.1	0.6	3.0	0.6
Q25	Check steps	2.8	0.6	3.0	0.6	2.9	0.6
Q26	Avoid distractions	2.3	0.8	2.5	0.8	2.6	0.8
Q27	Monitor strategies	2.7	0.6	2.7	0.6	2.7	0.7
Q28	Goal achievement	2.6	0.6	2.8	0.66	2.8	0.8
Q29	Task improvement	2.7	0.7	2.8	0.62	3.0	0.6
Q30	Engage with feedback	3.0	0.6	3.0	0.57	3.0	0.6
Scale		**2.8**	**0.7**	**2.8**	**0.7**	**2.8**	**0.7**

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Q1 refers to Question 1, Q2 to Question 2, etc. *N* denotes the sample size. Likert scale range 1 to 4.

6.3 Research Question 1 - To What Extent Can a Curriculum Intervention Enhance Students' Self-Regulated Learning Skills?

6.3.1 MSLQ-Motivation – Weighted Scores

6.3.1.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of one independent, between-subjects variable (group) on the dependent, within-subject variables of students' self-regulated learning skills (Course Approach, Affective Response) and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3).

Figure 6.3.1.1
Changes in Mean Weighted Factor Scores Across Time for MSLQ-Motivation, Course Approach Items

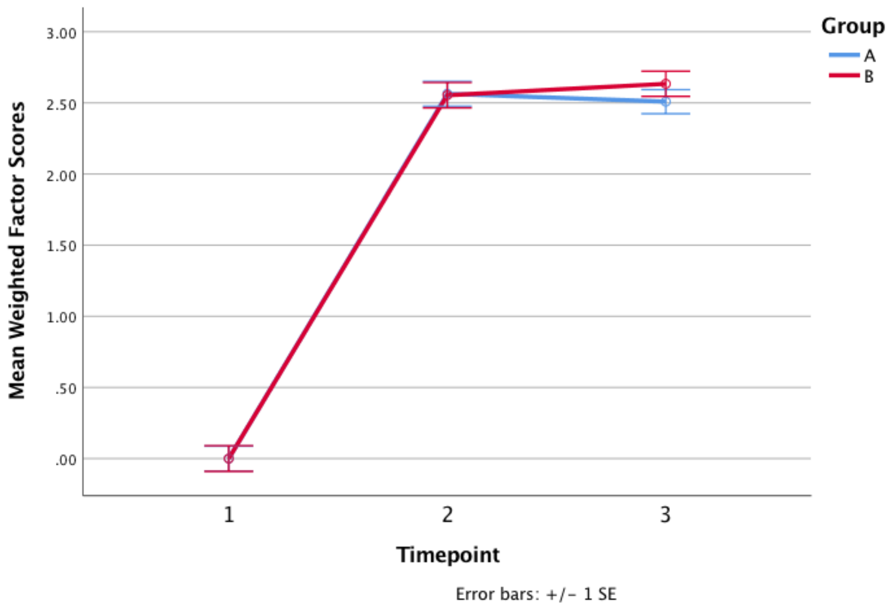
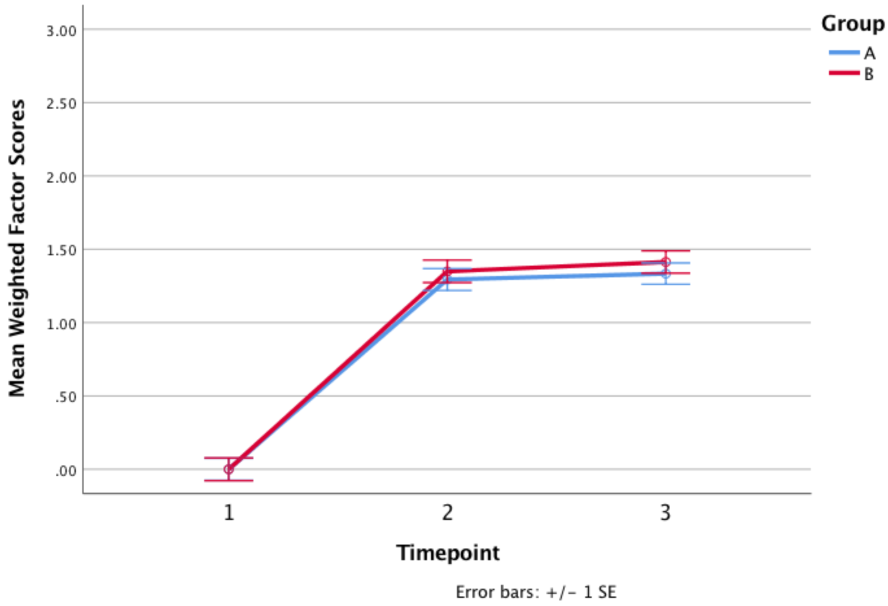


Figure 6.3.1.2
Changes in Mean Weighted Factor Scores Across Time for MSLQ-Motivation, Affective Response Items



For the MSLQ-Motivation, *Box's M* (510.16) was significant, ($p < .001$) indicating that there are significant differences between the covariance matrices. As assumptions are violated, Pillai's Trace test statistic will be used for these data.

Table 6.3.1.1
Mixed MANOVA Multivariate Test Results using Pillai's Trace Statistics for the MSLQ-Motivation Weighted Scores

Effect	*Value*	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.82	108.96	4	634	< .001	.40	1.00
Group	.00	0.36	2	316	.695	.00	.11
Timepoint * Group	.00	0.24	4	634	.915	.00	.10

A mixed MANOVA examined the two latent variables Course Approach and Affective Response as dependent variables, and timepoint and group as independent variables. The multivariate main effect for timepoint (Pillai's Trace = .82, $F(4, 634) = 108.96$, $p < .001$, $\eta_p^2 = .40$), was accompanied by significant univariate effects for Course Approach ($F(2, 317) = 562.52$, $p < .001$, $\eta_p^2 = .78$), and Affective Response, ($F(2, 317)$ =

211.05, $p < .001$, $\eta_p^2 = .57$), confirming that students' self-regulated learning skills improved across the three timepoints. The multivariate main effects for both group and the interaction between timepoint and group were not statistically significant, both accompanied by univariate effects which were also not significant. Detailed tables showing the full results of the ANOVAs run as part of this analysis can be found in Appendix N.

6.3.1.2 Games-Howell *Post Hoc* Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint.

Table 6.3.1.2

Games-Howell Post Hoc Test Results for the MSLQ-Motivation Weighted Scores

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Course Approach	1	2	2.6	.10	< .001	-2.80	-2.32
		3	2.6	.10	< .001	-2.81	-2.33
	2	1	2.6	.10	< .001	2.32	2.80
		3	0.0	.06	.985	-0.15	0.13
	3	1	2.6	.10	< .001	2.33	2.81
		2	0.0	.06	.985	-0.13	0.15
Affective Response	1	2	1.3	.09	< .001	-1.54	-1.10
		3	1.4	.09	< .001	-1.59	-1.15
	2	1	1.3	.09	< .001	1.10	1.54
		3	0.1	.03	.168	-0.12	0.02
	3	1	1.4	.09	< .001	1.15	1.59
		2	0.1	.03	.168	-0.02	0.12

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure ($p = .05$) was performed. The result suggested that for Course Approach, students' self-regulated learning skills differed significantly between timepoints 1 and 2 ($M = 2.6$, $p < .001$), and also between timepoints 1 and 3 ($M = 2.6$, $p < .001$). Similar differences were observed for

Affective Response, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 (M = 1.3, $p < .001$), and also between timepoints 1 and 3 (M = 1.4, $p < .001$).

6.3.1.3 Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. To evaluate whether students' self-regulated learning skills have improved over time and whether there is the difference between groups and factor, a mixed ANOVA was performed examining the effects of the within-subject manipulation of timepoint and students' self-regulated learning skills (Course Approach, Affective Response) and between-subjects manipulation of group, and all the interactions between these. As Mauchly's test indicated that the assumption of sphericity had been violated for timepoint ($\chi^2(2) = 14.48$, $p < .001$), Greenhouse-Geisser corrected tests are reported ($\varepsilon = .80$). Results indicated a significant difference for students' self-regulated learning skills over timepoint ($F(1.59, 79.63) = 689.61$, $p < .001$, $\eta_p^2 = .93$). As expected, results were significant for factor ($F(1, 50) = 362.94$, $p < .001$, $\eta_p^2 = .88$). In terms of the interactions, Mauchly's test indicated that the assumption of sphericity had been violated for timepoint × group ($\chi^2(2) = 58.44$, $p < .001$), and, as above, the Greenhouse-Geisser corrected tests are reported ($\varepsilon = .59$). Results were significant for this interaction ($F(1.18, 58.94) = 88.40$, $p < .001$, $\eta_p^2 = .64$). Detailed tables showing the full results of this analysis can be found in Appendix O.

6.3.1.4 *T*-Test Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A *t*-test using propensity scores was used to examine the extent to which the intervention enhanced students' self-regulated learning skills. As shown in Table 6.3.1.4, Levene's Test was non-significant ($p > .05$) suggesting that assumptions of homogeneity of variances has not been violated and that the variances are therefore roughly equal. As such, *equal variances assumed* output has been used. There was no significant difference between groups at timepoint 2 for the MSLQ-Motivation items (BCa 95% CI [-.01, .05], *t* (102) = 1.34, *p* = .183).

Table 6.3.1.4

T-Test Results for Difference Between Means of Propensity Scores for the MSLQ-Motivation

Levene's Test		***t*-test for Equality of Means**						
F	***p***	***t***	***df***	***p***	**MD**	**Std. Error**	**95% Confidence Interval**	
							Lower	**Upper**
0.04	.840	1.34	102	.183	.02	.02	-.01	.05

Note. *df* denotes degrees of freedom. MD denotes mean difference.

6.3.2 MSLQ-Cognitive – Weighted Scores

6.3.2.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills.

Figure 6.3.2.1

Changes in Mean Weighted Factor Scores Across Time for MSLQ-Cognitive, Cognitive Control Items

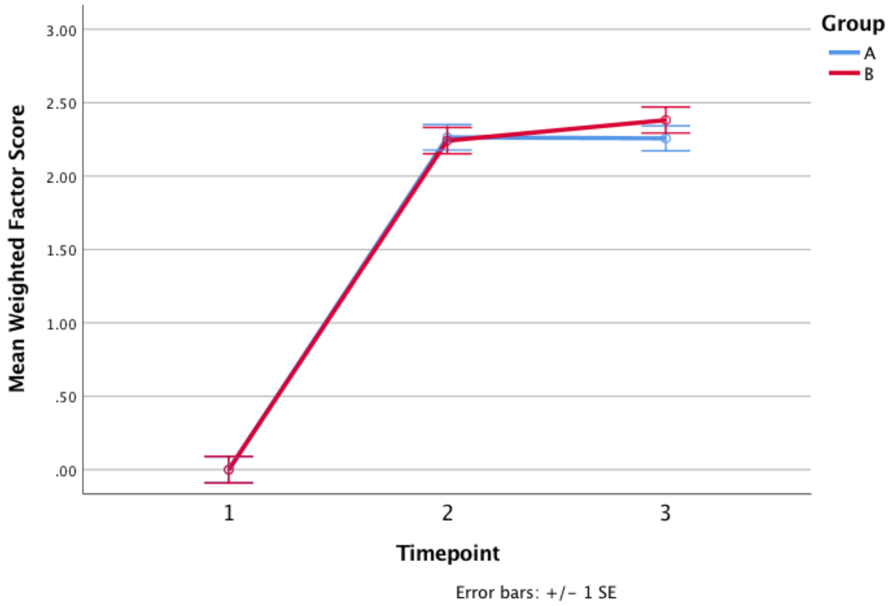
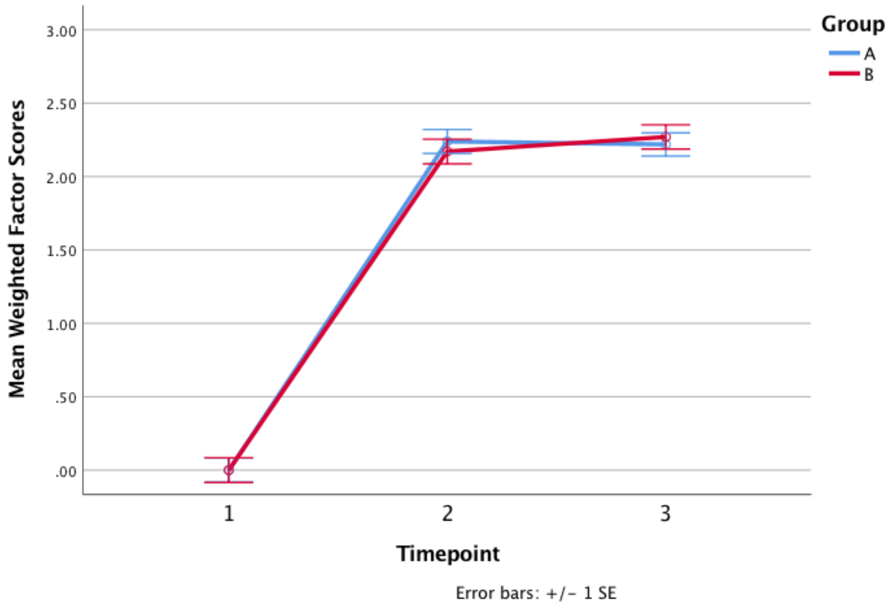


Figure 6.3.2.2

Changes in Mean Weighted Factor Scores Across Time for MSLQ-Cognitive, Self-Management Items



A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of one independent between-subjects variable (group) on the dependent, within-subjects variables of students' self-regulated learning skills (Cognitive Control, Self-Management) and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). For the MSLQ-Cognitive *Box's M* (553.30) was significant ($p < .001$), indicating that there are significant differences between the covariance matrices. Therefore, as assumptions are violated, Pillai's Trace is once again the most appropriate test statistic to use for these data.

Table 6.3.2.1
Mixed MANOVA Multivariate Test Results using Pillai's Trace Statistics for the MSLQ-Cognitive Weighted Scores

Effect	Value	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.83	113.29	4	634	< .001	.42	1.00
Group	.00	0.13	2	316	.881	.00	.07
Timepoint * Group	.0	0.30	4	634	.880	.00	.18

As observed in the results for the MSLQ-Motivation, the multivariate main effect for timepoint (Pillai's Trace = .83, $F(4, 634) = 113.29$, $p < .001$, $\eta_p^2 = .42$), was accompanied by significant univariate effects for Cognitive Control ($F(2, 317) = 442.96$, $p < .001$, $\eta_p^2 = .74$), and Self-Management ($F(2, 317) = 481.71$, $p < .001$, $\eta_p^2 = .75$), providing statistically significant support to the prediction that students' self-regulated learning skills would improve across the three timepoints. The multivariate main effects for both group and the interaction between timepoint and group were not significant, both accompanied by non-significant univariate effects. Detailed tables showing the full results of this analysis can be found in Appendix P.

6.3.2.2 Games-Howell *Post Hoc* Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint.

Table 6.3.2.2
Games-Howell Post Hoc Test Results for the MSLQ-Cognitive Weighted Scores

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive Control	1	2	2.3	.10	< .001	-2.50	-2.01
		3	2.3	.10	< .001	-2.56	-2.07
	2	1	2.3	.10	< .001	2.01	2.50
		3	0.1	.05	.461	-0.19	0.06
	3	1	2.3	.10	< .001	2.07	2.56
		2	0.1	.05	.461	-0.06	0.19
Self-Management	1	2	2.2	.10	< .001	-2.44	-1.97
		3	2.2	.10	< .001	-2.47	-2.01
	2	1	2.2	.10	< .001	1.97	2.44
		3	0.0	.04	.635	-0.13	0.06
	3	1	2.2	.10	< .001	2.01	2.47
		2	0.0	.04	.635	-0.06	0.13

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure ($p = .05$) was performed. The result suggested that for Cognitive Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 ($M = 2.3$, $p < .001$), and also between timepoints 1 and 3 ($M = 2.3$, $p < .001$). Similar differences were observed for Self-Management items, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 ($M = 2.2$, $p < .001$), and also between timepoints 1 and 3 ($M = 2.2$, $p < .001$).

6.3.2.3 Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. To evaluate the predictions that students' self-regulated learning skills will improve over time and that there will be a difference between both groups and factor, a mixed ANOVA was performed examining the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills (Cognitive Control, Self-Management), and the between-subjects manipulation of group, and all interactions between these. As Mauchly's test indicated that the assumption of sphericity had been violated for timepoint ($\chi^2(2) = 6.77$, $p = .034$), Greenhouse-Geisser corrected tests are reported ($\varepsilon = .89$). Results indicated significant difference for students' self-regulated learning skills over timepoint ($F(1.77, 88.57) = 921.54$, $p < .001$, $\eta_p^2 = .95$). A detailed table showing the full results of this analysis can be found in Appendix Q.

6.3.2.4 *T*-Test Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A *t*-test using propensity scores was used to examine the extent to which the intervention enhanced students' self-regulated learning skills. As shown in Table 6.3.2.4, Levene's Test was non-significant ($p > .05$) suggesting that assumptions of homogeneity of variances has not been violated and that the variances are therefore roughly equal. As such, *equal variances assumed* output has been used. There was no significant difference between groups at timepoint 2 for the MSLQ-Motivation items (BCa 95% CI [-.01, .05], t (102) = 1.48, $p = .141$).

Table 6.3.2.4
T-Test Results for Difference Between Means of Propensity Scores for the MSLQ-Motivation

Levene's Test		*t*-test for Equality of Means						
F	***p***	***t***	***df***	***p***	**MD**	**Std. Error**	**95% Confidence Interval**	
							Lower	**Upper**
1.73	.191	1.48	102	.141	.02	.02	-.01	.05

Note. *df* denotes degrees of freedom. MD denotes mean difference.

6.3.3 SRLEDS – Weighted Scores

6.3.3.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills.

Figure 6.3.3.1

Changes in Mean Weighted Factor Scores Across Time for SRLEDS, Motivation and Control Items

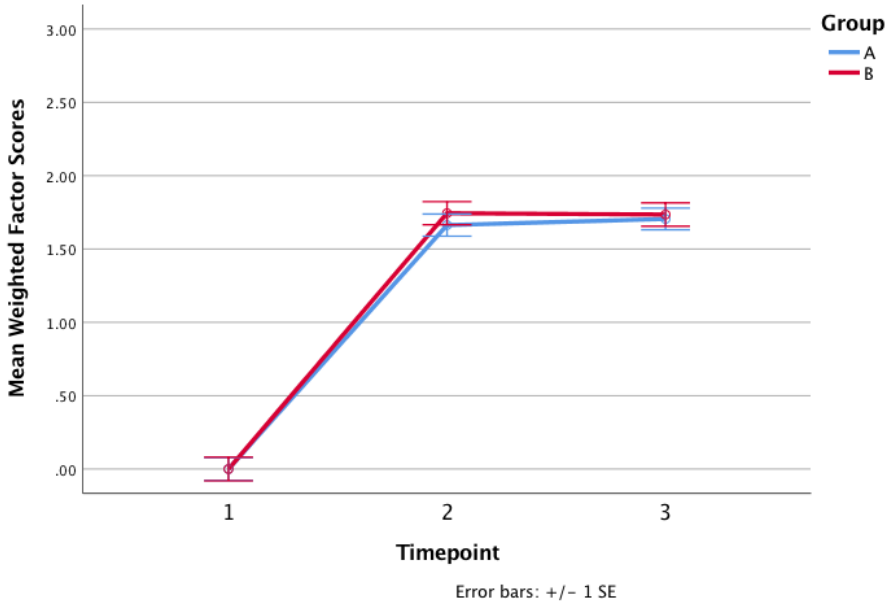
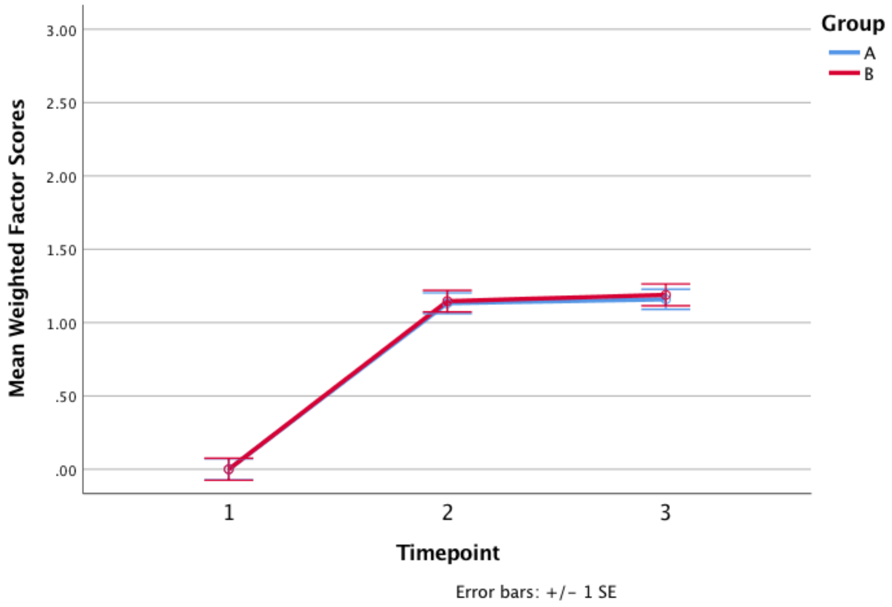


Figure 6.3.3.2

Changes in Mean Weighted Factor Scores Across Time for SRLEDS, Communication and Forethought Items



A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of two independent variables (timepoint, group) on students' self-regulated learning skills (Motivation and Control, Communication and Forethought). Timepoint included three levels (1, 2 and 3) and group consisted of two levels (Group A and Group B). For the SRLEDS, *Box's M* (950.76) was significant ($p < .001$), indicating that there are significant differences between the covariance matrices. Therefore, as assumptions are violated, Pillai's Trace is once again the most appropriate test statistic to use for these data.

Table 6.3.3.1
Mixed MANOVA Multivariate Test Results Using Pillai's Test Statistics for the SRLEDS Weighted Scores

Effect	*Value*	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.75	88.78	4	594	< .001	.37	1.00
Group	.00	0.19	2	296	.828	.00	.08
Timepoint * Group	.00	0.08	4	594	.989	.00	.07

For the SRLEDS the multivariate main effect for timepoint (Pillai's Trace = .75, $F(4, 594) = 88.78$, $p < .001$, $\eta_p^2 = .37$), was accompanied by significant univariate effects for the Motivation and Control items ($F(2, 297) = 317.52$, $p < .001$, $\eta_p^2 = .68$), and Communication and Forethought items ($F(2, 297) = 166.64$, $p < .001$, $\eta_p^2 = .53$), confirming that students' self-regulated learning skills improved across the three timepoints. The multivariate main effects for both group and the interaction between timepoint and group were not significant, both accompanied by univariate effects which were also non-significant. Detailed tables showing the full results of this analysis can be found in Appendix R.

6.3.3.2 Games-Howell *Post Hoc* Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint.

Table 6.3.3.2

Games-Howell Post Hoc Test Results for the SRLEDS Weighted Scores

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Motivation and Control	1	2	1.7	.10	< .001	-1.93	-1.48
		3	1.7	.10	< .001	-1.95	-1.49
	2	1	1.7	.10	< .001	1.48	1.93
		3	0.0	.03	.845	-0.09	0.06
	3	1	1.7	.10	< .001	1.49	1.95
		2	0.0	.03	.845	-0.06	0.09
Communication and Forethought	1	2	1.1	.09	< .001	-1.35	-0.92
		3	1.2	.09	< .001	-1.39	-0.96
	2	1	1.1	.09	< .001	0.92	1.35
		3	0.0	.02	.106	-0.07	0.01
	3	1	1.2	.09	< .001	0.96	1.39
		2	0.0	.02	.106	-0.01	0.07

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure (p = .05) was performed. The result suggested that for Motivation and Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 (M = 1.7, p < .001), and also between timepoints 1 and 3 (M = 1.7, p < .001). Similar differences were observed for Communication and Forethought items, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 (M = 1.1, p < .001), and also between timepoints 1 and 3 (M = 1.2, p < .001).

6.3.3.3 Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. To evaluate whether students' self-regulated learning skills improved over time and if there is a difference between groups and factor, a mixed ANOVA was performed examining the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills (Motivation and Control, Communication and Forethought), and the between-subjects manipulation of group, and all interactions between these. As Mauchly's test indicated that the assumption of sphericity had been violated for timepoint ($\chi^2(2) = 55.71$, $p < .001$), Greenhouse-Geisser corrected tests are reported ($\varepsilon = .58$). Results indicated a significant difference for students' self-regulated learning skills over timepoint ($F(1.17, 53.80) = 460.27$, $p < .001$, $\eta_p^2 = .91$). As expected, results were significant for factor ($F(1, 46) = 70.41$, $p < .001$, $\eta_p^2 = .60$). In terms of the interactions, Mauchly's test indicated that the assumption of sphericity had been violated for timepoint × group ($\chi^2(2) = 135.55$, $p < .001$), and, as above, the Greenhouse-Geisser corrected tests are reported ($\varepsilon = .51$). Results were significant for this interaction ($F(1.03, 47.16) = 24.16$, $p < .001$, $\eta_p^2 = .34$). A detailed table showing the full results of this analysis can be found in Appendix S.

6.3.3.4 *T*-Test Using Propensity Scores to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A *t*-test using propensity scores was used to examine the extent to which the intervention enhanced students' self-regulated learning skills. As shown in Table 6.3.3.4, Levene's Test was non-significant ($p > .05$) suggesting that assumptions of homogeneity of variances has not been violated and that the variances are therefore roughly equal. As such, *equal variances assumed* output has been used. There was no significant difference between groups at timepoint 2 for the MSLQ-Motivation items (BCa 95% CI [-.01, .08], t (92) = 1.75, $p = .083$).

Table 6.3.3.4

T-Test Results for Difference Between Means of Propensity Scores for the MSLQ-Motivation

Levene's Test		*t*-test for Equality of Means						
F	***p***	***t***	***df***	***p***	**MD**	**Std. Error**	**95% Confidence Interval**	
							Lower	**Upper**
0.65	.421	1.75	93	.083	.04	.02	-.01	.08

Note. *df* denotes degrees of freedom. MD denotes mean difference.

6.3.4 Summary of Findings for Research Question 1

6.3.4.1 MSLQ-Motivation – Weighted Scores. With regard to the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, significant univariate effects for both Course Approach items and Affective Response items accompanied the multivariate main effect for timepoint, confirming improvement in students' self-regulated learning skills across the three timepoints. The results of the Games-Howell *post hoc* test suggested that for the Course Approach items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3. Similar differences were observed for the Affective Response items, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference for students' self-regulated learning skills over timepoint and between factors. In terms of the interactions, results were significant for the interaction between timepoint and group. Having calculated propensity score matching for the data at timepoint 2, a *t*-test showed no significant difference between groups for the MSLQ-Motivation items.

6.3.4.2 MSLQ-Cognitive – Weighted Scores. With regard to the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, results aligned with those for the MSLQ-Motivation. The multivariate main effect for timepoint was accompanied by significant univariate effects for both Cognitive Control items and Self-Management items, confirming improvement in students' self-regulated learning skills across the three timepoints. The results of the Games-Howell *post hoc* test suggest that for the Cognitive Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3. Similar differences were observed for the Self-Management items, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference for students' self-regulated learning skills over timepoint. Having calculated propensity score matching for the data at timepoint 2, a *t*-test showed no significant difference between groups for the MSLQ-Cognitive items.

6.3.4.3 SRLEDS – Weighted Scores. In terms of the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, results aligned with those for both the MSLQ-Motivation and the MSLQ-Cognitive. The multivariate main effect for timepoint was accompanied by significant univariate effects for both Motivation and Control items and Communication and Forethought items, confirming improvement in students' self-regulated learning skills across the three timepoints. The multivariate main effects for both group and the interaction between timepoint and group were non-significant, both accompanied by non-significant univariate effects. The results of the Games-Howell *post hoc* test suggest that for Motivation and Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3. Similar differences were observed for Communication and Forethought items, where students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference for students' self-regulated learning skills over timepoint and factor. In terms of the interactions, results were significant for the interaction between timepoint and group. Having calculated propensity score matching for the data at timepoint 2, a *t*-test showed no significant difference between groups for the SRLEDS items.

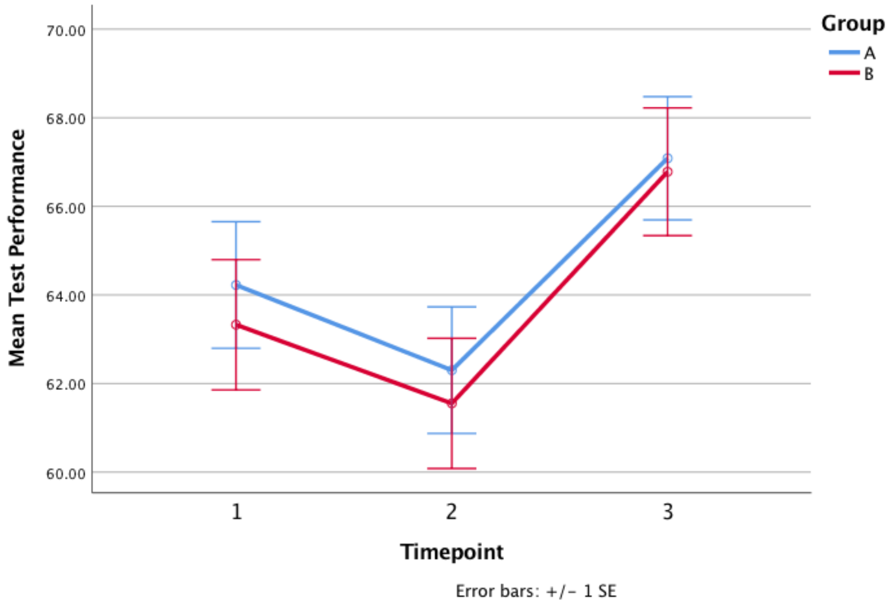
6.4 Research Question 2 – Does Students' Mean Test Performance Improve Across Timepoint and to What Extent Does Students' Self-Regulated Learning Skills Predict Their Mean Test Performance?

As a reminder to the reader, students' test performance data was generated by working in collaboration with the Head of Science to map the faculty's programme of assessment on to the timeline of the present study. As such, test performance data for the three separate sciences, namely Biology, Chemistry and Physics, was generated during the same weeks that students completed the two surveys across the three timepoints of this research. This programme of assessment takes the form of standardised block testing based on *bona fide* GCSE past paper questions, sat at the end of each topic within the specification. These topic tests are publicised to students in advance, affording them time to prepare thoroughly and revise for these important summative checkpoints along the Science GCSE journey. In the analyses the follow, the mean test performance score from across the three separate sciences for each student at each timepoint is used. The justification for this is that it follows internal tracking, monitoring and reporting protocols as the majority of students will be awarded a Combined Science GCSE, rather than the three separate sciences.

6.4.1.1 Mixed ANOVA to Examine the Extent to Which Students' Mean Test Performance Changed Across Timepoint. To evaluate whether students' test performance improved over time and whether there is the difference between group, a 3 (Timepoint: 1 v 2 v 3) x 2 (Group: A v B) two-way between-subjects ANOVA was performed. Results indicated a main effect for students' test performance over timepoint ($F(2) = 6.27$, $p = .002$, $\eta_p^2 = .04$). There were no other significant main effects. Detailed tables showing the full results of this analysis can be found in Appendix T.

Figure 6.4.1.1

Changes in Students' Mean Test Performance Over Time



6.4.1.2 Games-Howell *Post Hoc* Test to Examine the Extent to Which Students' Mean Test Performance Changed Across Timepoint. Given the considerations outlined in Section 5.5.2, the Games-Howell *post hoc* test is the most appropriate as: (a) the assumption of the homogeneity of variance has been violated (significant Levene's test); (b) there are unequal group sizes; (c) it is the most powerful *post hoc* test that corrects for heterogeneous data.

To assess pairwise differences among the three levels of timepoint for the effect of students' test performance, the Games-Howell follow-up procedure (p = .05) was performed. The result suggested that for timepoint, students' test performance differed significantly between timepoints 2 and 3 (M = 5.0, p = .002). Whilst a notable increase was observed between timepoint 1 and 3 (M = 3.2), this was not significant at the .05 level (p = .083).

Table 6.4.1.2

Games-Howell Post Hoc Test Results for Changes in Students' Mean Test Performance Over Time

Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	1.9	1.45	.491	-1.63	5.33
	3	-3.2	1.43	.083	-6.59	0.29
2	1	-1.9	1.45	.491	-5.33	1.63
	3	-5.0	1.43	.002	-8.44	-1.56
3	1	3.2	1.43	.083	-0.29	6.59
	2	5.0	1.43	.002	1.56	8.44

6.4.2 SRLEDS – Weighted Scores

6.4.2.1 Pearson's *r* Correlation Coefficient to Examine the Relationship Between Students' Self-Regulated Learning Skills and Test Performance. To examine the relationship between students' self-regulated learning skills and test performance, Pearson's *r* Correlation Coefficient was calculated. Conscious of avoiding Type I error and given the lack of significant group differences in the analyses conducted relative to Research Question 1, it is important to highlight that these analyses are somewhat exploratory. In light of this, correlations were also calculated for the MSLQ-Motivation and the MSLQ-Cognitive (see Appendix U). Correlations were broadly similar across all three scales, however as the SRLEDS is an original and tailored instrument representing a significant contribution of this research, these data were chosen to be written-up in this paper in response to Research Question 2.

Using the two factors of the SRLEDS, the Motivation and Control items and the Communication and Forethought items, Pearson's *r* was calculated for the relationship between these data and students' test performance across all three timepoints. The results of these analyses are shown in Table 6.4.2.1. There were no statistically significant correlations, however it is worth noting that the strength of the correlations does increase across timepoint. To test this observation statistically, Table 6.4.2.2 shows the results of comparisons of correlations for independent samples calculated using a resource published by Lenhard and Lenhard (2014). Whilst there were no statistically significant *z*-scores, as with above observation it is interesting to note that the *p*-value decreases across timepoint for both factors, albeit remaining not significant.

Table 6.4.2.1
Pearson's r Correlation Coefficient Results for Students' Test Performance Across Timepoint

	Factor	***N***	**Pearson's *r***	***p* (two-tailed)**
Timepoint 1	Motivation and Control	97	.01	.929
	Communication and Forethought		-.04	.724
Timepoint 2	Motivation and Control	101	.02	.820
	Communication and Forethought		.11	.256
Timepoint 3	Motivation and Control	103	.14	.157
	Communication and Forethought		.19	.058

Note. *N* denotes number.

Table 6.4.2.2
Results of Comparison of Correlations (z-scores) for Students' Test Performance Across Timepoint

Timepoints	**Motivation and Control**		**Communication and Forethought**	
	z	***p***	***z***	***p***
1-2	-0.07	.472	-1.04	.149
2-3	-0.85	.197	-0.58	.282
1-3	-0.91	.181	-1.61	.053

6.4.2.2 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 1. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 1, an ANCOVA was performed. Using students' mean test performance at timepoint 1 as the dependent variable, this analysis explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. As detailed in Section 5.6.4, there are a number of assumptions to check when conducting an ANCOVA. The assumption of homogeneity of variance was tested using Levene's test and as the *p*-value ($p = .612$) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. Lastly, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the *p*-values for the interaction between both group and Motivation and Control ($p = .944$) and group and Communication and Forethought ($p = .919$) is greater than .05, the assumption is tenable.

Although students in Group A ($M = 64.5$, $N = 50$) posted slightly higher test performance than those in Group B ($M = 63.1$, $N = 47$), the main effect of group was found not to be significant ($F(1, 97) = .75$, $p = .388$, $\eta_p^2 = .08$). In terms of the covariates, neither Motivation and Control ($F(1, 97) = .01$, $p = .912$, $\eta_p^2 = .00$) or Communication and Forethought ($F(1, 97) = .13$, $p = .721$, $\eta_p^2 = .00$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix V.

6.4.2.3 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 2. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 2, an ANCOVA was performed. Using students' mean test performance at timepoint 2 as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. The assumption of homogeneity of variance was tested using Levene's test. As the *p*-value (p = .435) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. Lastly, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the *p*-values for the interaction between both group and Motivation and Control (p = .428) and group and Communication and Forethought (p = .232) is greater than .05, the assumption is tenable.

Although students in Group B (M = 62.8, N = 52) posted slightly higher test performance than those in Group A (M = 61.8, N = 49), the main effect of group was found not to be significant ($F(1, 101) = .41$, $p = .523$, $\eta_p^2 = .04$). In terms of the covariates, neither Motivation and Control ($F(1, 101) = 1.31$, $p = .254$, $\eta_p^2 = .01$) or Communication and Forethought ($F(1, 101) = 2.54$, $p = .115$, $\eta_p^2 = .03$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix W.

6.4.2.4 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 3. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 3, an ANCOVA was performed. Using students' mean test performance at timepoint 3 as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. The assumption of homogeneity of variance was tested using Levene's test. As the *p*-value (p = .634) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. Lastly, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the *p*-values for the interaction between both group and Motivation and Control (p = .289) and group and Communication and Forethought (p = .136) is greater than .05, the assumption is tenable.

At timepoint 3 students in Group A (M = 67.4, N = 55) posted slightly higher test performance than those in Group B (M = 66.8, N = 48), however the main effect of group was found not to be significant ($F(1, 103) = .18$, $p = .676$, $\eta_p^2 = .00$). In terms of the covariates, neither Motivation and Control ($F(1, 103) = .00$, $p = .993$, $\eta_p^2 = .00$) or Communication and Forethought ($F(1, 103) = 1.66$, $p = .200$, $\eta_p^2 = .02$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix X.

6.4.5 Summary of Findings for Research Question 2

Students' test performance data was generated from the Science Faculty's programme of summative assessment using *bona fide* GCSE past papers sat by students across the three separate sciences: Biology, Chemistry and Physics. These tests were sat at the end of each topic, aligning positively with the timeline of this research as these tests took place during the same weeks in which students completed the MSLQ and SRLEDS at each of the three timepoints of this research.

To evaluate whether students' test performance improved over time and whether there is the difference between group, a 3 (Timepoint: 1 v 2 v 3) x 2 (Group: A v B) two-way between-subjects ANOVA was performed. Results indicated a main effect for students' test performance over timepoint, however there were no other significant effects. As a follow-up to this, the Games-Howell *post hoc* test was run. The results of this suggested that for timepoint, students' test performance differed significantly between timepoints 2 and 3, and whilst a notable increase was observed between timepoint 1 and 3, this difference was not found to be significant.

Pearson's *r* Correlation Coefficient was calculated to examine the relationship between students' self-regulated learning skills as measured by the SRLEDS, and test performance. Given the lack of significant group differences in the analyses conducted relative to Research Question 1 and also being mindful of inflating Type I error, these analyses were framed as being exploratory in nature. Although correlations were calculated for all three scales, as the correlations were broadly similar across all three scales and the SRLEDS is an original and tailored instrument representing a significant contribution of this research, these data were chosen to be written-up in this paper in response to Research Question 2. Although there were no statistically significant correlations, it is worth noting that the strength of the correlations increased across timepoint, albeit remaining non-significant. This observation was tested using a statistical tool published by Lenhard and Lenhard (2014) that compares correlations for independent samples, however results were not significant.

To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoints 1, 2 and 3, an ANCOVA was performed for each of these timepoints. Using students' mean test performance at each timepoint as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. Whilst differences in mean test performance between Group A and B were observed at each timepoint, there was no significant main effect for group. In terms of the covariates, neither Motivation and Control or Communication and Forethought were significantly related to students' test performance across any of the three timepoints.

Paper 7

Follow-up Analyses

This paper presents the follow-up analyses to Paper 6, analyses run using *average scores* from the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS. Initially, context and justification for the use of average scores is outlined along with the method by which these scores were calculated. Having provided detailed context for these data used in this set of follow-up analyses, this paper is then organised in the same way as Paper 6, using the two research questions as a clear framework within which the results relative to the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS will be presented. In doing so, the follow-up analyses detailed in this paper provide further support to the results outlined in the Paper 6 and the study as a whole.

Written September 2019, revised July 2020.

7.1 Average Scores – Context and Calculation

The analyses documented in Paper 6 used *weighted scores* calculated using the factor scores generated from exploratory factor analysis at timepoint 1, in conjunction with Thurstone's (1947) method to overcome factorial non-invariance. The analyses documented in this paper however, make effective use of *average scores* to analyse these data. DiStefano et al. (2019) differentiate between two main classes of factor score computation methods: refined and non-refined. The steps detailed in Section 5.3, Exploratory Factor Analysis, constitute the refined method, where factor scores are created using sophisticated and technical approaches, to which Thurstone’s method was subsequently applied. The factor scores generated by the exploratory factor analysis have applied different weights to items depending on how correlated the item was to the solution, in addition to having been rotated to have as little overlap as possible in terms of variance between the two scores generated. Changes in these *weights* across timepoint could account for the factorial non-invariance identified and, when combined with Thurstone’s method used to generate weighted factor scores for timepoints 2 and 3, might also provide an explanation for the significant increase in students’ self-regulated learning skills between timepoint 1 and 2; something to be discussed further in Paper 8.

In light of this, the analyses detailed in this paper make of use *average scores* calculated using what DiStefano et al. (2019) describe as a non-refined method. Non-refined factor scores are thought to be more stable across samples than refined methods (Grice & Harris, 1998), which provides strong support for its use in response to the factorial non-invariance highlighted in Paper 5. In addition to this, Hair et al. (2014) state that as the *sum score* non-refined method might be most desirable when the scales used to collect the original data are untested and exploratory as for the SRLEDS, with little or no evidence of reliability or validity. Further support for the sum score method can be found from Tabachnick et al.

(2007), who note that as the summed scores preserve the variation in the original data, this approach is acceptable for most exploratory research situations. In light of this support, the sum score non-refined method of calculating factor scores has been used here, the calculated scores from which have been carried forward to the parametric analyses conducted as part of this paper. A detailed account of the steps taken to calculate the average scores using the sum score method can be seen in Table 7.1.

Despite the justification provided above for the method used to calculate the average scores used in this paper, it is important to note the considerations cited in the literature surrounding their use. Firstly, all items that load on to a factor are given the same weight, meaning that items with a low loading are allotted the same weight in the factor score as those with a high loading (DiStefano et al., 2019). The same authors also state that consideration must be given to how cross-loading items are accommodated; something detailed in Table 7.1. Lastly, non-refined methods do not achieve a set mean and/or standard deviation for each of the factor scores. Instead, DiStefano et al. (2019) state the mean and standard deviation of the factors will be dependent upon the characteristics of the items (e.g., scale of measurement, variability in data, etc.); something to explored further in Paper 8, Discussion.

Table 7.1

Steps Followed to Calculate the Average Factor Scores

Step Number	Explanation
1	Take the rotated factor loadings from the exploratory factor analysis run for the MSLQ-Motivation at timepoint 1 (see Table 5.3.1.1, Paper 5).
2	Using these rotated factor loadings, the items that loaded on to each of the two factors were identified. Mindful of cross-loading, there were no instances where an item loaded on to both factors.
3	For each item in turn that loaded on to Factor 1, a mean *sum score* was calculated using the raw data. This was done by calculating the sum of each participants' response to each item, then divided by the number of participants to create an *average factor score* for each item.
4	Step 3 was then repeated for all the items that loaded on to Factor 2 of the MSLQ-Motivation.
5	Steps 1-4 were then repeated for the rotated factor loadings from the exploratory factor analysis run for the MSLQ-Cognitive at timepoint 1 (see Table 5.3.1.2, Paper 5).
6	Steps 1-4 were then repeated for the rotated factor loadings from the exploratory factor analysis run for the SRLEDS at timepoint 1 (see Table 5.3.2.2, Paper 5).

7.2 Data Analytic Plan

Further to the Data Analytic Plan outlined in Section 5.1, the below table provides a reminder to the reader as to the parametric tests conducted to help answer each of the two research questions of this study, also informing the structure of this paper which mirrors that of Paper 6.

Table 7.2

Summary Table of the Parametric Tests Run Yielding the Results Detailed in Paper 7

Research Question 1 To what extent can a curriculum intervention enhance students' self-regulated learning skills?	**Mixed MANOVA** • Conducted on the influence of the between-subjects variable of group on the within-subjects variables of students' self-regulated learning skills and timepoint. • Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). **Gabriel *Post Hoc* Test** • To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Games-Howell follow-up procedure (p = .05) was performed. **Mixed ANOVA to see the extent to which the intervention enhanced students' self-regulated learning skills** • Assumption of sphericity tested using Mauchly's Test. • The effects of the within-subject manipulation of timepoint and students' self-regulated learning skills and between-subjects manipulation of group were examined.
Research Question 2 Does student's mean test performance improve across timepoint and to what extent does students' self-regulated learning skills predict their mean test performance?	**Pearson's r Correlation Coefficient** • To examine the relationship between students' self-regulated learning skills and test performance, Pearson's *r* Correlation Coefficient was calculated for both factors for MSLQ-Motivation, MSLQ-Cognitive and SRLEDS, and students' test performance. **ANCOVA** • Using students' mean test performance as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with both factors of students' self-regulated learning skills at each timepoint as covariates.

7.3 Research Question 1 - To What Extent Can a Curriculum Intervention Enhance Students' Self-Regulated Learning Skills?

7.3.1 MSLQ-Motivation – Average scores

7.3.1.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills.

Figure 7.3.1.1

Changes in Mean Average Factor Scores Across Time for MSLQ-Motivation, Course Approach Items

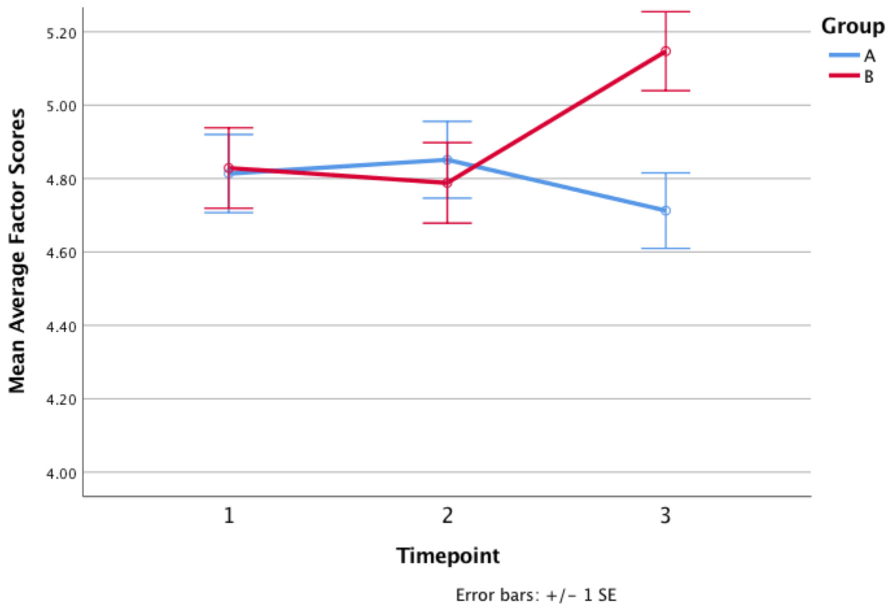
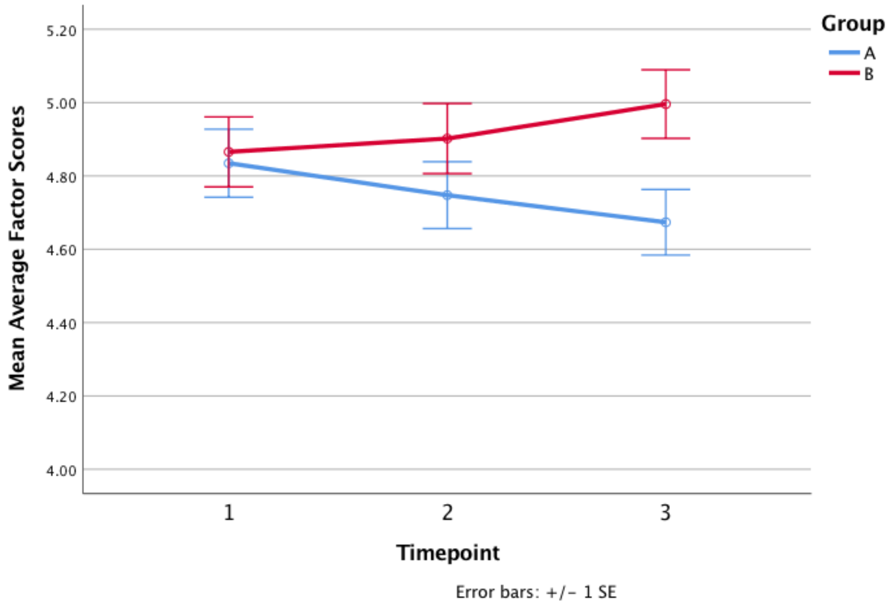


Figure 7.3.1.2

Changes in Mean Average Factor Scores Across Time for MSLQ-Motivation, Affective Response Items



A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of two independent variables (timepoint, group) on students' self-regulated learning skills (Course Approach, Affective Response). Timepoint included three levels (1, 2 and 3) and group consisted of two levels (Group A and Group B). For the MSLQ-Motivation, *Box's M* (22.33) was not significant (p = .109) indicating that there are no significant differences between the covariance matrices. Therefore, Wilks' Lamda is the most appropriate test statistic to use for these data as assumptions have not been violated.

Table 7.3.1.1
Mixed MANOVA Multivariate Test Results Using Wilks' Lambda Statistics for the MSLQ-Motivation Average Scores

Effect	Value	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.99	0.75	4	634	.559	.00	.24
Group	.98	2.48	2	316	.085	.02	.50
Timepoint * Group	.97	2.03	4	634	.088	.01	.61

The multivariate main effects for timepoint, group and the interaction between timepoint and group did not yield any statistically significant results. Significant univariate effects were observed for Affective Response items of group ($F(2, 317) = 4.97$, $p = .027$, $\eta_p^2 = .02$), and for Course Approach items for the interaction between timepoint and group ($F(2, 317) = 3.18$, $p = .043$, $\eta_p^2 = .02$). Detailed tables showing the full results of the ANOVAs run as part of this analysis can be found in Appendix Y.

7.3.1.2 Gabriel *Post Hoc* Test as a Follow-Up to the Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. Whilst the results from the mixed MANOVA in Section 7.3.1.1 shows there is an overall difference between group, it does not state which specific differences. As detailed in Section 5.6.2 of Paper 5, it is necessary to carry out further analyses. Given the considerations detailed here, the Gabriel *post hoc* test is the most appropriate as: (a) the assumption of the homogeneity of variance has not been violated (non-significant Levene's test); (b) there are unequal group sizes; (c) it is a more powerful *post hoc* test than Hochberg's GT2, the alternative test given points (a) and (b) (Field, 2013).

Table 7.3.1.2
Gabriel Post Hoc Test Results for the MSLQ-Motivation Average Scores.

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Course Approach	1	2	0.0	.11	> .999	-.26	.26
		3	0.1	.11	.729	-.36	.16
	2	1	0.0	.11	> .999	-.26	.26
		3	0.1	.11	.727	-.35	.16
	3	1	0.1	.11	.729	-.16	.36
		2	0.1	.11	.727	-.16	.35
Affective Response	1	2	0.0	.09	.986	-.20	.25
		3	0.0	.09	.993	-.20	.24
	2	1	0.0	.09	.986	-.25	.20
		3	0.0	.09	> .999	-.23	.22
	3	1	0.0	.09	.993	-.24	.20
		2	0.0	.09	> .999	-.22	.23

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Gabriel follow-up procedure (p = .05) was performed. The result suggested that although there were some observed mean differences for both Course Approach items and Affective Response items, there were no statistically significant differences in students' self-regulated learning skills between timepoints.

7.3.1.3 Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills (Course Approach, Affective Response), and the between-subject manipulation of group, and all interactions between these. For these data, sphericity can be assumed given that Mauchly's test was non-significant for timepoint ($\chi^2(2) = 3.11$, $p = .212$), timepoint × group ($\chi^2(2) = 1.54$, $p = .463$), timepoint × factor ($\chi^2(2) = 5.78$, $p = .056$) and lastly, timepoint × group × factor ($\chi^2(2) = 2.84$, $p = .242$). Results indicated a significant difference for students' self-regulated learning skills between groups ($F(1, 50) = 4.46$, $p = .040$, $\eta_p^2 = .08$). Detailed tables showing the full results of this analysis can be found in Appendix Z.

7.3.2 MSLQ-Cognitive – Average scores

7.3.2.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills.

Figure 7.3.2.1

Changes in Mean Average Factor Scores Across Time for MSLQ-Cognitive, Cognitive Control Items

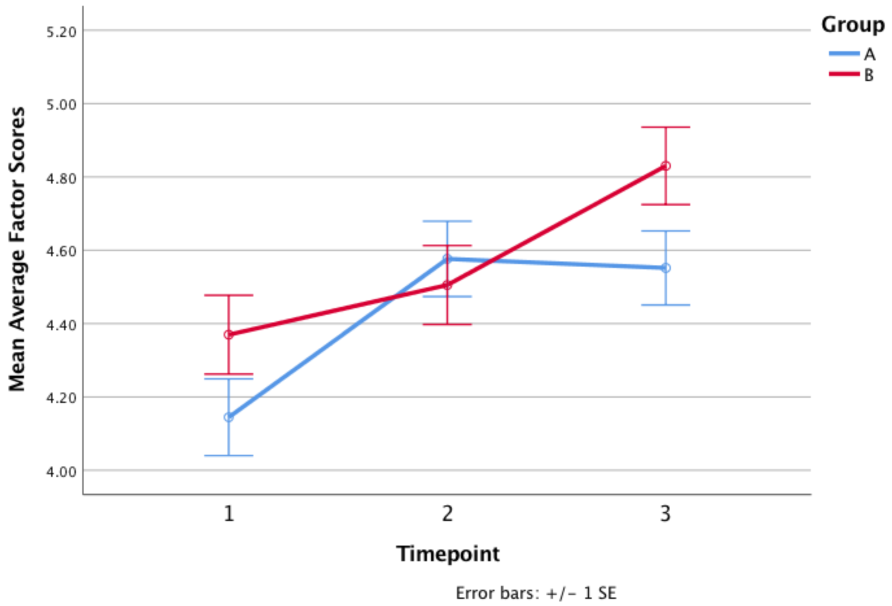
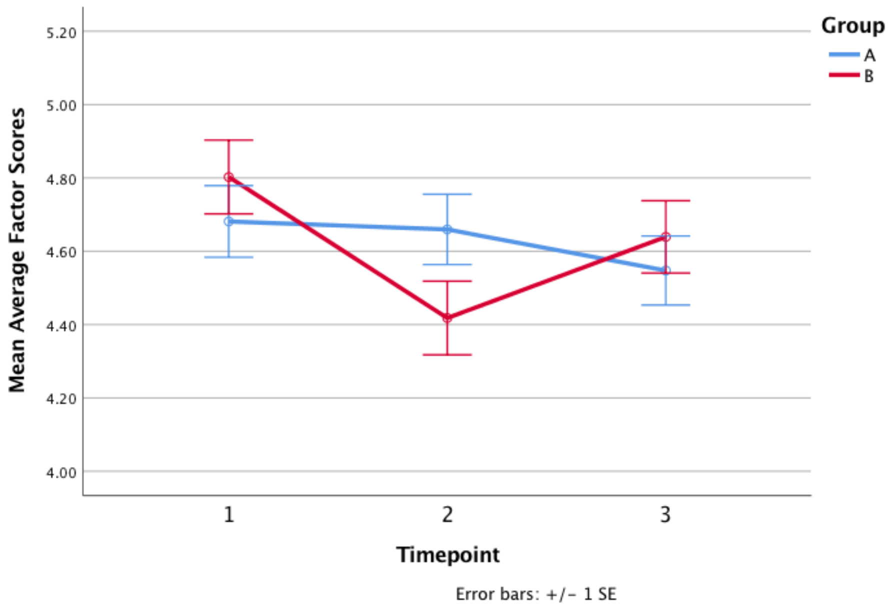


Figure 7.3.2.2

Changes in Mean Average Factor Scores Across Time for MSLQ-Cognitive, Self-Management Items



A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of one independent, between-subjects variable (group) on the dependent, within-subjects variables of students' self-regulated learning skills (Cognitive Control, Self-Management) and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). For the MSLQ-Cognitive, *Box's M* (35.91) was not significant ($p < .001$) indicating that there are no significant differences between the covariance matrices. Wilks' Lamda is therefore the most appropriate test statistic to use for these data as assumptions have not been violated.

Table 7.3.2.1
Mixed MANOVA Multivariate Test Results Using Wilks' Lambda Statistics for the MSLQ-Cognitive Average Scores

Effect	Value	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.86	12.03	4	634	< .001	.07	1.00
Group	.98	2.48	2	316	.086	.02	.50
Timepoint * Group	.98	1.21	4	634	.307	.01	.38

The multivariate main effects for timepoint (Wilks' Lambda = .86, $F(4, 634) = 12.03$, $p < .001$, $\eta_p^2 = .07$), was accompanied by a significant univariate effect for Cognitive Control items ($F(2, 317) = 8.80$, $p < .001$, $\eta_p^2 = .05$). There was a significant univariate effect for Self-Management items for group ($F(2, 317) = 4.97$, $p = .027$, $\eta_p^2 = .00$), and Cognitive Control items for the interaction between timepoint and group ($F(2, 317) = 3.18$, $p = .043$, $\eta_p^2 = .01$). All other multivariate and univariate tests were not significant for the MSLQ-Cognitive items calculated using average scores. Detailed tables showing the full results of the ANOVAs run as part of this analysis can be found in Appendix AA.

7.3.2.2 Gabriel *Post Hoc* Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint.

Table 7.3.2.2
Gabriel Post Hoc Test Results for the MSLQ-Cognitive Average Scores

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Cognitive Control	1	2	0.3	.11	.020	-.54	-.04
		3	0.4	.10	< .001	-.68	-.18
	2	1	0.3	.11	.020	.04	.54
		3	0.1	.10	.434	-.39	.11
	3	1	0.4	.10	< .001	.18	.68
		2	0.1	.10	.434	-.11	.39
Self-Management	1	2	0.2	.10	.137	-.04	.43
		3	0.2	.10	.337	-.09	.38
	2	1	0.2	.10	.137	-.43	.04
		3	0.1	.10	.949	-.28	.19
	3	1	0.2	.10	.337	-.38	.09
		2	0.1	.10	.949	-.19	.28

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Gabriel follow-up procedure (p = .05) was performed. The result suggests that for Cognitive Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 (M = 0.3, p = .020), and also between timepoints 1 and 3 (M = 0.4, p < .001). Similar differences were observed for Self-Management items, where students' self-regulated learning skills differed between timepoints 1 and 2 (M = 0.2, p = .137), and also between timepoints 1 and 3 (M = 0.2, p = .337), however these differences were not significant.

7.3.2.3 Mixed ANOVA to examine the extent to which the intervention enhanced students' self-regulated learning skills. A mixed ANOVA was performed examining the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills (Cognitive Control, Self-Management), and the between-subjects manipulation of group, and all interactions between these. For these data, sphericity can be assumed given that Mauchly's test was non-significant for timepoint ($\chi^2(2) = 4.76$, $p = .093$), timepoint × group ($\chi^2(2) = 3.41$, $p = .182$), timepoint × factor ($\chi^2(2) = 3.68$, $p = .159$) and lastly, timepoint × group × factor ($\chi^2(2) = 1.68$, $p = .432$). Results indicated significant difference between factors ($F(1, 50) = 13.39$, $p = .001$, $\eta_p^2 = .21$). Results were also significant for timepoint × factor ($F(2, 100) = 25.18$, $p < .001$, $\eta_p^2 = .33$) and group × factor ($F(1, 50) = 6.84$, $p = .012$, $\eta_p^2 = .12$). Detailed tables showing the full results of this analysis can be found in Appendix BB.

7.3.3 SRLEDS – Average scores

7.3.3.1 Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills.

Figure 7.3.3.1
Changes in Mean Average Factor Scores Across Time for SRLEDS, Motivation and Control Items

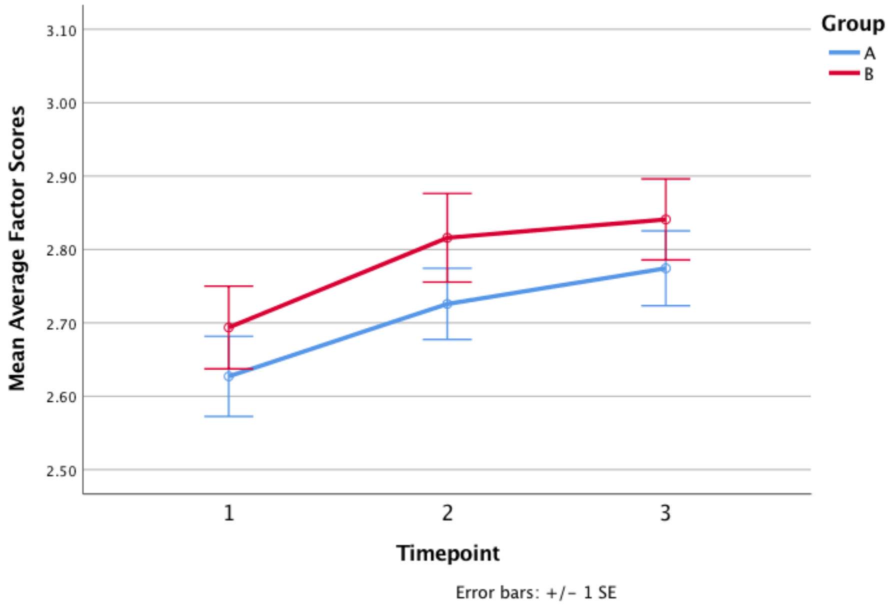
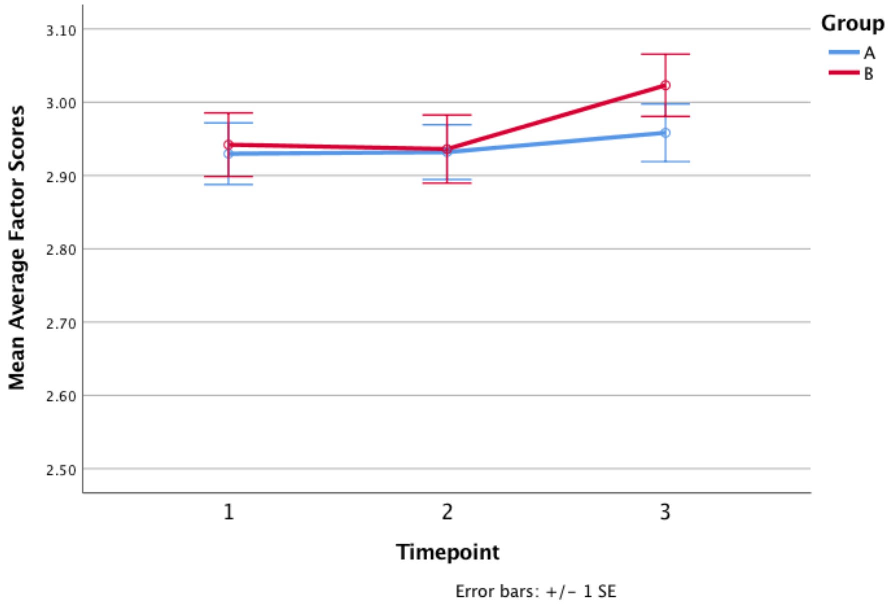


Figure 7.3.3.2
Changes in Mean Average Factor Scores Across Time for SRLEDS, Communication and Forethought Items



A two-way mixed multivariate analysis of variance (MANOVA) was conducted on the influence of one independent between-subjects variable (group) on the dependent, within-subjects variables of students' self-regulated learning skills (Motivation and Control items, Communication and Forethought items) and timepoint. Group consisted of two levels (Group A and Group B) and timepoint included three levels (1, 2 and 3). For the SRLEDS, *Box's M* (25.74) was not significant (p = .05) indicating that there are no significant differences between the covariance matrices. As assumptions have not been violated, Wilks' Lambda is the most appropriate test statistic to use for these data.

Table 7.3.3.1
Mixed MANOVA Multivariate Test Results Using Wilks' Lambda Statistics for the SRLEDS Average Scores

Effect	Value	*F*	Hypothesis *df*	Error *df*	*p*	η_p^2	Observed Power *d*
Timepoint	.97	2.46	4	588	.044	.02	.70
Group	.99	1.40	2	294	.248	.01	.30
Timepoint * Group	1.00	0.28	4	588	.889	.00	.11

For the SRLEDS, the multivariate main effect for timepoint (Wilks' Lambda = .03, $F(4, 588) = 2.46$, $p = .044$, $\eta_p^2 = .02$), was accompanied by a significant univariate effect for Motivation and Control ($F(2, 297) = 3.93$, $p = .021$, $\eta_p^2 = .03$). All other multivariate and univariate tests were non-significant for the SRLEDS calculated using the average scores. Detailed tables showing the full results of the ANOVAs run as part of this analysis can be found in Appendix CC.

7.3.3.2 Gabriel *Post Hoc* Test to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills Across Timepoint.

Table 7.3.3.2

Gabriel Post Hoc Test Results for the SRLEDS Average Scores

Dependent Variable	Timepoint (Variable I)	Timepoint (Variable J)	Mean Difference (I-J)	Std. Error	*p*	95% Confidence Interval	
						Lower Bound	Upper Bound
Motivation and Control	1	2	0.1	.05	.176	-.23	.03
		3	0.2	.05	.023	-.28	-.02
	2	1	0.1	.05	.176	-.03	.23
		3	0.0	.05	.794	-.17	.08
	3	1	0.2	.05	.023	.02	.28
		2	0.0	.05	.794	-.08	.17
Communication and Forethought	1	2	0.0	.04	> .999	-.10	.10
		3	0.1	.04	.504	-.15	.05
	2	1	0.0	.04	> .999	-.10	.10
		3	0.1	.04	.455	-.15	.04
	3	1	0.1	.04	.504	-.05	.15
		2	0.1	.04	.455	-.04	.15

To assess pairwise differences among the three levels of timepoint for the main effect of students' self-regulated learning skills, the Gabriel follow-up procedure (p = .05) was performed. The result suggested that for Motivation and Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 3 (M = 0.2, p = .023). Similar differences were observed between timepoints 1 and 2 (M = 0.1, p = .176), however this difference was not statistically significant. With regard to Communication and Forethought items, there were differences in the means between timepoints 1 and 3, and 2 and 3, however these differences were not significant.

7.3.3.3 Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills. A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills (Motivation and Control items, Communication and Forethought items), and the between-subjects manipulation of group, and all interactions between these. For these data, sphericity can be assumed given that Mauchly's test was non-significant for timepoint ($\chi^2(2) = 3.54$, $p = .170$), timepoint × group ($\chi^2(2) = 1.39$, $p = .498$), timepoint × factor ($\chi^2(2) = 2.39$, $p = .303$) and lastly, timepoint × group × factor ($\chi^2(2) = .99$, $p = .609$). Results indicated a significant difference between factors ($F(1, 39) = 83.53$, $p < .001$, $\eta_p^2 = .68$). The interaction between timepoint and factor was also significant ($F(2, 78) = 3.55$, $p = .033$, $\eta_p^2 = .08$). A detailed table showing the full results of this analysis can be found in Appendix DD.

7.3.4 Summary of findings for Research Question 1

7.3.4.1 MSLQ-Motivation – Average Scores. With regard to the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, the multivariate main effects for timepoint, group and the interaction between timepoint and group did not yield any statistically significant results. Significant univariate effects were observed for Affective Response items for group and for Course Approach items for the interaction between timepoint and group. The results of the Gabriel *post hoc* test suggested that although there were some observed mean differences for both Course Approach items and Affective Response items, there were no statistically significant differences in students' self-regulated learning skills between timepoints.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference for students' self-regulated learning skills between groups.

7.3.4.2 MSLQ-Cognitive – Average Scores. With regard to the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, the multivariate main effect for timepoint was accompanied by a significant univariate effect for Cognitive Control items. Univariate effects were significant for group for the Self-Management items, and also for the interaction between timepoint and group for Cognitive Control items. The results of the Gabriel *post hoc* test suggested that for Cognitive Control items, students' self-regulated learning skills differed significantly between timepoints 1 and 2 and also between timepoints 1 and 3. Similar differences were observed for Self-Management items, where students' self-regulated learning skills differed between timepoints 1 and 2 and also between timepoints 1 and 3, however these differences were not significant.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference between factors, for the interaction between timepoint and factor, and also between group and factor.

7.3.4.3 SRLEDS – Average Scores. With regard to the results of the mixed MANOVA used to examine the extent to which the intervention improved students' self-regulated learning skills, the multivariate main effect for timepoint was accompanied by a significant univariate effect for Motivation and Control items. All other multivariate and univariate tests were non-significant for the SRLEDS calculated using the average scores. The results of the Gabriel *post hoc* test suggested that there is a significant difference between timepoints 1 and 3 for the Motivation and Control items. With regard to the

Communication and Forethought items, there were differences in the means between timepoints 1 and 3, and 2 and 3, however these differences were non-significant.

A mixed ANOVA was performed to examine the effects of the within-subject manipulations of timepoint and students' self-regulated learning skills, and the between-subjects manipulation of group, and all interactions between these. Results indicated a significant difference between factors and also for the interaction between timepoint and factor.

7.4 Research Question 2 - Does Student's Mean Test Performance Improve Across Timepoint and to What Extent Does Students' Self-Regulated Learning Skills Predict Their Mean Test Performance?

As a reminder to the reader, students' test performance data was generated by the Science Faculty's programme of assessment for the three separate sciences, namely Biology, Chemistry and Physics. By mapping this programme of assessment on to the timeline of the present study, test performance data was collected during the same weeks that students completed the two surveys across the three timepoints of this research. As previously stated, this programme of assessment takes the form of standardised block testing based on *bona fide* GCSE past paper questions, sat at the end of each topic within the subject specification. These topic tests are publicised to students in advance, allowing them time to revise for these important summative checkpoints.

7.4.1 SRLEDS – Average scores

7.4.1.1 Pearson's *r* Correlation Coefficient to Examine the Relationship Between Students' Self-Regulated Learning Skills and Test Performance. To examine the relationship between students' self-regulated learning skills and test performance, Pearson's *r* Correlation Coefficient was calculated. As stated in Paper 6 and being mindful of inflating Type I error, it is important to highlight that these analyses are somewhat exploratory. As such, correlations were also calculated for the MSLQ-Motivation and the MSLQ-Cognitive (see Appendix EE). As with the correlations calculated using weighted scores, they were broadly similar across all three scales, however for the same reasons cited in Paper 6, as the SRLEDS is an original and tailored instrument representing a significant contribution of this research, these data were chosen to be written-up in this paper in response to Research Question 2.

Using the two factors of the SRLEDS average scores, the Motivation and Control items and the Communication and Forethought items, Pearson's *r* was calculated to examine the relationship between these data and students' test performance across all three timepoints. The results of these analyses are shown in Table 7.4.1.1. There were no statistically significant correlations, however it is worth noting that the strength of the correlations increased at timepoint 2, before weakening again at timepoint 3. To test this observation statistically, Table 7.4.1.2 shows the results of comparisons of correlations for independent samples calculated using a resource published by Lenhard and Lenhard (2014). Results were significant for the comparison of correlations between timepoints 1 and 2 for the Motivation and Control items of the SRLEDS (*z* = -2.03, *p* = .021). There were no other significant results.

Table 7.4.1.1
Pearson's r Correlation Coefficient Results for Both Motivation and Control Items and Communication and Forethought Items, and Students' Test Performance Across Timepoint

	Factor	*N*	Pearson's *r*	*p* (two-tailed)
Timepoint 1	Motivation and Control	97	-.09	.414
	Communication and Forethought		.06	.570
Timepoint 2	Motivation and Control	101	.20	.051
	Communication and Forethought		.16	.112
Timepoint 3	Motivation and Control	103	.12	.219
	Communication and Forethought		.12	.221

Note. *N* denotes number.

Table 7.4.1.2
Results of Comparison of Correlations (z-scores) for Students' Test Performance Across Timepoint

Timepoints	Motivation and Control		Communication and Forethought	
	z	***p***	***z***	***p***
1-2	-2.03	.021	-0.70	.241
2-3	0.58	.282	0.29	.387
1-3	-1.47	.071	-0.42	.337

7.4.1.2 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 1. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 1, an ANCOVA was performed. Using students' mean test performance at timepoint 1 as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. The assumption of homogeneity of variance was tested using Levene's test, and as the *p*-value ($p = .697$) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. In addition to this, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the *p*-values for the interaction between both group and Motivation and Control ($p = .292$) and group and Communication and Forethought ($p = .301$) is greater than .05, the assumption is tenable.

Although students in Group A ($M = 64.5$, $N = 50$) posted slightly higher test performance than those in Group B ($M = 63.1$, $N = 47$), the main effect of group was found not to be significant ($F(1, 97) = 0.43$, $p = .512$, $\eta_p^2 = .01$). In terms of the covariates, neither Motivation and Control ($F(1, 97) = 1.32$, $p = .253$, $\eta_p^2 = .01$) or Communication and Forethought ($F(1, 97) = 1.09$, $p = .299$, $\eta_p^2 = .01$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix FF.

7.4.1.3 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 2. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 2, an ANCOVA was performed. Using students' mean test performance at timepoint 2 as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. The assumption of homogeneity of variance was tested using Levene's test. As the *p*-value (p = .136) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. Lastly, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the *p*-values for the interaction between both group and Motivation and Control (p = .922) and group and Communication and Forethought (p = .352) is greater than .05, the assumption is tenable.

Although students in Group B (M = 62.8, N = 52) posted slightly higher test performance than those in Group A (M = 61.8, N = 49), the main effect of group was found not to be significant ($F(1, 101) = 1.17$, $p = .281$, $\eta_p^2 = .01$). In terms of the covariates, neither Motivation and Control ($F(1, 101) = 0.10$, $p = .749$, $\eta_p^2 = .00$) or Communication and Forethought ($F(1, 101) = 2.12$, $p = .149$, $\eta_p^2 = .02$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix GG.

7.4.1.4 ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 3. To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoint 3, an ANCOVA was performed. Using students' mean test performance at timepoint 3 as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (SRLEDS: Motivation and Control, Communication and Forethought) as covariates. The assumption of homogeneity of variance was tested using Levene's test, and as the *p*-value (p = .519) is greater than the alpha level of .05, the variances can be assumed to be equal. Secondly, described as appropriate for fundamental assessment of linearity by Johnson (2016), bivariate scatterplots and residuals plots were inspected to confirm the assumption of linearity. Finally, the assumption of homogeneity of regression slopes was also tested by examining the effect of the interaction between group and each of the two covariates. As the p-values for the interaction between both group and Motivation and Control (p = .390) and group and Communication and Forethought (p = .510) is greater than .05, the assumption is tenable.

At timepoint 3 students in Group A (M = 67.4, N = 55) posted slightly higher test performance than those in Group B (M = 66.8, N = 48), however the main effect of group was found not to be significant ($F(1, 103) = 1.24$, $p = .267$, $\eta_p^2 = .01$). In terms of the covariates, neither Motivation and Control ($F(1, 103) = .27$, $p = .607$, $\eta_p^2 = .00$) or Communication and Forethought ($F(1, 103) = .00$, $p = .932$, $\eta_p^2 = .00$) were significantly related to test performance. Detailed tables showing the full results of this analysis can be found in Appendix HH.

7.4.2 Summary of findings for Research Question 2

Students' test performance data was generated from the Science Faculty's programme of assessment which uses GCSE past papers sat by all students across the three separate sciences: Biology, Chemistry and Physics. These tests were conducted at the end of each topic aligning positively with the timeline of this research, with tests sat during the same weeks in which students completed the MSLQ and SRLEDS at each of the three timepoints.

To examine the relationship between students' self-regulated learning skills and test performance, Pearson's *r* Correlation Coefficient was calculated. Using the two factors of the SRLEDS average scores, the Motivation and Control items and the Communication and Forethought items, Pearson's *r* was calculated for the relationship between these data and students' test performance across all three timepoints. There were no statistically significant correlations, however it is worth noting that the strength of the correlations increased at timepoint 2, before weakening again at timepoint 3. In terms of the comparison of correlations, results were significant for the comparison between timepoints 1 and 2 for the Motivation and Control items of the SRLEDS (z = -2.03, p = .021), however there were no other significant results.

To examine the extent to which students' self-regulated learning skills predicts mean test performance at timepoints 1, 2 and 3, an ANCOVA was performed for each of these timepoints. Using students' mean test performance at each timepoint as the dependent variable, this test explored the effects of the between-subject manipulation of group (Group A and Group B), with students' self-regulated learning skills (Motivation and Control, Communication and Forethought) as covariates. Whilst differences in mean test performance between Group A and B were observed at each timepoint, the main effect for group was not significant. In terms of the covariates, neither Motivation and Control or Communication and

Forethought were significantly related to students' test performance across any of the three timepoints.

7.5 Paper 7 Summary

As a follow-up to the analyses documented in Paper 6, this paper contributes to this portfolio by providing a detailed account of the results from the same raft of parametric tests conducted in Paper 6 using the average score data from the three measurement components: the MSLQ-Motivation, MSLQ-Cognitive and the SRLEDS. As in Paper 6, this paper has been structured using the two research questions to organise the relevant analyses, providing a parallel structure to that used in Paper 6. Summaries at the end of each research question collate the key findings for each of the analyses, supporting the reader's navigation through this paper and the results of this study. As the penultimate paper of this portfolio, this sets the scene for Paper 8, the Discussion, where the results will be examined in detail, the limitations outlined and implications for future research and practice proposed.

Paper 8

Discussion

As the final paper of this portfolio, the Discussion builds on the results from the preceding papers by examining, interpreting, and qualifying the results, drawing inferences and conclusions from them, giving meaning to both the results and the research as a whole (American Psychological Association, 2020). This paper consists of a summary of the findings before presenting a detailed examination of the extent to which they have answered the research questions. Limitations of the research are identified and discussed, before considering the broader implications of the findings, making suggestions for both future research and a number of recommendations for practice. The purpose of the latter sections is to expand on the concepts studied in this research providing a clear context the to research findings and my understanding of self-regulated learning.

Written February 2020, revised June 2021.

8.1 Summary of the Present Study

This study aimed to evaluate the impact of a discipline-independent intervention designed to enhance students' self-regulated learning skills. As a further aim, I wanted to investigate the relationship between students' self-regulated learning skills and their academic achievement. Results indicate that whilst students' self-regulated learning skills improved across timepoint, there were no significant differences in students' self-regulated learning skills between Group A and Group B. In terms of students' academic achievement, similar results were found in that although students' test scores improved across the three timepoints of the intervention, there were no significant differences between group nor did students' self-regulated learning skills predict their level of academic achievement.

This study offers a number of contributions to both research and practice. Firstly, in response to the development of the discipline-independent intervention underpinning this research, a new and original scale was created to measure students' perception of their self-regulated learning skills; the Self-Regulation Experimental Design Survey (SRLEDS). Using the MSLQ (Pintrich et al., 1991; 1993), a widely-used measure within the field of self-regulated learning research, the SRLEDS has been validated by positive correlations for the factor loadings across timepoint between the two scales, and therefore represents a valid, reliable and original scale. In doing so, the creation and validation of this instrument represents a significant contribution to the field. Whilst its composition and structure is focused on this study's intervention, the SRLEDS has utility in future self-regulated learning research.

Secondly, this is the first study of its type to be conducted within the context of the research setting; Year 9 (13-14 year olds) in a United Kingdom co-educational boarding school. As students join the school in Year 9, conducting research on this year group provides a valuable insight into developing and implementing a curriculum intervention for students who have recently transitioned to secondary school, when research suggests that the relationship between self-regulated learning and academic achievement weakens (Dent & Koenka, 2016). In doing so, this research provides a useful perspective for other teaching colleagues and researchers working in similar settings as to some of the key ideas and principles underpinning the evaluation of a curriculum intervention in addition to supporting the development of students' self-regulated learning skills.

Lastly, this study provides a useful reference point to fellow teacher-researchers who intend to conduct research evaluating educational programmes in school settings. Working as a researching practitioner provides a number of challenges in terms of balancing the conflicting requirements of day-to-day teaching combined with rigorous academic research. However, having successfully managed what Palmer (2007) describes as *the tension of opposites* of this dualistic role, my reflection on the research process provides an insight into some of the important practical and methodological considerations surrounding the use of control groups as part of a quasi-experimental design within the context of a school setting.

8.2 Discussion of the Findings

To facilitate the detailed discussion of the findings of this research, Section 8.2 has been structured using the two research questions to briefly outline the main findings relative to each, followed by a comprehensive sub-section (Section 8.2.3) that brings the findings together, discussing them in detail and considering changes within the local context that account for the results.

8.2.1 Research Question 1

1. **Increases in students' self-regulated learning skills were not due directly to the curriculum intervention.**

The present findings indicate that although students' self-regulated learning skills improved across timepoint, this was not as a direct response to the discipline-independent intervention as there were no significant differences in students' self-regulated learning skills between Group A and Group B. Whilst the results of previous studies (e.g. Dörrenbächer & Perels, 2016a; Hofer & Yu, 2003; Reeves & Stich, 2011) show that students' self-regulated learning skills can be trained and improved by a discipline-independent intervention, the same positive longitudinal training effects have not been found in this study.

As detailed in Paper 6 and Paper 7, there was not a significant difference between the self-regulated learning skills of Group A and Group B at timepoint 2. These results contrast with much of the research literature which suggests that students' self-regulated learning skills can be improved through training programmes (Dignath & Büttner, 2008; Hattie, Biggs, & Purdie, 1996; Raaijmakers, Baars, Paas, et al., 2018). Interestingly, these results also contrast with research that suggests that explicit instruction in strategy training is necessary before any significant improvement in students' independent performance of self-regulated learning skills will be seen (Borkowski & Cavanaugh, 1981; Brown, Bransford, Ferrara, & Campione, 1983; Brown, Campione, & Day, 1981; Brown & Palincsar, 1985). Given that at timepoint 2 only Group A had received the 10-week intervention and Group B had not, the documented increase in both group's self-regulated learning skills suggests that there were other local factors at work within the school that accounts for the increase in Group B's self-regulated learning skills despite not yet receiving the intervention.

8.2.2 Research Question 2

2. **Although mean test performance improves across timepoint, students' self-regulated learning skills do not predict mean test performance.**

The present findings indicate that students' mean test performance improved across timepoint, however self-regulated learning skills did not significantly predict test performance. The improvements in students' test performance across timepoint aligns with the overall improvements in students' self-regulated learning skills outlined in Research Question 1, also aligning with previous studies (e.g. Fischer, 2008; Richardson et al., 2012; Sontag & Stoeger, 2015). However, as with Research Question 1, there was no significant difference between groups suggesting that the improvements in students' test performance were not as a direct result of the discipline-independent intervention, but instead a response to other local factors within the school. As such, this contrasts with research literature highlighted in Section 2.5 which states that self-regulated learning abilities have a major impact on a student's academic achievement (Broadbent et al., 2020; Dent, 2013; Dent & Koenka, 2016; Kistner et al., 2010; Montague, 2007; Raaijmakers, Baars, Paas, et al., 2018; Raaijmakers, Baars, Schaap, et al., 2018; Schunk, 2008). Whilst the length of the intervention used in this research spanned just 10 weeks, discipline-independent training interventions used in previous research have shown increases in longer-term academic outcomes (Bail et al., 2008; Broadbent et al., 2020; Dörrenbächer & Perels, 2016a; Schmitz & Wiese, 2006). These interventions fostered several motivational, cognitive, metacognitive and resource management components of self-regulated learning. In doing so, these enhanced skills served to support students in accessing a higher level of academic outcomes over a longer period of time. Whilst the 10-week training intervention might have been too shorter time period to observe significant positive changes in students' academic achievement, the three timepoints over which this study ran have yielded statistically significant changes in students' test performance, even if not accurately predicted by their self-regulated learning skills.

8.2.3 Discussion of the Findings

In short, it could be argued that the findings were real and that there was no effect of the intervention. As highlighted in Paper 6 and Paper 7, in response to research question 1 there was no significant difference between the self-regulated learning skills of Group A and Group B at timepoint 2. In terms of research question 2, whilst the improvements in students' test performance across timepoint aligns with the overall improvements in students' self-regulated learning skills outlined in research question 1, also aligning with previous studies (e.g. Fischer, 2008; Richardson et al., 2012; Sontag & Stoeger, 2015), there was no significant difference between groups.

It is of course the case that given the findings, there was no effect of the intervention. Whilst all students' self-regulated learning skills increased between timepoint 1 and timepoint 2, there was no significant difference between those students in Group A who received the intervention, and those in Group B yet to do so. Although a number of changes within the local context of the research setting could account for the findings have been identified and discussed at length (see following sub-sections), it is possible that despite the careful consideration that went into the design and implementation of the content independent curriculum intervention, it did not yield the effect or impact on students' self-regulated learning skills as hypothesised.

Reflecting on this further within the context of the threats to validity identified and described in Section 4.6, it is possible that there was diffusion of the treatment between Groups A and B which accounts for the increase in both groups' self-regulated learning skills between timepoint 1 and timepoint 2. Identified as another threat to internal validity, the repeated use of the instruments could have resulted in pupils providing socially desirable responses to the instruments used again at timepoints 2 and timepoints 3, especially as the year group where aware of the overall aim of the intervention; to improve their self-regulated learning skills. This also links to two of the external threats to validity. Firstly, interaction effects of pre-testing meaning that the participants may have become sensitised to the intervention as a result of pre-testing, and secondly the reactive effects of experimental arrangements, with participants' awareness of their involvement in an intervention designed to improve their self-regulated learning skills may have influenced how they responded to the intervention.

The discipline-independent training intervention delivered during academic year 2017/18 also aligned with an increased school-wide emphasis on the development of students' self-regulated learning skills, not least in Year 9; the year group from which participants for this research were drawn. This section will frame some of the changes to the local context within the research setting that help to explain and give meaning to the findings of this research.

However, before sharing some *post hoc* reflections on changes to the local context of the research setting and in doing so, providing hindsight explanations for the findings of the present study, it is important to remind the reader that it was the Year 9 participants' first year at the setting for this research, having started at the school shortly before the intervention formally began in week four of the Michaelmas Term. Although only Group A were exposed to the training intervention between timepoints 1 and 2 during the Michaelmas Term, the increase in both groups' self-regulated learning skills could be a response to all participants' first exposure to a new setting with a departmentalised curriculum, a different timetable structure and longer lessons (55 minutes versus shorter lesson length at most primary schools) as a function of them starting at secondary school. These factors relative to students' first term at their new school, in addition the school's boarding provision meaning that they reside at school during term-time, provides further explanation for the increases in students' self-regulated learning skills between timepoints 1 and 2. These new, formative experiences that all Year 9 students are exposed to would implicitly support the development of students' self-regulated learning skills and are highlighted at the outset of this important section within the context of this paper as it helps to provide further background to the discussion that follows.

8.2.3.1 *The Teddies Curriculum 2.0* – Reflection and Hindsight Explanation. The training intervention used in this study draws its roots from the school's academic aims from previous years. As detailed in Section 4.3, Materials, in its first incarnation The Teddies Curriculum was intended to be a practical representation of the school's desire to equip students with the skills and dispositions needed to be successful, not just in externally examined qualifications, but also in their lives beyond the bounds of school. Whilst the skills and values that comprised the original Teddies Curriculum were intended to underpin teachers' planning and delivery of the curriculum to Year 9, the theoretical foundations were weak at best, no empirical research was conducted to assess and evaluate its impact, and the extent to which it was adopted and implemented across the school varied significantly. That said, although not embedded universally, the language of the original Teddies Curriculum had begun to permeate through the school before *The Teddies Curriculum 2.0* was launched as part of this research at the start of the academic year 2017/18. This provides an important historical insight into changes outside of the control of this research, giving context to the discussion of the findings of the present study that follows.

Supported by the rigour of doctoral-level research in addition to the alignment of this study and the school's updated academic aims, *The Teddies Curriculum 2.0* built on the first iteration by conflating research and practice; one of the ideals of the Doctor of Education (EdD) course at the University of Cambridge. As the discipline-independent intervention underpinning the methodological approach to this research, *The Teddies Curriculum 2.0* was theoretically founded on Zimmerman's model of self-regulated learning (see Section 2.3), providing a robust theoretical foundation for supporting the development of students' self-regulated learning skills. Although the 10-week intervention was the main vehicle for supporting the development of students' self-regulated learning skills, when reflecting in hindsight it is clear that this sat alongside the increased school-wide emphasis on the development of these skills. Through the sharing of best teaching practice and discussion between colleagues at department and faculty level, there is little doubt that the increased focus on the development of students' self-regulated learning skills gathered momentum across the academic year, with the language of self-regulated learning becoming increasingly embedded across the school. As a hindsight explanation that falls outside of the control of the methodological approach to this study, these changes within the local context of the research setting together with the aforementioned point that it is Year 9 participants' first year at the school, offer a valid explanation as to why Group B's self-regulated learning skills measured at timepoint 2 have also increased in-line with Group A's, despite having not yet received the 10-week intervention.

The increased school-wide emphasis on the development of students' self-regulated learning skills also gave rise to more opportunities for students to apply their newly acquired and evolving knowledge of the components of a self-regulated learning cycle and associated skills, even if yet to receive the intervention. Stemming from the school's academic aims and in turn, the academic development plan for 2017/18, schemes of work and lessons were planned at department level with a view to increasing the number of opportunities for students to develop their self-regulated learning skills, in parallel with the syllabus content that comprises subject and exam board specifications. Again, whilst this falls outside of the control of the methodological approach of the present study, it serves to provide a hindsight explanation for the findings of this research.

A link can be made here between the increased number of opportunities for students to develop their self-regulated learning skills and Zimmerman's (2013) multi-level model of self-regulated learning development outlined in Paper 2 (see Section 2.4). Underpinned by Bandura's (1986) Social Cognitive Theory, Zimmerman's multi-level model emphasises the sociocultural dimension present in the development of self-regulatory skills. For Group B who were yet to receive the intervention before the surveys were completed by all participants for a second time at timepoint 2, the development of their self-regulated learning skills would have been supported by the first two levels of Zimmerman's (2013) multi-level model. Within a classroom environment planned with the increased provision of opportunities to develop self-regulated learning skills in mind, all students would have had more opportunity to *observe* and *emulate* their teachers' and peers' execution of these skills. However, although yet to receive the training intervention, it can be argued that students in Group B might have benefited more from this experience than those student in Group A. Although at the primitive stages of self-regulated learning skill development, the first two stages of Zimmerman's multi-level model (observation and emulation) would support the development of a foundation level of self-regulated learning skills for Group B, whilst with the support of the intervention Group A would be able to progress to level 3, self-control. This provides theoretical support for the observed increased in Group B's self-regulated learning skills relative to their peers, despite having not yet received the training intervention.

Furthering this, the adjunct nature of the training intervention links to research by Simpson et al. (1997), who suggest that transfer of self-regulated learning skills across domains can be facilitated by making the declarative, procedural and conditional knowledge about strategy use explicit to students, allowing them then the opportunity to apply this across their studies. Furthering this, the increased school-wide emphasis would have meant that even those students in Group B yet to receive the intervention at timepoint 2 would have been exposed to the declarative knowledge in classroom lessons, that is the knowledge of the different strategies available (Paris et al., 1983). In doing so, this would have also served to support the development of students' procedural and conditional knowledge of strategies to support the development of self-regulated learning skills across all subjects. This *high-road* transfer was argued to require students to be more metacognitively aware and reflective about their strategy use compared to *low-road* transfer. Despite having not been exposed to the training intervention itself, the increased school-wide emphasis and focus on the development of self-regulated learning skills would have expedited Group B's exposure to the declarative knowledge, in turn facilitating the development of their procedural and conditional knowledge as well (Hofer et al., 1998; Paris et al., 1983; Salomon & Perkins, 1989). Taken collectively, this exposure would serve to provide further support to the development of students' self-regulated learning skills for students in both Groups A and B.

This links to Bandura's (1986) emphasis on the importance of mastery experiences in the development of self-efficacy, an important sub-process in the forethought phase of Zimmerman's (2000) model of self-regulated learning. Day-to-day classroom learning provided students with mastery experiences where, for those students in Group A who had received the training intervention before timepoint 2, they were able to apply and practise the strategies delivered as part of *The Teddies Curriculum 2.0*. For those yet to receive the intervention in Group B, this provided an opportunity to observe their peers' use of newly acquired self-regulated learning strategies, informing their own adoption and implementation of these skills through observation and emulation.

8.2.3.2 Changes to Assessment Practice. Another notable change within the local context worthy of discussion was the removal of summative assessment checkpoints at the end of each half term across the Year 9 curriculum, apart from the three separate sciences and Maths as these subjects teach a three-year GCSE starting in Year 9. This movement away from the regimented programme of block testing in all subjects of previous academic years was driven by a one of the key tenets of the academic development plan, which was to enhance students' feedback literacy through greater provision of formative assessment feedback. Through an increased focus on the provision of high quality, specific feedback that informs students' next steps in learning, students are encouraged to actively engage with this feedback, fully understanding and internalising its meaning, before proactively responding to it through the demonstration of progress from the original piece of work. This shift in assessment policy also aligns with the desire for students to foster of a mastery goal orientation, implicit within the training intervention sessions on Goal Setting (session 1), Resilience (session 3) and Reflection (session 10). This school-wide shift in assessment policy implemented and embedded at department-level also encouraged the movement of students' goal orientation along a continuum away from a performance goal orientation fostered by the previous focus on regular summative assessment, towards that of a mastery goal orientation. The provision of formative feedback which became increasingly focused on students' use of self-regulated strategies and skills rather than on the summative outcome of the learning task, can also be argued to support the development of a mastery goal orientation, in turn expediting students' movement along the continuum outlined above. Providing this type of feedback to all Year 9 students, whether they had received the training intervention or not, would also serve to further support the development of their self-regulated learning skills.

8.2.3.3 The Role of the Academic Tutor. Another area of note within the local context of the school is the role of students' academic tutors. An academic tutor is a school-level equivalent to a doctoral supervisor who leads weekly student-tutor meetings with each of their tutees. These weekly meetings provide a formal academic check-in with students, where their scholastic progress is monitored and discussed. All classroom teaching staff have a role as an academic tutor to between six to eight students from across year groups, often referred to as a vertical tutor system. The reason that this is mentioned here is that just as the language of the first incarnation of The Teddies Curriculum had begun to permeate the classroom before this study began at the start of academic year 2017/18, it was also being adopted and used in the tutoring system. Whilst its limitations have been noted both in this paper and in Paper 4, the language and underpinning principles of The Teddies Curriculum provided tutors with a framework and students with a lens through which they could reflect on their learning and academic progress in a more structured and focused way. Although not formally part of the tutor system, *The Teddies Curriculum 2.0* and its strong theoretical foundations provided a significantly enhanced structure for tutors to guide students' evaluation of the effectiveness of newly acquired self-regulated learning skills. Taken together, I would argue that these insights into changes within the local context linked to, but not directly connected to this research, offers an additional layer of discussion and explanation for the increases in Group B's self-regulated learning skills at timepoint 2, especially given that it is Year 9's first year at the school. Although Group B received the intervention second, they were indirectly exposed to the language and strategies of self-regulated learning through their weekly student-tutor meetings throughout the first term, as a result of the increased emphasis on the development of self-regulated learning across the school.

8.2.3.4 Self-Regulated Learning - Test Performance and Academic Ability.

Shifting the focus now to discussion of the findings relative to Research Question 2 and students' test performance, it is clear from the above discussion that there are a number of other factors at work within the local context aside from students having an improved understanding of the cognitive and metacognitive components of self-regulated learning in response to the 10-week training intervention. Whilst an improved understanding of these components plays an important role, especially given the context and overall aims of this research, it is clear from the results that these findings are at odds with the findings of previous research examining self-regulated learning and academic performance. Although significant differences were found for test performance across timepoint, using data generated from the Science Faculty's programme of summative assessment which aligned with the timeline of data collection for the present study, there was no difference in the levels of academic achievement between groups. As discussed in Paper 4, students were divided into Groups A and B using purposeful sampling making effective use of an existing structure within the school timetable, namely students' Form groups. The ability profile of these sets was mixed in nature, populated based on students' entrance exam results sat in advance of joining the school, whilst also ensuring parity in terms of demographics. However, for Mathematics and the three separate sciences (Biology, Chemistry and Physics), students are taught in streamed ability sets. Data analysis was conducted using the Form group structure, as these were the groups in which students received the training intervention. It is possible therefore, that although these groups were mixed ability in nature when created at the start of the academic year, by the end of the intervention at timepoint 3 their composition contained a disproportionate number of students of either a higher or lower level of mathematical and scientific ability and subsequent academic achievement. In light of the regular re-setting conducted across the Mathematics and Science faculties in response to students' test performance in these subjects (every half term, approximately 6 weeks), this would have had an impact on students' academic progress in these subjects, perhaps effecting their level of summative achievement to a greater extent than the training intervention designed to support the development of their self-regulated learning skills.

As discussed in Section 2.5, it is often assumed that highly intelligent and high achieving students know more about different self-regulated learning strategies and than their peers, but they are also able to regulate their learning without outside help (Sontag & Stoeger, 2015). Research by Sontag and Stoeger (2015) suggests that on average, highly intelligent and high-achieving students do possess more metacognitive knowledge, however this does not mean that they actually use self-regulated learning strategies more often or indeed more effectively than their peers. This aligns with the findings of the present study, as self-regulated learning did not accurately predict students' test performance scores. Extrapolating this, students with high levels of self-regulated learning skills as measured by the MSLQ and SRLEDS are not those that achieved highly in terms of their test performance. This provides evidence to support the notion that just because students are highly intelligent and high achieving, these students will still benefit from a training intervention targeting the development of their self-regulated learning skills. This is further supported in research conducted by Fischer (2008), who showed that academically gifted students who practised self-regulated learning skills in small groups showed improvements in both declarative knowledge and academic performance across pre-test post-test comparisons to their peers.

Whilst this research does not differentiate between students of different academic ability and achievement profiles, it is clear that students have made progress in terms of both their self-regulated learning skills and test performance scores for this to be significant across timepoint, regardless of academic ability. That said, this would provide an interesting additional layer of data to be collected and used as a covariate for further statistical testing, allowing the examination of the extent to which highly intelligent and high-achieving students not only benefited from the intervention itself, but also made greater academic progress as shown in test performance relative to their peers.

8.2.3.5 Academic Achievement – Changes Over Time. In their comprehensive meta-analysis of how self-regulated learning influences achievement and how factors moderate this correlation, Dent and Koenka (2016) found that academic performance is significantly correlated with both the cognitive strategies and metacognitive processes of self-regulated learning. Although the correlation between self-regulated learning and academic achievement became significantly stronger when students reached the older years of secondary school (16-18 year olds), interestingly the meta-analysis identified the weakening of the correlation between self-regulated learning and achievement when students transition into secondary school. Although a year younger than the students cited in their meta-analysis, the participants of this research (Year 9, 13-14 year olds) have also just transitioned from primary to secondary school where it might be these students' first exposure to a departmentalised curriculum, academic tracking and monitoring in addition to other factors that could influence variation in achievement (Benner & Graham, 2009; Dent & Koenka, 2016). These explanations offer support for the results gained relative to Research Question 2 in the present study, as although students' self-regulated learning skills and academic achievement improved across timepoint, self-regulated learning skills did not accurately predict their level of academic achievement as shown by test performance. That said, as the nature of academic tasks becomes more challenging across the course of an academic year, and indeed throughout students' secondary school careers, these tasks will require more adept, frequent and effective use of self-regulated learning strategies in order to successfully complete tasks and improve academic performance.

Within the context of results of the ANCOVAs conducted to examine the extent to which students' self-regulated learning skills predict test performance, it is interesting to note Dent and Koenka's (2016) interpretations of findings relative to the cognitive and metacognitive components of self-regulated learning and students' academic achievement. The authors state that while cognitive strategies allow students to learn, metacognitive processes ensure that they have done so. Active self-control and self-observation, the two sub-processes in the performance phase of Zimmerman's (2000, 2013) model of self-regulated learning, enable students to identify a divergence between a learning goal and task performance, adapting their approach, making the necessary adjustments in order to successfully complete the academic task and achieve their learning goal. This is especially pertinent when considered relative to the subject in which academic performance is measured. In terms of curriculum subjects, Social Studies and the Humanities yielded a significantly stronger association with metacognitive strategies whereas Mathematics and Science provided stronger associations with cognitive strategies.

It is possible however, that there is a delay to the effect of the intervention in terms of its impact on students' academic achievement as shown in their Science test performance scores. As highlighted in Papers 6 and 7, whilst there were no significant correlations between self-regulated learning skills and timepoint, it was noted that the strength of the correlations increased across timepoint, with the lowest *p*-value at timepoint 3 for the SRLEDS weighted score data. The strengthening of these correlations infers a delay to the effect of the intervention in terms of students' test performance. Research by Mevarech and Amrany (2008) found that after controlling for prior achievement, students who were exposed to a metacognitive instructional method designed to support the development of their metacognitive regulatory strategy use (IMPROVE) significantly outperformed the control group on the delayed post-test ($F(1, 58) = 4.79$, $p = .033$). Significant differences were found on Regulation of Cognition ($F(1, 58) = 4.55$, $p < .05$) with students that received support for the development of their metacognitive strategy use reporting significantly higher Regulation of Cognition than the control group (Adjusted $M = 3.6$ and 3.3; $SD = 0.3$ and 0.5, for IMPROVE and control groups, respectively; effect size = 0.48). Linking the findings of Mevarech and Amrany (2008) to the present study, it provides support to the notion that there might be a delay to the impact of the intervention in terms of students' test performance, with a longer timeframe required after the intervention in order for students' self-regulated learning skills to accurately predict test performance.

As in the present study, most studies that explore outcomes of self-regulated learning do so in a single subject (Dent & Koenka, 2016). Whilst the cognitive and metacognitive strategies are important skills to master regardless of academic domain (Dent & Koenka, 2016; J. Lee & Shute, 2010), students' use of these skills which underpin self-regulated learning may vary based on the subject domain (Wolters & Pintrich, 1998). Research by the same authors (Wolters & Pintrich, 1998) found a main effect for subject area ($F(2, 542) = 17.96$, $p < .001$), confirming their hypothesis that cognitive strategy use would differ across subjects, however no main effect was found for subject area when analysing classroom performance ($F(2, 542) = 0.08$, $p > .01$).

Again, drawing on Dent and Koenka's (2016) comprehensive meta-analysis of the factors that moderate the correlation between self-regulated learning and achievement, the results show that the correlation between metacognitive processes and achievement varied significantly based on the academic subject under fixed-effect assumptions ($Q_b(3) = 143.48$, $p < .001$) and random-effects assumptions ($Q_b(3) = 8.99$, $p = .03$). Interestingly, within the context of the American and Canadian research included in this meta-analysis, the correlation was strongest for Social Studies ($r = .34$, 95% CI [.27, .40], $k = 7$) followed by Science (r = .26, 95% CI [.09, .42), $k = 9$), English/Language Arts ($r = .23$, 95% CI [.18, .29], $k = 28$), and finally Mathematics ($r = .21$, 95% CI [.16, .26], $k = 39$)(Dent & Koenka, 2016).

It is important to note the relative strength of the correlation and its place in the rank order of subjects for Science, the subject from which test performance data was collected for the present study, which when used to examine the extent to which test performance predicted students' self-regulated learning skills, did not yield any significant results. Studies have shown that there is systematic variation between subjects (e.g. Grossman & Stodolsky, 1995; Stodolsky & Grossman, 1995), and as such each subject area constitutes a distinct context that influences students' self-regulated learning (Dent & Koenka, 2016). Wolters and Pintrich (1998) comment on how teacher's beliefs about the nature of their subject influences instruction practices, with Mathematics representing a distinct context reflecting it's defined, sequential and static nature. Linking to this, the GCSE Science curriculum followed in English secondary schools is more akin to American and Canadian Mathematics, rooted in highly structured, linear tasks that are more sequential and static in nature compared to other subjects in the Year 9 curriculum, such as English or the Humanities. Research by Lodewyk et al. (2009) builds on this discussion, with students reporting that highly structured tasks such as those in GCSE Mathematics and Science required less frequent use of cognitive and metacognitive strategies than on less-structured subjects (e.g. English, Humanities, Arts). Given the theoretical and empirical reasons outlined above, stronger self-regulated learning skills will therefore be required to achieve more highly on less-structured tasks than on highly structured ones, providing support for the findings of this research where no significant relationship was found between students' self-regulated learning skills and test performance. It also offers a theoretical insight that helps to account for why student's self-regulated learning skills did not accurately predict test performance.

8.2.3.6 Year 9 Curriculum Structure. To provide further context to the findings relative to Research Question 2, it is also important to consider the structure of the department-level, subject-specific curriculum that students study in Year 9. Unusual relative to the state maintained sector where typically students begin secondary school at Year 7 joining from a small number of feeder primary schools, students join the research setting for this study at the start of Year 9 from a large number of primary schools (50+). As such, students joining the school do so from a diverse range of learning experiences to that point, both in terms of the subject-specific curriculum studied and also in terms of the degree to which self-regulated learning skills have been explicitly or implicitly supported and guided. In terms of the findings of this study, these factors specific to the local context of the research setting are noteworthy as the structure and progression of the Year 9 curriculum is developed with this in mind. As such, topics studied at the start of the academic year provide a strong foundation in terms of subject-specific knowledge and understanding, aiming to bring all students quickly up to the same level. Across the rest of the academic year, like many curriculum structures, the material studied becomes increasingly complex and challenging. When the subject-specific content becomes more challenging, understanding the material on a conceptual level becomes especially important in order to achieve a higher level of academic performance (Brookhart, 1994; Crooks, 1988; Dent & Koenka, 2016; Eccles et al., 1993). Whilst this point draws together a number of strands explored within the discussion so far, the findings of this study contrast with the literature and previous research.

In order for students to access a higher level of academic achievement when tested on material that is more challenging therefore requiring greater conceptual understanding, they require stronger self-regulated learning skills, effectively combining cognitive and metacognitive processes to facilitate learning and ensure that they have done so (Dent & Koenka, 2016). As more active participants in the process of learning, stronger self-regulated learners use a variety of appropriate cognitive and metacognitive learning strategies to supervise their own progress in order to achieve their goals relative to their engagement with more challenging material (Lavasani et al., 2011). As such, they are aware of their academic strengths and weaknesses, and have a repertoire of strategies at their disposal to support achievement efforts, in turn developing their conceptual understanding (Kaur et al., 2018). As numerous studies suggest (e.g. Bail et al., 2008; Broadbent et al., 2020; Dörrenbächer & Perels, 2016a; Schmitz & Wiese, 2006), discipline-independent training interventions used in previous research have shown increases in longer-term academic outcomes. Whilst both students' self-regulated learning skills and their test performance improved over the three timepoints of this research, it can be argued that the timeframe of two academic terms was not long enough for the increase in academic outcomes to be accurately predicted by self-regulated learning skills. This will be elaborated on in Section 8.3.5, Future Research Directions.

Research conducted by Lavasani et al. (2011), found that the explicit teaching of self-regulated learning strategies through a training intervention had a significant effect on the academic achievement and self-efficacy of students. This also aligns with the findings of research conducted by Pintrich and de Groot (1990), who found that self-efficacy was positively correlated with both prior and subsequent academic achievement. Forming an important component of students' self-motivation beliefs within the forethought phase of Zimmerman's model (2000, 2013), students' self-efficacy is worth noting relative to the present study. Defined in Paper 2 as an individual's belief in their capacity to execute the behaviours necessary to produce specific performance attainments (Bandura, 1977), the findings of previous research are no surprise. Whilst self-efficacy was not isolated and measured separately in this research, there are a number of items across both the MSLQ and SRLEDS that target this important self-motivation belief (e.g. items 5, 12, 20, 29 and 31 from the MSLQ, items 11, 12 and 30 from the SRLEDS). As such, although students' self-regulated learning skills did not accurately predict students' test performance, the observed increase in both of these measures would support the notion that individuals' self-efficacy improved across the academic year, perhaps to some extent in response to the training intervention. Whilst correlations between self-efficacy and academic achievement as shown by test performance scores are not analysed and reported as part of this research, it does give rise to an additional avenue of future research in response to *The Teddies Curriculum 2.0* training intervention.

8.2.4 Discussion of Differences between Weighted Scores and Average Scores

Before exploring the limitations of this research, it is important to highlight and account for the differences in results between the *weighted scores* calculated using Thurstone's (1947) method used to address factorial non-invariance across timepoint, and those calculated using *average scores*. To recap, the factorial non-invariance highlighted in

Section 5.4 of Paper 5 was overcome following a method devised by Thurstone (1947) whereby factor scores generated from exploratory factor analysis at timepoint 1 were used to calculate *weighted scores* for timepoints 2 and 3. In terms of the *average scores*, these were calculated as another layer of support in addition to the *weighted scores*.

The fundamental aim of any parametric analysis comparing latent mean scores over time is to capture changes in latent score or alpha change (Brown, 2015). However, in light of the marked jump observed in students' self-regulated learning skills between timepoints 1 and 2 it is possible that the results for the *weighted scores* reflect changes in the construct being measured (gamma change) or changes in the measurement proportions of the indicators (beta change) (Lommen et al., 2014). Drawing on the results detailed in Paper 6, statistically significant changes were observed in both Group A and Group B's self-regulated learning skills between timepoint 1 and 2, shown visually in Figures 6.3.1, 6.3.2, 6.4.1 and 6.4.2, and also to a lesser degree although still statistically significant in Figures 6.5.1 and 6.5.2. Thurstone's method was employed to overcome the challenge presented by factorial non-invariance across timepoint, but rather than the results of the parametric tests conducted using *weighted scores* capturing alpha changes, as was the intended aim of this research, it could be that these results are masking the effects of the various factors affecting the year group as a whole (see previous sub-section, Section 8.2.3), resulting in this marked jump in students' self-regulated learning skills.

If the intervention alone was responsible for the changes observed, as much of the previous research suggests (Dignath & Büttner, 2008; Hattie, Biggs, & Purdie, 1996; Raaijmakers, Baars, Paas, et al., 2018), then there would also be a visible and statistical difference between Group A and B's self-regulated learning skills across timepoints 1 and 2, and then also across timepoints 2 and 3. Whilst differences were observed between Group A and B's mean weighted factor scores across timepoints, especially at timepoint 3 where

Group B's scores were higher for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS, the fact that the changes follow a very similar trajectory suggests that something was happening within the setting in terms of supporting the development of self-regulated learning skills, in addition to the intervention itself. This could be a function of changes to the local context of within the research setting, during the academic year 2017/18, when the intervention was delivered and data was collected.

8.3 Limitations and Future Research Directions

The limitations section explains the unexpected circumstances that constrained the interpretation of the findings of this research. Whereas delimitations are anticipated constraints, limitations are the unanticipated constraints associated with sampling, the measures, the procedure and the data analyses. As such, this section will be structured using these headings, considering the generalizability of the findings to other groups and contexts, before exploring suggestions for future directions in research.

8.3.1 Limitations in Sampling

In terms of sampling, whilst the sample size of the present study easily exceeded the minimum total sample size for calculated through a power analysis for *F*-tests (32 for ANOVA and 71 for MANOVA), the power of the parametric tests run to analyse the data was not as high as it would have been with a larger sample. As differential analyses were conducted to avoid the misinterpretation of training effects, an even larger sample size is needed to derive more valid conclusions. Linking to this, it is possible that some training effects of the intervention might not have been detected due to the smaller statistical power. Additionally, a larger sample size would permit including personality factors within the investigation of differential training effects and to investigate them in combination with self-regulated learning profiles, an exciting potential avenue of future research. A larger sample could only have been achieved by significantly increasing the scale of the study to include more year groups within the school or Year 9 groups from other, similar settings; something not viable given my professional commitments within the school in addition to more practical, setting-specific challenges.

Whilst the proportion of participants who completed the surveys relative to the total number of students in the year group was high, it is important to question and acknowledge the extent to which a lack of representativeness has biased the results. Unlike most school-based research, this study was characterised by high consent rates, low percentage of non-response and only one participant dropping out of the research, owing to a change in schools halfway through the year. As such, the sample size has placed only a negligible constraint on the interpretations of the findings of this research.

It is also important to reflect on the ethical conditions surrounding the recruitment of participants, achieved through the delivery of a year group assembly in students' second week at their new school. Whilst students were offered the opportunity to participate in the research by gaining their voluntary informed consent, it is important to consider the extent to which students at such an early stage in the secondary school careers, felt compelled to participate rather than of their own volition.

In terms of the sampling strategy itself, participants were divided into two groups through convenient or purposeful sampling by way of their Form groups (Bryman, 2012). The justification for this decision was rooted in practical considerations, in that the nature of both the school timetable and subsequent structure of Form groups, random allocation of participants to groups simply wasn't viable. However, if modifications were made to the timings of the intervention sessions by timetabling these as formal lessons within the school timetable, in much the same way as you would for a curriculum subject like Mathematics, then this would allow for students to be allocated randomly to sets to receive the intervention, signalling a movement towards more of an experimental design. This would allow for the potential for the sampling to take on more of a randomised control trial structure; the use of which has increased significantly in educational research over the last 15 years (Connolly et al., 2018). A hotly debated topic in educational research (Connolly et al., 2017), randomised control trials are unique among research designs as they provide a practical solution to issues of bias in results in terms of the effects of interventions, policies and practices (Styles & Torgerson, 2018). Despite sustained criticism from some sections of the education research community (Connolly et al., 2018), a randomised control trial research design would allow for a less biased sampling strategy; something to be picked up in Section 8.3.5, Future Research Directions.

8.3.2 Limitations in the Measures

As with sampling, it is important to question the extent to which the instruments used in this study adequately operationalized the variables measured. With regard to the MSLQ, as a measure it aligns strongly with the underpinning theoretical framework of this research as it is based on a broad social-cognitive model of motivation and learning. Also, as a valid and reliable instrument used widely within the field of self-regulated learning research, it represents a useful and valid means for assessing students' motivation and learning strategy use in the classroom (Garcia & Pintrich, 1996; Pintrich et al., 1991, 1993). In terms of the internal consistency of the MSLQ, although there is some variation in the Cronbach's alphas calculated across the three timepoints, alphas gained in this study are broadly in-line with the original reliabilities as calculated by Pintrich et al. (1991), even exceeding the original alphas on some sub-scales. It is, therefore, a reliable measure and can be used effectively to yield data to help answer the research questions from this study.

As a new measure developed specifically for this research, the SRLEDS represents a tailored self-report instrument, tightly focused on *The Teddies Curriculum 2.0* and the 10 self-regulated learning skills that comprise it. To create the instrument, items were selected from pre-existing instruments used widely in self-regulated learning research (Dörrenbächer & Perels, 2016a; Leidinger & Perels, 2012; Pintrich et al., 1991), or new items were developed using existing ones as a framework to cover the relevant skills of *The Teddies Curriculum 2.0*. Each of the 30 items on the SRLEDS was responded to on a four-point Likert scale (Strongly agree, agree, disagree, strongly disagree), however by providing participants with more options on the Likert scale this would yield more detailed insights into self-regulated learning and help to avoid potential ceiling effects which a four-point scale might facilitate. In terms of the reliability of this instrument, the overall reliability was strong as shown by Cronbach's alpha (α = .83, M = 58.4, SD = 6.6). However, in terms of the sub-scales that comprise the instrument itself, there was some variation in the reliabilities of the sub-scales across timepoints. At their lowest (e.g. Goal Setting at timepoint 2, α = .13), a minority of sub-scale reliabilities were weak, calling into question the reliability of specific sub-scales within the measure in terms of their ability to accurately measure and capture students' self-regulated learning skills. However, given the strength in Cronbach's alpha demonstrated for the overall scale, the SRLEDS represents a reliable measure that has been used to gain valid data used to answer the two research questions of the present study.

Whilst the SRLEDS was conceived as an objective and discipline-independent tool to assess students' self-regulated learning at given timepoints and, in turn, capturing any potential changes to students' self-regulated learning skills, it might only provide potentially limited utility in other research as it is a tailored, original measure tightly focused on *The Teddies Curriculum 2.0*. That said, as the items themselves were either taken from existing instruments or devised using others a framework, this instrument can be used in future self-regulated learning research, especially if the intervention was also rooted in Zimmerman's model of self-regulated learning (2000); the theoretical framework underpinning this research.

A major limitation of this study is that as both measures used to collect data in this study were self-report in nature, conclusions can only be drawn based on students' perceptions of their self-regulated learning skills. As highlighted in Paper 3, self-report data relies on judgements concerning one's own behaviour and therefore may be distorted by memory retention, social desirability or generalisation problems (Dörrenbächer & Perels, 2016a; Winne & Perry, 2000). However, McCardle and Hadwin (2015) cogently argue in favour of their use, stating that self-report measures provide important information for examining and interpreting self-regulated learning even when the reports are inaccurate or skewed. Whilst relations between variables could be inflated due to method bias, the self-report nature of the measures provided students with a valuable opportunity to reflect on their own learning in a more formal way than perhaps they were used to at their previous schools. This is an important learning skill within the context of this research, emphasised in both the *The Teddies Curriculum 2.0* and forming one of the three cycles of Zimmerman's (2000) model of self-regulated learning.

A more practical limitation and consideration is that the MSLQ is a much longer measure than the SRLEDS (MSLQ – 80 items), with anecdotal participant feedback negatively skewed in terms of the length of time taken to complete the survey relative to the shorter SRLEDS (30 items). This feedback also aligns with data gained from Qualtrics, the survey platform used to administer the two surveys, which suggested that some students spent less time completing the MSLQ for the third and final time at the end of the second intervention cycle. Although no student spent less than eight minutes completing the survey (480 seconds as measured on Qualtrics), it is important to acknowledge this as a limitation, possibly a demonstration of survey fatigue; a component of respondent burden (Porter et al., 2004). Linking to this, research conducted by Sharp and Frankel (1983) found that instrument length was the only experimental variable (others include effort required to answer questions and the administration of a second interview as a follow-up to the first), which yielded statistically significant differences in burden perception. Interestingly, as an attitudinal factor, belief in the usefulness of the survey was strongly associated with low burden perception (Sharp & Frankel, 1983). Given the repeated measures, pre-test post-test research design of this study, it is important to acknowledge that participants were required to complete the same surveys three times in relatively quick succession, giving rise to the potential for negative burden perception about the survey completion.

8.3.3 Limitations in the Procedure

In terms of the procedure itself, it was executed according to the plans outlined in Paper 4 with very few unforeseen problems impairing progress through the two cycles of intervention delivery. In this regard, both the students and my colleagues were superb in the manner in which they engaged with the research, allowing the successful delivery of the procedure prescribed as part of the research design (see Section 4.5). That said, as within any live school setting, there were some minor practical and logistical issues encountered that can be characterised as unanticipated constraints that are documented here.

Firstly, the timing of the intervention sessions. As described in Paper 4, the weekly intervention training sessions took place on a Wednesday afternoon during Period 6 (15.30-16.25). As with any school timetable, lessons that fall at the end of the day are sometimes less productive than those at the start or those that immediately follow a break. This is a function of students' physical and mental fatigue having engaged with five 55-minute lessons already, in addition to the various other activities that comprise the school day in a busy boarding school. For Year 9, the year group providing the sample for this research, this lesson is normally ring-fenced for supervised prep forming the main justification as to why this lesson was used to deliver the intervention to half the year group, as there would be no disruption to academic lessons. However, given the points made above, by moving forward the lesson in which the intervention was delivered and removing *the Period 6 effect* as it is affectionately known in school staff rooms, this might have served to enhance student experience and engagement whilst also increasing the implicit importance of the research through a more central place within the shape of the day.

Whilst the delivery of the intervention fell within the formal school timetable, as with any school there are some infrequent calendared events that give rise to pupil absence from lessons, in addition to more *ad hoc* pupil absence through either illness or attendance at music lessons for example. To overcome this, a register was taken at the start of each session and the associated resources from the session were forwarded in both electronic and hard copy to the students that missed any sessions (see Table 4.5.1). Whilst sub-optimal relative to attending the session itself, students were encouraged to complete the activities with guidance from their peers during supervised prep sessions later the same day, with further support provided by me as requested by the students and their academic tutors.

Moving away from more practical, prosaic limitations in terms of the procedure, it is also important to consider broader, more holistic constraints. Bandura (1986) emphasised the importance of mastery experiences in the development of self-efficacy. The design of this research was focused on two cycles of intervention, book-ended by three data collection points: before the first cycle, at the end of the first cycle, and after the second cycle. Linking to Bandura's comments, one limitation was the relatively short-term nature of this longitudinal study lasting two terms in total, giving rise to whether this timeframe provided students with enough mastery experiences for the development of self-efficacy, a key component of Zimmerman's (2000) model of self-regulated learning, the theoretical framework underpinning this research. Furthering this, Hager et al. (2000) outline the effects of a post-interventional increase, where having received the training intervention the effects of the training increase over time, described as a long-term development boost. In light of this, the lack of a fourth timepoint of data collection potentially falling after the participants' end of academic year exams sat in June is a valid limitation worthy of discussion. By not extending the data collection into the Summer Term to include a fourth data collection point, this limits the ability of the research to capture any potential post-interventional changes to students' self-regulated learning skills, changes achieved through the provision of more opportunities for mastery experiences, where students are able to practise and apply the skills they have been taught as part of the intervention. To that end, as Dörrenbächer and Perels (2016a) suggest, it would be interesting to know how long the effects of the training intervention will last, and if indeed a change occurs after achievement feedback such as the end of academic year exams.

8.3.4 Limitations in the Data Analysis

As highlighted in Section 5.4, the variance observed in factor scores calculated for the MSLQ-Motivation, MSLQ-Cognitive and SRLEDS across all three timepoints rendered comparison inappropriate. Van De Schoot et al. (2015) state that if factor scores are to be compared in a meaningful and unbiased way across groups and timepoints, the measurement structures and their survey items should be stable or invariant. In response to this, the present study made effective use of a process outlined by Thurstone (1947), who proposed a *coarse* factor scoring method to overcome factorial invariance. In light of this, *weighted scores* were manually calculated for each instrument at each timepoint, allowing the same parametric tests to be performed and analysed as detailed in Section 5.1, Data Analytic Plan.

The reason this is raised as a limitation is that whilst a research-informed approach was used to address and overcome the factorial variance, enabling the same analyses to be conducted as originally proposed, the calculation of the weighted scores could have masked the effect of intervention through the marked jumped in self-regulated learning observed in both groups across timepoints. Although unavoidable given the method of calculating the weighted scores, it is important to note this here as the extent to which this has impacted on the data analysis is unknown, hence why the same analyses were conducted using the average scores as a self-check of sorts. Although not a limitation as such, a significant investment of time was required to source a solution to the problem of factorial non-invariance in addition to the time taken to apply the procedure across all data, hindering any progress in terms of data analysis itself. That said, it was imperative that this unexpected circumstance was given due care and attention, as without clarity and accuracy with regard to these data, any subsequent analyses would be meaningless and would serve to undermine the study as a whole.

8.3.5 Future Research Directions

This section offers a number of suggestions for future research directions. However, before these are presented, I would like to propose a new research design in response to the discussion and limitations cited in this paper.

8.3.5.1 Proposed Changes to Research Design. This research has highlighted some of the challenges surrounding the use of control groups within a quasi-experimental design; an approach common in education programme evaluation (Walser, 2019). The lack of random assignment of participants used in this research increased the threat to the internal validity, as although students, classrooms and schools can be matched on a number of known and observable variables, they may differ on other unknown and/or unobservable variable in a way that differentially impacts results (Walser, 2019). This is certainly the case in this research, despite the carefully considered research methodology. The two groups forming the non-equivalent group design in this research were as evenly matched in terms of demographic characteristics as much as normal school conditions allow, in addition to the offset delivery of *The Teddies Curriculum 2.0* intervention creating the control group as part of the quasi-experimental design. However, as detailed in Section 8.2.3, it is the unknown and unobservable variables that have undermined the research design and methodological approach of this research, impacting the results. It is clear that as discussed earlier in this paper, the school-wide emphasis on the development of students' self-regulated learning skills has had an impact on the integrity of the intervention and the control group, with the intervention seeping into whole school practise. It has been suggested that this accounts for the overall increases in students' self-regulated learning skills across timepoint, with no significant differences observed between groups. Although a movement towards an experimental design would, to an extent, enhance a teacher-researcher's ability to evaluate the effectiveness of educational programmes or interventions, Szafran (2019) state a number of ethical and practical reasons (e.g. timetable, lesson allocation, resources etc.) that regularly prevent the use of experimental designs in assessing the impact of educational programmes.

In response to the challenges and limitations surrounding the implementation of control groups as part of the quasi-experimental design of this research, I would like to propose an alternative research design through the use of *historical cohort control groups*. A cohort is a group of people considered to have similar demographic or statistical characteristics, and in teaching this term is used to describe successive year groups within a school. Walser (2019) argues that through the use of a historical cohort control group, it is possible to conduct a quasi-experiment comparing the outcomes of a treatment group that receives a treatment to those that do not. Furthering this, Shadish et al. (2002) contend that cohorts are particularly useful as control groups if: (a) one cohort experiences a given intervention and earlier/later cohorts do not, (b) cohorts differ in only minor ways from their contiguous cohorts, (c) schools insist that an intervention be given to everybody, thus precluding simultaneous controls and making possible only historical controls, and (d) a school's archival records can be used for constructing and then comparing cohorts.

In terms of the design itself, I would propose that this research could be run over two years, using two consecutive Year 9 cohorts at the school. The first year could be used as the control group, who do not receive the intervention but complete both the MSLQ and the SRLEDS at the start and end of the academic year to measure any *normal* change in self-regulated learning across the year. The second cohort of Year 9 students could be the intervention group who receive the treatment, namely *The Teddies Curriculum 2.0*. However, rather than a short, intense 10-week intervention, this could be delivered across the academic year with enough time for two sessions on each of the 10 skills that comprise *The Teddies Curriculum 2.0*. I would also suggest that within this second cohort the group is divided into two, with one group receiving just the intervention and the other completing an online app-based learning diary to support their metacognitive reflections whilst also receiving the intervention. As in this study, students' test performance data could be collated across both academic years to observe changes in academic achievement, however in addition to this, I would also suggest using students' end of year exam results from all Year 9 curriculum subjects, not just the three separate sciences as used in this study.

This research design would yield a wealth of data to compare to that of the control group provided by the historic cohort from the previous academic year, also addressing many of the challenges and limitations of implementing experimental or commonly used quasi-experimental designs in school settings (Szafran, 2019). Due to its feasibility and appropriateness in addressing many of these challenges, the use of historical cohort control groups presents an attractive and viable option for teacher-researchers. Walser (2019) also cites a number of benefits to this design, in that no students are denied access to the intervention in order for a control group to be formed, in addition to the fact that no new data collection is needed as data comes from archival sources, therefore decreasing the resources required in addition to minimising, even eliminating, disruption to school routines. As a teacher-researcher working individually on this study, this approach provides a number of benefits. However, within the context of a busy secondary boarding school, minimising the resource needs and practical implications for the research setting will also serve to gain the *buy-in* required from the school's senior leaders, not just to support the research being conducted, but also to act in response to the findings, fostering a positive and sustainable school-wide impact.

8.3.5.2 Proposed Changes to Intervention. The previous section outlined a number of proposed changes to the research design of this study, including the use of historical cohort groups (Walser, 2019), extending the length of the intervention to a full academic year, and also the use of a learning diary. The use of historical cohort groups has been described and justified at length in Section 8.3.5.1, and therefore the focus of this section will be on the benefits of stretching the intervention across one academic year and the potential use of a learning diary.

The main benefits of stretching the intervention from two terms, as in the present study, across an academic year would be three-fold. Firstly, lengthening the research would provide additional time for the delivery of the intervention itself. The discipline-independent intervention underpinning this research, *the Teddies Curriculum 2.0*, could then be delivered across a longer timeframe than the intense, 10-week period in which it was delivered in the present study. This would allow for more time to focus on each of *The Teddies 10* key skills that comprise the intervention, affording students more time to practice the delivered skills as part of the intervention, before then applying them across the academic curriculum. Linking to this, the second benefit would be the increased opportunity for students to apply and practice their newly acquired self-regulated learning skills within subject areas that comprise the Year 9 curriculum, in light of the additional term of research and data collection. The final benefit of stretching the intervention over one year also outlined in Section 8.3.5.1, would be that additional data can be collected from students' end of year examinations. These are terminal exams sat at the end of the academic year in June, where students are examined in all subjects studied as part of the Year 9 curriculum. This would provide a substantial volume of additional data that could then be analysed in response to research question 2 which seeks to explore changes in students' academic achievement and the extent to which their self-regulated learning skills predicts their academic achievement.

In Section 8.3.5.1 the use of a learning diary was also discussed relative to the proposed changes to the research design. Furthering this, Wallin and Adawi (2018) state that reflection and metacognition are core elements in self-regulated learning. The authors contend that active learning methods should encourage students to reflect not only on the content, but also on their own thinking and learning to support the development of metacognition needed for productive self-regulated learning (Flavell, 1979; Vos & Graaff, 2004; Wallin & Adawi, 2018). Linking to the three phases of Zimmerman's model of self-regulated learning, learning diaries also support the development of planning, self-monitoring and self-reflection (Broadbent et al., 2020). Research by Dignath-van Ewijk et al. (2015) by and Schmitz and Perels (2011) provides empirical support for the use of learning diaries, where their use was shown to increase self-efficacy, self-regulation and metacognitive skills and attitude (Broadbent et al., 2020). More recent research from Yan (2018) showed that learning diaries significantly enhanced students' self-efficacy, intrinsic value and academic achievement, with students of lower past achievement benefiting more than other students from the intervention. That said, the previous research highlights the importance of both the intervention and the learning diary in combination, as shown in a study by Dignath-van Ewijk et al. (2015) who found an effect for the combined learning diary and university course on self-regulated learning group, but no effect for the learning diary alone. These findings are also supported by research conducted by Dörrenbächer and Perels (2016a), who outline statistically significant increases for the Combination Group (training and learning diary). As such, the potential use of a learning diary alongside the discipline-independent intervention would provide strong support for the development of students' self-regulated learning skills.

In terms of supporting the development of students' self-regulated learning skills, in addition to any potential academic benefits, the learning diary also has several practical advantages. Firstly, as the completion of the learning diary does not require any instruction time, students are able to complete this outside of both the formal school timetable and the intervention during either prep or their free time (Yan et al., 2020). This serves to further support and reinforce the development of students' self-regulated learning skills introduced and taught during the intervention itself. Linking to the discipline-independent nature of the intervention underpinning this study, the learning diary is general, rather than subject-specific, and can therefore be easily applied to different contexts. Lastly, as highlighted by Panadero et al. (2016) the learning diary can be used as a tool to combine intervention and measurement, not only supporting the development of students' self-regulated learning skills, but also providing rich data for analysis and discussion.

8.3.5.3 Measuring Self-Regulated Learning. Picking up on the limitations highlighted in Section 8.3.2 relating to the self-report nature of the measures used in this study, it is difficult to find an objective and discipline-independent measure (Dörrenbächer & Perels, 2016a; Veenman, 2011). This forms the major justification for the creation of the SRLEDS for this study, used alongside the MSLQ as a discipline-independent measure to capture changes in students' self-regulated learning skills across timepoints. However, despite the addition of this measure to the self-regulated learning research landscape there is the opportunity for future research in the field to develop an objective self-regulated learning instrument that covers long-term learning cycles, and in doing so gives rise to the potential for an enhanced insight as to how these cycles are linked and develop over time.

8.3.5.4 Self-Regulated Learning and Personality. In their research into the relationship between learning and study strategies and big five personality traits, Kokkinos et al. (2015) assume that students' personality influences the way in which students react to different learning tasks in addition to their selection of different learning strategies (Dörrenbächer & Perels, 2016b; Entwistle & McCune, 2004). This aligns with Heinström's (2000) argument that students' personality traits can promote or hinder motivation and learning strategies, also suggesting that students' personality traits are expressed in the manner with which individuals negotiate different learning tasks. In light of this, a future research direction would be to examine the relationship between self-regulated learning and personality more closely, allowing interventions to be tailored to students' preferences and personality, potentially enhancing the impact of the intervention. This aligns with a direction proposed by Bidjerano and Dai (2007) following research using personality variables as predictors of students' self-regulated learning, who suggested using personality variables as moderators to see whether certain personality characteristics facilitate or impede the acquisition of self-regulatory skills under a treatment condition.

There is also a clear implication for school practice here, as if classroom teachers become more aware of individual differences in terms of both personality and self-regulated learning skills, then they are able to adapt their instruction methods and resources to provide better support to students, yielding an even greater impact on students' learning and subsequent achievement. This links to comments by Vygotsky (1978), who stated that in order for educators to know where their students are going, they need to also know where they are coming from. By having a greater awareness of students' antecedent characteristics that they bring with them to present learning experiences, as teachers we are better placed to provide a more tailored and personalised experience, optimising learning opportunities. An example of this is cited by Kokkinos et al. (2015), who suggest that in the case of a student displaying neurotic antecedent characteristics, a range of information processing strategies can be provided to support their learning by making effective use of these strategies to logically work through learning tasks serving to limit any anxious or neurotic thoughts. Within the context of well-being and pastoral care provision, something of significant importance in any school, not least a boarding school, research that explores how an improved awareness of students' antecedent characteristics impacts on their acquisition and development of self-regulated learning skills might yield some significant implications for professional practice.

8.3.5.5 Differentiating the Intervention. In terms of the training intervention used in this study, it was very much a one-size-fits-all model, whereby the sessions were delivered to half a year group at a time (either Group A or Group B). As such, there was little scope for effective differentiation at the individual level, supporting students with different competencies and skillsets in terms of self-regulated learning. As such, it is likely that not every student benefited from the intervention to the same extent. Several authors point out that a person-centred approach has rarely been used in self-regulated learning research (e.g. Bidjerano & Dai, 2007; Dörrenbächer & Perels, 2016b). Linking to Winne's (1995) comments on the five sources of self-regulated learning differences (domain knowledge, knowledge of tactics and strategies, performance and regulation of tactics and strategies, and global dispositions), an exciting future research direction would be the development of a training programme that was oriented towards these components, with a view to providing more effective, personalised support to different types of self-regulated learners. Furthering this, Niemivirta (2002) also suggested studying the possible aptitude treatment effects of a training intervention relative to different types of self-regulated learners.

Another alternative line of research proposed by Reschly et al. (2007) focuses on the *response to intervention* approach, where an intervention's progress is monitored and adapted in response to the impact on the participants. Linking to the points made in the previous sub-section relating to a more person-centred approach to self-regulated learning research (see Section 8.3.5.3), this line of research serves to address some of the limitations of this study's procedure whilst yielding a positive impact on students' self-regulated learning skills. This approach could incorporate the monitoring of students' personality traits in the early stages of the intervention, allowing for the effective differentiation of the intervention in terms of the delivery of strategies to support the development of self-regulated learning. The addition of a learning diary, allowing students to record their on-going thoughts and reflections in response to the training intervention, might also serve as a useful tool to monitor student progress in addition to providing more and different data for analysis.

8.3.5.6 Sampling Strategy. As highlighted in Section 8.3.1, Limitations in Sampling, the use of convenient or purposeful sampling to divide participants into two groups using the existing Form group structure within the school was highlighted as a limitation of the study. Although justified in terms of both practical and logistical considerations surrounding the shape of the school day and its timetable, it can reasonably be suggested that sampling could follow a randomised control trial structure. Unique among research designs, the use of randomised control trials has increased significantly over the last 15 years as they are able to obtain less biased results about the effects of interventions, policies and practices (Connolly et al., 2017, 2018; Styles & Torgerson, 2018). That said, Broadbent et al. (2020) state that very few studies have conducted robust randomised controlled methods that include self-regulated learning training. Whilst randomised control trials have received sustained criticism from some sections of the education research community (Connolly et al., 2018), this type of research design would allow for a less biased sampling strategy. Despite some obvious practical and logistical challenges presented by this research design, for example the availability of students at the same time in the school day, these could certainly be overcome through effective collaboration between the researcher(s) and the senior leaders within the research setting. In terms of the ethical considerations surrounding randomised control trials, as the intervention was designed rooted in the principle that it would enhance students' self-regulated learning skills, ethically it cannot be withheld from half of the sample. As such, in order to be justified ethically the pre-test post-test non-equivalent group design structure used this study could be retained alongside a randomised control sampling approach, where the intervention is not completely withheld, but only delayed.

8.3.5.7 Self-Regulated Learning Interventions and Online Learning. Alonso-Mencía et al. (2020) highlight the trend towards more online learning experiences evident within the education sector, especially at university level. This trend accelerated throughout 2020 in response to the global COVID pandemic, where almost overnight schools, colleges and universities had to shift their learning provision to online platforms. However, Broadbent et al. (2020) state that this shift towards online learning courses threatens to undermine the learning experience unless augmented with targeted resources to enhance students' self-regulated learning skills within this context. There is, therefore, the potential for a tidal wave of research opportunities focusing on the development of secondary school-level students' self-regulated learning skills within the context of online learning. As education moves towards a more *blended learning* environment, drawing on both analogue and digital learning resources, the provision of online training to support the development of students' self-regulated learning skills presents an exciting avenue of potential research. Whilst the research landscape is flooded with studies examining the development of self-regulated learning skills at university level, I am not aware of any studies that have employed an online discipline-independent training intervention following a similar methodological approach as this research within a secondary school context. Linking to this, another potential avenue of research is provided by combination of online training in conjunction with the use of an online app-based learning diary to support students' daily metacognitive reflection.

8.3.5.7.1 Advantages of Online Learning. Broadbent et al. (2020) state that online training overcomes some of the limitations of face-to-face interventions, namely that face-to-face interventions are hamstrung by the number of students that can be trained simultaneously, and also by the need for students to be in the same physical location as the teacher. The delivery of an online intervention to support the development of students' self-regulated learning skills would increase the number of students able to engage with the intervention, perhaps even whole year groups within a school, serving to increase the potential impact of the intervention as measured through the number of students exposed to the discipline-independent intervention. In conjunction with this, online training also allows the same intervention to be delivered across different research settings, harvesting more data for analysis and potentially an even greater impact. This makes online training particularly cost effective, and given the discipline-independent nature of the *Teddies Curriculum 2.0*, has particular utility over face-to-face and discipline-dependent training (Broadbent et al., 2020).

Broadbent (2017) states that a high level of self-regulated learning competency is important for university students' academic success, regardless of study model (face-to-face or online) (Broadbent et al., 2020). Even before the global COVID pandemic took hold, the trends in the university sector were towards more online courses, which require a high level of autonomy and self-direction (Alonso-Mencía et al., 2020; Broadbent et al., 2020). Within the context of the rationale for this research project that calls for the development of life-worthy learning skills, a toolkit of self-regulated learning skills and strategies students need to maximise their academic potential both at school and beyond, this carries significant importance. The acquisition and development of self-regulated learning skills is one of the most important goals of education (Dörrenbächer & Perels, 2016b; Hadwin & Winne, 2001;

Luftenegger et al., 2012; Nota et al., 2004b; Zimmerman, 1986), however the move towards online courses threatens to undermine the learning experience unless augmented with targeted resources to enhance students' self-regulated learning skills.

There are other more prosaic, practical benefits, such as the ease of recording intervention sessions for the benefit of those unable to make the scheduled live time. This would be of significant benefit for those students unable to make the live sessions, allowing them to catch-up on the missed session, but also signalling a move towards more on-demand learning experiences where the students themselves take greater ownership and responsibility for their learning. Linking to this, the ability to deliver the intervention online would also release the pressure for the intervention to be delivered as part of the formal school timetable. Instead, evening prep sessions and potentially even weekends become an option where, as the researcher, I am still able to connect with the students without having to be present with them in-person. This would present some challenges in terms of safeguarding and child protection, however within the context of a co-educational boarding school this would now be considered normal practice and assuming all safeguarding checks and protocols were in place, this would not present a problem.

8.3.5.7.1 Disadvantages of Online Learning. The use of technology to deliver an online intervention to support the development of students' self-regulated learning skills presents some clear advantages, however there are also a number limitations or disadvantages which are considered here. Pedrotti and Nistor (2019) state that given the rising popularity of online-based learning scenarios, students face new challenges compared to traditional, face-to-face classroom settings. Mcmahon and Oliver (2001) cite how the lack of close social interaction in online learning environments significantly diminishes the regulatory mechanisms that ensure students' smooth progression through their course. Furthering this, there is a discrepancy between enrolment and completion rates in Massive Open Online

Courses (MOOCs) (Breslow et al., 2013; Jordan, 2014) which suggests that learning online presents unique challenges relative to analogue modes, and students may require some form of additional support to become successful. Although studying through a MOOC is more open and networked than in other online learning environments, it is interesting to note some of the reasons for the high dropout rates such as inability to understand the course content, insufficient prior knowledge, and also not having the same level of help and support as in face-to-face teaching (Wong et al., 2019).

Azevedo (2005) emphasises that students can struggle in online learning environments because they do not make use of critical self-regulated learning strategies (Wong et al., 2019). Online environments afford higher levels of learner autonomy and lower levels of teacher presence compared to traditional, face-to-face learning environments, stressing the importance of self-regulated learning skills within this mode of learning (Lehmann et al., 2014). This therefore presents a major disadvantage in terms of the online delivery of an intervention to support the development of students' self-regulated learning skills, as if students do not possess a minimum level of self-regulated learning skills at the start of the online intervention then they will struggle to access and engage with the discipline-independent intervention. This line of argument is further supported by evidence from previous studies which showed that learners studying complex topics online are not proficient in regulating their own learning and do not gain conceptual understanding when they are not given self-regulated learning support (Azevedo & Hadwin, 2005; Wong et al., 2019).

Research conducted by Bellhäuser et al. (2016) used online training to enhance Mathematics students' self-regulated learning skills. Whilst they found that online training improved self-efficacy and self-regulated learning knowledge at post-intervention, some contradictive findings were found in relation to a decrease in self-regulated learning behaviour across all interventions, contrasting with a positive improvement in self-regulated learning for the combination group (online training and online learning diary). Broadbent et al. (2020) state that these contradictive findings leave doubt about the efficacy of online training.

Hill and Hannafin (2001) identified four functionalities of supports for the development of self-regulated learning in online learning environments: (a) conceptual support to help learners prioritise information; (b) metacognitive support to assist learners in gauging their learning; (c) procedural support to aid use of resources; and (d) strategic support to provide additional options to complete a task. As when supporting self-regulated learning in face-to-face learning environments, these types of support can come in a variety of forms including tools (e.g. organisers and search functions), additional cues (e.g. questions for learners to reflect and suggestions to use certain resources), feedback (e.g. evaluation of learning), or guidance (e.g. intelligent tutoring system) during learning (Wong et al., 2019).

Moving the intervention online might also have an impact on the attrition rate from the research. This study was characterised by a very low attrition rate, with most students who started the research completing both surveys at all three timepoints. Wandler and Imbriale (2017) state that attrition rates in online learning can be twice as high as a traditional classroom format, with a lack of ability to self-regulate as a significant reason for dropout rates in online courses. Linking to this, another challenge of delivering online training to support the development of self-regulated learning skills is how the shift from face-to-face delivery to online might influence students' perception. Within the context of the research setting, anything that falls within the formal school timetable is compulsory and therefore perceived as being important by the students. Although participation in this study was voluntary, the face-to-face sessions delivered as part of the *Teddies Curriculum 2.0* were administered during period 6 when Year 9 would normally have supervised prep sessions.

Therefore, the movement to online delivery at a time outside of the formal school timetable might serve to lower students' perception as to its utility and importance, potentially increasing the attrition rate and limiting the impact of the intervention.

The final disadvantage that I would like to highlight comes from the critical reflection on this as a classroom practitioner. One of the benefits of sharing the same physical space as students when delivering lessons or training sessions is one's ability to gauge students' response to instruction or learning activities. As a teacher you gain a sense of how explanation has been received by the students and how engaged or otherwise they are with the learning tasks set based on their reaction, body language, and the intangible energy in the room. This is something that would be lost if the intervention were to be delivered online, also forming one of the great challenges felt by classroom teachers during the various phases of remote learning in response to COVID lockdown.

8.3.5.8 Self-Regulated Learning Interventions and the Researcher's Stance Within the School. Research by Dignath et al. (2008) suggests that metacognitive educational interventions generate the largest impact and therefore strongest effects, when they are implemented by their designers. In terms of future research directions, Mannion (2018) makes the link between this and the emerging field of implementation science, underlining the importance of its role in emphasising to school leaders the significance of the person or team delivering the intervention. As Kelly and Perkins (2012) state, the intervention is the person. Moreover, if the intervention is designed to replicate or indeed improve on the evidence from research literature, generating the greatest impact on students' learning, the importance of the person or team delivering the intervention must not be underestimated.

Organisations like the Research Schools Network play an important role in this regard. As a collaboration between the Education Endowment Foundation (EEF) and the

Institute for Effective Education (IEE), the Research Schools Network aims to promote school-based educational research, supporting the use of research evidence to improve teaching practice whilst also building affiliations with large numbers of schools within their regions. Other school-specific examples include the Tony Little Centre for Innovation and Research in Learning at Eton College and the Learning and Research Centre at Wellington College; both similar settings to that in which this study was conducted. These organisations have the potential to harvest a significant impact on future school-based research, affording postgraduate students and academics alike a strong foothold in schools, enabling them to lead and deliver the interventions themselves as an insider within the research setting.

8.4 Reflections and Recommendations for Practice

Although not normally part of an APA-formatted thesis, I feel that this is an important section given the context of the research, the course that it's a product of, and myself as a researching practitioner. One of the ideals of the Doctor of Education (EdD) course at the University of Cambridge is to foster a positive and tangible impact on practice, which sits alongside one of the guiding principles of the EdD's older sibling, the PhD, which is to make a significant contribution to the field. In light of the findings of this research, I would like to offer some personal reflections on aspects of the research process, before outlining some recommendations for practice as to how school settings and specifically teacher-researchers can support the development of students' self-regulated learning skills.

8.4.1 Reflections

Speaking candidly, it is with a strong sense of disappointment that I write this section. As you will have seen from the way that this portfolio has unfolded and the story that it has told, the results are not what I had hoped for when I designed this research project. My hope was to design an intervention that would yield a significant impact on students' self-regulated learning skills, with the pre-test post-test non-equivalent group design clearly showing a marked difference between Group A and B across timepoint. I would, therefore, have been able to write about the utility of self-regulated learning within the context of the secondary education and its importance in supporting the development of what this research dubbed *life-worthy learning skills*. However, for a number of reasons outlined in this paper, it is with a heavy heart that I am unable to do this. Instead, I would like to use this sub-section to reflect on the research process, and in doing so offering an insight into some aspects of this process that I think should be considered by fellow teacher-researchers.

The first reflection I would like to offer is on my experience testing an innovative curriculum intervention within the context of a secondary school. As a researching practitioner, I am motivated by the aim of providing the optimum-learning environment for all students. In doing so, this provides students with the best chance of maximising their academic potential, both whilst at school and in their futures beyond the bounds of formal education. *The Teddies Curriculum 2.0* was conceived as an original, innovative and rigorous curriculum intervention designed to support the development of students' self-regulated learning skills. The research design was formulated in such a way that it would allow the selected instruments to show changes in students' self-regulated learning skills across timepoint in response to *The Teddies Curriculum 2.0* intervention, through the use of a control group (Group B). The rationale for this research design was that by delaying the delivery of the intervention to Group B rather than withholding it altogether, this would not only address some of the ethical considerations surrounding the use of a control group, but would also serve to demonstrate the impact of the intervention itself. As documented in this portfolio, this research has not yielded the impact on students' self-regulated learning that I hoped for.

In light of this, I have proposed an alternative research design using a historical cohort control group which allows for a quasi-experimental approach whilst overcoming some of the limitations of the current study (See Section 8.3.5, Future Research Directions). However, having outlined the practicalities of this in the aforementioned section, the reflection here is for the benefit of teacher-researchers who intend to devise and implement a curriculum intervention. As with any research, the findings of this study are a function of the research design. Limitations relative to this research have been discussed at length, however I would urge fellow teacher-researchers to give careful consideration to the use of control groups when testing a curriculum intervention. As I have experienced first-hand, even the most carefully thought-through research design tailored to the research setting will present unforeseen challenges that will influence results, especially when rooted in the comparison between control and treatment groups across time. As such, a key reflection is to give careful consideration to the use of control groups, especially when year groups or cohorts are split into two groups, when both the control group and treatment group are exposed to other conditions outside of the control of the research which might serve to undermine the measurable impact of the curriculum intervention.

As stated at the start of this paper, the development and validation of the SRLEDS forms the major contribution of this research to the field. In light of this, an additional reflection that I would like to offer is on the process of developing a new questionnaire used to measure the construct being researched. In many ways it would have been an easier option to simply *lift* an existing scale widely used in self-regulated learning research and use it in this study, however there are a number of unintended benefits that creating the SRLEDS has given to both me as the teacher-researcher, and indeed this study. Firstly, my engagement with this process has provided a powerful insight into the mechanics of self-report instruments and some of the considerations surrounding their use. Tightly focused on *The Teddies Curriculum 2.0,* the SRLEDS represents a tailored self-report instrument, developed specifically for this research. To create the instrument, items were selected from pre-existing instruments used widely in self-regulated learning research (Dörrenbächer & Perels, 2016a; Leidinger & Perels, 2012; Pintrich et al., 1991), or new items were created using existing ones as a framework to cover the relevant skills of *The Teddies Curriculum 2.0*. In creating this instrument, it forced me to give careful consideration to exactly how the construct of self-regulated learning was going to be measured alongside the valid and reliable MSLQ. Despite the substantial variability in self-regulated learning assessment methods (Boekaerts & Corno, 2005), self-report instruments represent an important part of strategy research as they assess learners' perception of their cognitive, metacognitive and motivational strategy use (Roth et al., 2016). As such, the wording and focus of every item was carefully thought through, ensuring that it accurately mapped on to *The Teddies Curriculum 2.0,* gauging students' perception of their cognitive, metacognitive and motivational approach. In doing so, I had to explore Item Response Theory, engaging with the theories surrounding the measurement of latent variables and acquiring a stronger understanding of the relationship between unobservable latent traits, and their observed and measured manifestation. Linking to teaching practice, this is an example of where the rigour of doctoral-level study has had a positive impact on my teaching, as through the development of the SRLEDS I now give much more thought to the wording of questions posed to students, be they verbally or in writing, enhancing the impact of the learning environment fostered.

The self-report nature of the MSLQ and SRLEDS has been discussed at length in this research, both in terms of the methodological approach and the limitations outlined earlier in this paper. These two self-report instruments were chosen for this research because as a tool for measuring self-regulated learning they are highly suitable for secondary and tertiary education where students are able to complete them for themselves, requiring little teacher-researcher input at the time of data collection. In addition to this, more objective assessment methods (e.g. observations, trace analysis, microanalysis; see Paper 3), were neither practicable given the size of the sample, nor easily interpretable given the lack of a laboratory environment (Roth et al., 2016). However, despite the relative weight of support for the use of self-report instruments, they do have well-documented limitations (e.g. Veenman, 2011). As such, I would encourage teacher-researchers to give thought to developing their own measures to accurately capture the changes in the construct being researched specific to the local context of the school. Every school is different, and therefore it is imperative that the data collection tools are appropriate, practicable and, most importantly, that they yield reliable data for analysis.

8.4.2 Mapping Theory - Challenges and Opportunities

This section contributes to this portfolio by providing a thorough and introspective assessment of the challenges and opportunities of mapping theory to an education programme, such as that used in this research; *The Teddies Curriculum 2.0*.

8.4.2.1 Context. To give my comments on mapping theory some context, first I would like to outline my position in terms of the personal and professional. For a part-time doctoral student, the meeting and interplay between the personal and professional is significant as it influences ones' views and actions. However, as an EdD candidate, a part-time professional doctorate for full-time educators across a diverse range of educational settings, I argue that the interplay between stances is even more important. As a professional doctoral researcher, I am immersed in professional practice, heightening the intensity of the overall research experience. There is the danger that this dichotomy of roles gives rise to conflict and tension between the sometimes-polarised goals of professional practice and research. Morrissey (2014) suggests how as a teacher, she has been trained to separate tensions that exist between the personal and professional. However, I would offer a contrasting perspective whereby the conflation of these two seemingly incompatible roles, in practical terms at least, complements, supports and benefits one another. As such my position as a professional doctoral researcher is one of strength, as I can draw on the assets of both roles, be they social, theoretical, or indeed practical. That said, it is only a position of strength if I can acknowledge the limitations and challenges presented by this dualistic stance, working to nullify any perceived weaknesses moving forward. The following themes draw on my reflections as a professional doctoral researcher that cover four key headings relative to the mapping of theory: blurring the lines, language, theory, and methodological considerations.

8.4.2.2 Blurring the Lines – Research v Practice. One of the challenges of mapping theory on to an educational programme such as the *Teddies Curriculum 2.0* is working between the two domains highlighted in Schön's (1983) metaphor; practice and theory. Whilst I argued the strength of this dualistic stance in Section 8.4.2.1, there are inherent challenges when working between two domains, each with their own language, idiosyncrasies, and cultural norms. Palmer (2007) describes the tension of opposites between the personal and professional, a tension that can be extrapolated to that which exists in this study between research and practice. Furthering this, Hammersley (2004) outlines two ways in which the tensions between research and other activities can be managed. The first is where research is subordinated to practice and the teaching and learning environment. The second is where inquiry becomes the primary occupational practice, giving research goals centre stage and adapting practice to accommodate this primary focus (Hammersley, 2004; Turner, 2017). Each of these two options has its own merits and limitations, impacting either source of the tension, however one of the great challenges of professional doctoral research is not just having an awareness of these tensions and the potential conflicts, but managing this paradox, drawing on the strength of my position immersed within both research and practice to successfully map theory on to the *Teddies Curriculum 2.0*.

That said, Clark et al. (2017) stress the importance of *boundary experiences*, the transformational potential provided by working in shared landscapes of practice, necessitating a new way of thinking about research methodology. The co-production supported by Clark et al.'s *boundary experiences*, allows for an interdisciplinary approach drawing on the strengths of both research and practice, requiring a more open and flexible approach to research design than is currently usually promoted within purely academic research infrastructures. Linking to Hammersley's (2004) comments earlier, this would suggest that research is being subordinated in favour of practice, however I argue that as outlined in Paper 4, this study has overcome these tensions by drawing on the strengths of both stances to develop a rigorous, effective and comprehensive method that satisfies the demands of both camps.

8.4.2.3 Language. Language is a cultural artifact, rooted in socially constructed subjectivities (Thomson & Kamler, 2010). As such, it is difficult to be entirely objective when interpreting and analysing the language of practice and research, as they are weighted with socially constructed subjectivities from the author and from myself as the reader. As language is the universal medium through which understanding is communicated (Radnor, 2001) the subjective lens through which I read and engage with language will thus influence my internalisation and understanding of it. It can therefore be argued that reading itself is a form of dialogue as my own understanding of the key ideas occurs through my interpretation of this internal discourse. That said, my interpretation of the language is also rooted in a research tradition that views itself as empirical, and therefore able to rise above experiential bias. Despite receiving criticism from some fellow professional doctoral researchers about my desire to write a quantitative thesis, reproach that made me think hard about the choices available to me in terms of my research design, the quantitative approach underpinning this study has also provided me with a lens through which the language of research can be internalised and understood. As an artifact of my research journey, it is also important to note that the language of this portfolio is also rooted in socially constructed subjectivities, which have morphed and changed across my six years of professional doctoral research, forming another dialogue between myself and the reader.

Griffiths (1998) discusses the language of academics as being used by a powerful group of people that can work to exclude the very people that it is designed to help – practitioners. That said, this hierarchy works both ways and the language of practice can be perceived to be impenetrable to those working in academia. Looking beyond this dualistic challenge and acknowledging the socially constructed subjectivities in which language is rooted, I have given careful consideration to the language in which I have mapped theory and documented my research journey in order to accurately convey understanding to the reader, in addition to making a significant impact on both domains; research and practice. After all, what use is this research journey if it doesn't contribute to the fields on both sides of Schön's topographical hierarchy, both research *and* practice?

On reflection, interpreting, internalising, and making effective use of appropriate language was the greatest challenge of mapping theory to an educational programme such as the *Teddies Curriculum 2.0*. Within the context of language, the use of *research-based theory* from academia to solve problems that are messy and confusing in practice gives rise to several challenges. To generate an impact on both research and practice, the language used in the educational programme underpinning this study must be appropriate, clear, and understood by all stakeholders. This is as much the case for the students and teachers as it is for the academics. Whilst this presented a challenge and a constant consideration running across the six years of study, it also served as an opportunity to bridge the divide between the two parts of my stance as a professional doctoral researcher: research and practice. The opportunity to share best practice through the Research Communities as part of the EdD programme to which I am attached has provided a vehicle for discussion and shared learning experiences benefiting other colleagues inhabiting the same spaces. In terms of practice, the unquantifiable impact on the culture within the school has been significant, with teachers, departments and faculties shifting their approach to becoming more evidence-informed in their practice. In doing so, they are actively engaging with the language of academic research, assimilating and processing it, using the key ideas to generate a positive impact on the teaching and learning environment fostered across the school.

8.4.2.4 Theory. One of the greatest challenges of mapping theory on to an educational programme is the initial choice of theory itself. As Table 2.2.1 shows, there are a number of theories of self-regulated learning, with two broad groups evident in the research; process models and component models (Kistner et al., 2010; Winne & Perry, 2000; Wirth & Leutner, 2008). As highlighted in Section 2.2, self-regulated learning interventions based on Social Cognitive Theory achieve the largest effect sizes (Dignath et al., 2008; Dignath & Büttner, 2008; Stoeger et al., 2015). As such, the theoretical framework chosen to underpin this study was Zimmerman's model of self-regulated learning which provides a theoretical framework of self-regulated learning based on Bandura's Social Cognitive Theory.

Whilst the theoretical framework outlined above was chosen for its merits in terms of the supporting research, this is an aspect of the research project that required the careful mediation of the interplay between research and practice. Zimmerman's model has been used widely in self-regulated learning research, serving as a cornerstone of this research in the last 25 years (Dunn & Lo, 2015). However, one of the benefits to practice is that Zimmerman's model provides a strong visual representation of a conceptual framework of self-regulated learning, acting as reference point and guide for both teachers and students. The model is characterised by three distinct phases (the forethought phase, performance phase and the self-reflection phase), making it arguably the easiest model to interpret and understand, especially within the context of the participants of this study aged 13 and 14 years old. Although this model of self-regulated learning was chosen based on its research merits, the framework and supporting structure that Zimmerman's model provides to all stakeholders involved in this study signals one of the great opportunities of mapping theory, especially in terms of providing staff and pupils *access* to theory originating from the high ground, scaffolding their conceptualisation and engagement with a theory of self-regulated learning. The mapping of theory on to an educational programme also supports a movement in contemporary education towards evidence-informed practice. However, this is not without challenge and the previous section on Language emphasises the need to re-frame the language used in the model to make it accessible to students and staff alike.

Wagner (2010) explores the notion of ignorance, defining it as the role and structure of collective deficits in academic understanding. Whether it is my own self-efficacious beliefs or my naturally cautious personality traits that lead me to second guess myself and doubt my academic ability, I continue to perceive myself to possess deficits in academic understanding. I have worked incredibly hard to identify and overcome these deficits in knowledge and I continue to fill gaps in academic understanding; something that I will have to continue to do even after the formal end of my doctoral journey. But what form do these *gaps* take? Are they blank spots – areas of knowledge of which I am aware, yet to fill and internalise, or are they blind spots, areas of understanding that I am simply unaware of currently? When mapping theory one of the great challenges that I have experienced has not necessarily been filling the blank spots, knowledge deficits of which I am aware, but actually reading and learning to illuminate the blind spots which might be pertinent to my research, but which are not yet visible to me. This illumination through proactive engagement with theory has resulted in epiphany moments, fundamental changes of research direction giving rise to a greater clarity of purpose which are all driven by the internalisation of new knowledge and understanding. By continuing to read, learn and experience these developments, I continue to reduce these collective deficits in academic understanding and become less ignorant, as defined by Wagner (2010).

8.4.2.5 Methodological Considerations. Applying a theoretically framed research design and the rigour of doctoral-level research methodology to a school setting adds significant weight to the practitioner research that this study represents. In terms of the overall research design, the approach adopted in this study is rooted and justified within the context of the relevant literature, providing strong support for the decisions made when planning the methodological approach. The opportunity provided by utilising the strong theoretical foundations of research design and associated ethical considerations have supported the development of a methodological approach that is both rigorous in its nature, collecting reliable quantitative data, whilst also being practicable and appropriate for use in the research setting. This *rigour* is extended to the materials used in this study, as when self-regulated learning is measured in quantitative studies it requires the use of a direct instrument that captures its conceptualisations, dispositions, and skills. In this regard the MSLQ and SRLEDS both represent useful, reliable, and valid means for assessing students' self-regulated learning skills. The development of the SRLEDS tailored to this research and the research setting not only provides a second measure to triangulate data, but it also represents a significant contribution to the field of self-regulated learning research.

Whilst the above outlines some of the opportunities provided mapping theory on to educational programmes, there are several challenges that this presents regarding methodological considerations. Due to the nature of the research setting, a busy co-educational boarding school, there was no time within the body of the formal timetable in which the sessions comprising the content independent intervention could be delivered. Instead, the *Teddies Curriculum 2.0* sessions were delivered on a Wednesday afternoon during Period 6 (15.30-16.25); a lesson normally ring-fenced for *supervised prep*. As highlighted in Section 8.3.3, Limitations in Procedure, lessons that fall at the end of the day are sometimes less productive than those at the start or those that immediately follow a break. As such, it could be argued that an optimal approach in terms of the delivery of the intervention would have been to move this forward into the body of the timetable, and given the same status as subjects that comprise the academic curriculum. This is an example of where, as Hammersley (2004) states, research goals are subordinated in favour of practice-based goals, namely the organisation of the curriculum timetable. That said, the methodological approach outlined in Paper 4 represents a carefully considered balance between the dualistic aspects of my stance as a researching practitioner.

Lastly, linking to the notion of evidence-informed practice mentioned in Section 8.4.2.4, the findings of doctoral level research can, and indeed have been used internally informing and directing actions taken to enhance the teaching and learning environment fostered across the school. The outputs (e.g. how many people receive an intervention or how many times a programme is delivered) and outcomes (e.g. changes in well-being for beneficiaries) (Laing & Todd, 2015) of this research has yielded a positive impact on practice within the research setting, with a far more collaborative approach evident in terms of supporting the development of students' self-regulated learning skills. However, speaking candidly, the same impact is not yet evident on the high ground of theory. A major challenge throughout the EdD journey has been mediating the tension between research and practice, attempting to satisfy both parties, but oftentimes conceding in favour of what is practicable and realistic given the constraints of conducting research within a live school setting. Much of the on-going reflection in response to my viva, and indeed the corrections submitted herewith, relates back to this tension, and forms a significant point of learning for me as the researching practitioner.

8.4.3 Recommendations for Practice

The following recommendations for practice are made within the context of this research, despite the findings of the present study. Having offered some candid reflections relative to my disappointment that the results are not what I had hoped for when I designed this research, the alignment of these reflections together with the research literature documented in this portfolio inform the recommendations that follow.

In terms of practice, my first recommendation is for schools to place a far greater emphasis on the development of students' self-regulated learning skills, not as a subordinate to the delivery of the various curricula pathway against which students will be assessed and ultimately graded, as is currently the case, but as an equal alongside these different pathways. Too often schools place too greater emphasis on the latter, which is understandable to an extent, given the ever-increasing accountability culture in schools driven by inspection reports and league table comparison. However, by making the development of students' self-regulated learning skills a central, *core* component of the curriculum studied across schools, this will place a greater and explicit emphasis on this important facet of students' academic toolkit. Embedding self-regulated learning and its associated language within programmes of study and schemes of work across faculties and departments will allow it to permeate into the classroom and be delivered explicitly, alongside the subject-specific content students need to be successful in terminal examinations.

My second recommendation builds on the first, in that the language of self-regulated learning and the strategies that support the development of students' self-regulated learning skills should be raised up to the same level as that of the syllabus content covered in the classroom, fully integrated within day-to-day instruction. There is a great deal of research that suggests that explicit instruction in strategy training is necessary before any significant improvement in students' independent performance will be seen (Borkowski & Cavanaugh, 1981; Brown, Bransford, Ferrara, & Campione, 1983; Brown, Campione, & Day, 1981; Brown & Palincsar, 1985). However, in order for this second recommendation for practice to be achieved, one of the greatest challenges will be to change the mindset of secondary classroom teachers who perceive their main responsibility to be the teaching of subject-specific, curriculum knowledge, as opposed to primary school teachers' beliefs about their role that reflects an emphasis on teaching for learning and development (Calderhead, 1996).

Path analysis conducted as part of innovative research by Dignath (2016) revealed that teachers' beliefs on instructing self-regulated learning, along with their self-efficacy beliefs regarding the promotion of self-regulated learning, were the most positive predictors of teachers' promotion of self-regulated learning. For me, this underlines the challenge highlighted in the previous paragraph in terms addressing teachers' beliefs and, in turn, the skillset that underpins these beliefs. The delivery of the curriculum is a function of the teachers, their knowledge and skillsets, thus having a direct impact on the degree to which students' self-regulated learning skills are developed and supported through instruction. It is fair to say that most teachers currently working in secondary education across the UK are highly trained and proficient within their given subject areas, however the explicit instruction of self-regulated learning skills has not been part of their teacher training nor their own education itself; an observation that provides support for the results published by Dignath (2016). If this recommendation for practice is going to come to fruition, then both Initial Teacher Training (ITT) programmes and Continuing Professional Development (CPD) programmes need to have an explicit focus on the development of teachers' skillset and toolkit in terms of their instruction of self-regulated learning skills across the curriculum. As such, a more top-down approach is required from universities and school leaders to successfully embed this within these programmes, supporting the development of teachers' knowledge and skillsets which, in turn, will lead to significant gains in terms of students' learning experiences and the growth of their self-regulated learning skills.

Linking to comments made in Section 8.3.5, Future Research Directions, there is scope for teachers to make more effective use of students' personality characteristics to inform their pedagogy and instruction. The recent reform of GCSEs and A levels has presented classroom teachers and subject leaders with significant challenges in terms of the adoption and delivery of updated specifications, with planning time spent learning new subject content and assessment frameworks. These reforms have served to narrow teachers' focus on to the content that they are teaching, leaving the development of students' self-regulated learning skills in a blind spot on the periphery of their professional vision. However, by broadening their professional view to encompass self-regulated learning and supplementary student information that will support its development, such as personality characteristics, teachers will not only be able to deliver subject-specific content more effectively, but will also facilitate the development of students' self-regulated learning skills.

In support of this argument, results from research conducted by Snow et al. (1996) suggest that educators should be aware of the personality predispositions each student brings to a specific learning situation, especially given the assumption that self-regulated learning strategies are learnable characteristics, amenable to change with appropriate training and efforts. Further support for this argument can be found in more recent research by Bidjerano and Dai (2007), who state that both formal and informal assessment of students' personality characteristics may inform the teacher as to who will naturally develop self-regulatory skills in response to task demands within their lessons, and who may not develop these skills without explicit training, allowing them to personalise tasks to the specific needs of students. As such, schools should give thought to how they can effectively and efficiently assess students' personality characteristics before sharing this information with teachers, allowing it to inform their planning and delivery of first-rate lessons that provide students with the subject-specific knowledge, understanding and skills they need, in addition to supporting the growth of their self-regulated learning skills.

Perkins and Salomon (1989) contend that thinking at its most effective depends on specific context-bound skills and units of knowledge. In light of this many researchers have developed integrated approaches to examining self-regulated learning (e.g. Boekaerts, 1997; Pintrich, Marx, & Boyle, 1993; Weinstein et al., 1997). Whilst this study was rooted in the delivery of a discipline-independent intervention taking the form of an adjunct, generic, stand alone course (Simpson et al., 1997), there is little doubt that if the skills delivered through the discipline-independent intervention were reinforced, contextualised and practiced within the subject-specific domains, this would serve to amplify the impact of the explicit self-regulated learning focus as provided by the intervention.

As highlighted in Section 2.6.3, The Issue of Transfer, the ability of students to effectively transfer strategies across different learning contexts and domains is one of the key goals of training self-regulated learning skills (Perkins & Salomon, 1989; Raaijmakers, Baars, Paas, et al., 2018). Described as a *low-road* approach by Perkins and Salomon (1989), it is argued that integrated programmes will increase the probability that the transfer of strategies will occur as students have the opportunity to use strategies in different subjects, topics areas and types of task (Hofer et al., 1998; Simpson et al., 1997). Veenman, Van Hout-Wolters, and Afflerbach (2006) cogently argue that without substantial (cognitive) domain-specific knowledge, it is challenging to have adequate metacognitive knowledge of one's competencies in a domain. However, *high-road* transfer involving the intentional, mindful abstraction of a strategy from one context and applied in a new one, requires greater metacognitive awareness relating to their strategy use (Salomon & Perkins, 1989). Within the context of the development of life-worthy learning skills, the title of this portfolio, a final recommendation for practice focuses on supporting students to develop the capacity to transfer strategy use across the range of tasks that comprise their daily learning experiences. This can be achieved by making the declarative, procedural and conditional knowledge about strategy use explicit to students, providing strong foundations to support the transfer of strategy knowledge and skills to new situations (Garner, 1990; Paris et al., 1983; Weinstein et al., 2000). Linking to the rationale for this research project that calls for the development of life-worthy learning skills, whether achieved through an integrated programme or, as in this research, through an adjunct intervention, it is imperative that students develop the capacity to apply the skills and strategies learned across a wide variety of contexts, just as they will be required to do in the rapidly changing world into which they will be propelled at the end of their secondary education careers.

8.4.4 Important Lessons for Improving my Future Research

This section builds on the previous two by drawing on the lessons learned in terms of how to approach practice-based research. Section 8.4.1 was written with a strong sense of disappointment, rooted in the fact that after a six year journey across the challenging landscape of professional doctoral research, the results were not what I had hoped for when I designed and implemented this study. Despite the meticulously planned and carefully considered research design outlined in Paper 4, the comparison between control and treatment groups across time has presented several unforeseen challenges that influenced the results. These have been documented at length (see Section 8.2.3) and will not be revisited here, however given my retrospective awareness and understanding of how factors outside of the control of the researcher can influence the findings, and therefore the challenges of conducting research in a live school setting, this section shares some lessons as to how I can improve future research.

The advice I would give to my future self would initially focus on pilot work. Whilst pilot work provided an excellent opportunity to pilot the use of the two instruments used in this study, the MSLQ and the SRLEDS, in addition to the way these were administered (see Section 4.4), it did not serve to highlight some of the more practical and prosaic challenges that the delivery of the *Teddies Curriculum 2.0* provided. Once the research design and method has been devised, I would rigorously stress-test this before starting the formal research itself. This would include the delivery of some of the sessions of the intervention to gauge student feedback, then conducting analyses on the data collected from the instruments. Within the context of practice-based research, this could only be achieved if more time were allocated to the pilot work itself, beginning this earlier on in the academic year creating more time for this important part of the research journey. On reflection, had the pilot work been more comprehensive, possibly including two data collection points, some of the changes experienced within the local context of the school might have been highlighted in advance, allowing changes to be made to the methodological approach ahead of formal data collection. That said, within the frame of both the EdD course and my role as a researching practitioner, I lacked sufficient funding and time to be able to extend the pilot work for longer than was conducted in this study. However, given this limitation it is still an important lesson which will positively inform my future research.

In terms of what type of data it would have been good to collect in retrospect, I would advocate the use of a mixed methods approach. Bryman (2012) states that mixed methods research is used as a simple shorthand for research that integrates both quantitative and qualitative research within a single project. This would serve to provide a greater sense of triangulation, as although this was achieved through the use of two different instruments to yield quantitative data in this study, results gained through a mixed methods approach can be cross-checked against the results from a qualitative research method and tools. It can be argued that completeness, a more complete answer to a research question, can be achieved by combining both quantitative and qualitative methods. However, as outlined in the previous paragraph, the constraints of both the EdD and my role as a researching practitioner significantly limit the resources available which made a mixed methods approach not viable in this research. Therefore, if this approach were to be adopted sufficient resources would have to be available and allocated to the collection and analysis of both types of data; a theme explored further later in this section.

As Denzin (1978) states, has self-regulated learning methods are like a kaleidoscope; depending on how they are approached, held, and acted toward, different observations will be revealed. As such, the tools outlined above will serve to provide a greater sense of triangulation. As discussed in Paper 3, as an internal process self-regulated learning cannot be directly accessed and therefore researchers need to find alternative ways of accessing it (Panadero et al., 2016). Panadero et al. (2016) identified three waves of measuring self-regulated learning, with learning diaries part of the third wave of self-regulated learning measurement. As an instrument, learning diaries combine different features that promote self-regulated learning whilst also acting as a data collection tool to measure the progress in students' self-regulated learning. They support the development of planning, self-monitoring and self-reflection, and their use has been shown to increase self-efficacy, self-regulation and metacognitive skills and attitude (Broadbent et al., 2020). In terms of promoting self-regulated learning, previous research by Dignath-van Ewijk et al. (2015) demonstrated the importance of the intervention and the learning diary in combination, as the authors found an effect for the combined learning diary and university course on self-regulated learning group, but no effect for the learning diary alone. As a recommendation for my future self, the use of a learning diary would not only add strength to the intervention, but it would also provide an additional source of qualitative data which can then be coded and analysed in response to research question 1.

The final theme within this reflective section is the importance of effective collaboration between researching practitioners when conducting practice-based research. As has already been mentioned, the scope of the EdD course and my role as a full-time researching practitioner placed limits on the resources allocated to this research, both in terms of funding and time. As such, this limitation places even greater emphasis on the need to collaborate effectively with colleagues within the research setting, drawing on their strengths to support the delivery of practice-based research. This brings together some of the themes already discussed in this section, as improved pilot work and a mixed methods approach is beyond the scope of what I was able to achieve conducting this research on my own. Through more effective collaboration the scale of the research can grow, allowing more resources to be deployed in order to conduct a piece of research which yields a significant impact on both sides of the EdD fence: research and practice.

8.5 Conclusion

Researchers and practitioners alike are working to enhance the learning environment enabling students to maximise their academic potential. Dubbed as *life-worthy learning skills* in the title of this portfolio and regarded as a crucial component of lifelong learning, the acquisition and development of self-regulated learning skills is one of the most important goals of education (Dörrenbächer & Perels, 2016b; Hadwin & Winne, 2001; Luftenegger et al., 2012; Nota et al., 2004; Zimmerman, 1986). Whilst this study has not yielded results that align with previous research (e.g. Dörrenbächer & Perels, 2016a; Hofer & Yu, 2003; Reeves & Stich, 2011), it has contributed a tailored, discipline-intervention in addition to an original self-report instrument, the SRLEDS, both of which can be used in future self-regulated learning research. Correlating with the widely used MSLQ, the SRLEDS is of particular utility in future research, offering researchers an alternative scale that can be reliably used to measure students' perception of their self-regulated learning skills. Additionally, to my knowledge this is the first study of its type completed in the context of the research setting.

At the end of my five-year professional doctorate research journey, it is hugely rewarding to be able to look back at the aims outlined in Paper 4 having achieved what I set out to. Whilst it is difficult to quantify the impact on practice and indeed the contribution of this study to the field of self-regulated learning research, the rigour of professional doctoral research has fostered the development of a wide range of academic research skills, in addition to the opportunity to present and publish. Just as for many doctoral students, my EdD journey has been long, challenging, and at times arduous, however there is little doubt that it has led to significant personal growth, development and ultimately improvement. As a teacher-researcher with a foot in both camps of practice and research, my professional doctoral journey has undoubtedly refocused my view of the educational landscape, providing me the confidence and clarity to make purposeful and positive evidence-informed decisions in my professional life. In doing so, it has equipped me with a number of life-worthy learning skills, and I remain hugely grateful for the opportunity to study, research and submit this portfolio for examination.

References

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning, and the psychological processes that mediate their relationship. *Journal of Educational Psychology*, *94*(3), 545–561. https://doi.org/10.1037/0022-0663.94.3.545

Airasian, P. W., & Walsh, M. E. (1997). Constructivist cautions. *Phi Delta Kappan*, *78*(6), 444–449.

Alexander, P. A., Dinsmore, D. L., Parkinson, M. M., & Winters, F. I. (2011). Self-Regulated Learning in Academic Domains. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance*. Routledge Handbooks Online. https://doi.org/10.4324/9780203839010.ch25

Allen, I. E., & Seaman, J. (2016). Online Report Card: Tracking Online Education in the United States. In *Babson Survey Research Group*. Babson Survey Research Group. https://eric.ed.gov/?id=ED572777

Alonso-Mencía, M. E., Alario-Hoyos, C., Maldonado-Mahauad, J., Estévez-Ayres, I., Pérez-Sanagustín, M., & Kloos, C. D. (2020). Self-regulated learning in MOOCs: Lessons learned from a literature review. *Educational Review*, *72*(3), 319–345. https://doi.org/10.1080/00131911.2019.1566208

Altman, D. G., & Bland, J. M. (1995). Statistics notes: The normal distribution. *BMJ*, *310*(6975), 298. https://doi.org/10.1136/bmj.310.6975.298

American Psychological Association. (2015). *Publication Manual of the American Psychological Association, 6th Edition*. CreateSpace Independent Publishing Platform.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, *84*(3), 261–271. https://doi.org/10.1037/0022-0663.84.3.261

Anders, K., & Simon, H. A. (1980). Verbal reports as data. *Psychological Review*, *87*(3), 215–251. https://doi.org/10.1037/0033-295X.87.3.215

Andrade, H. L., & Dugan, R. F. (2011). Exploring the construct validity of academic self-regulation using a new self-report questionnaire—The Survey of Academic Self-Regulation. *The International Journal of Educational and Psychological Assessment*, *7*(1), 45–63.

Andrade, H., & Valtcheva, A. (2009). Promoting Learning and Achievement Through Self-Assessment. *Theory Into Practice*, *48*(1), 12–19. https://doi.org/10.1080/00405840802577544

Ariel, R., & Karpicke, J. D. (2018). Improving self-regulated learning with a retrieval practice intervention. - Semantic Scholar. *Journal of Experimental Psychology: Applied*, *24*(1), 43–56.

Artelt, C. (2000). Wie prädiktiv sind retrospektive Selbstberichte über den Gebrauch von Lernstrategien für strategisches Lernen. *Zeitschrift Für Pädagogische Psychologie*, *14*(2/3), 72–84.

Askew, S. (1998). *Transforming Learning*. A&C Black.

Azevedo, R. (2005). Using Hypermedia as a Metacognitive Tool for Enhancing Student Learning? The Role of Self-Regulated Learning. *Educational Psychologist*, *40*(4), 199–209. https://doi.org/10.1207/s15326985ep4004_2

Azevedo, R. (2014). Issues in dealing with sequential and temporal characteristics of self- and socially-regulated learning. *Metacognition and Learning*, *9*(2), 217–228. https://doi.org/10.1007/s11409-014-9123-1

Azevedo, R., & Hadwin, A. F. (2005). Scaffolding Self-regulated Learning and Metacognition – Implications for the Design of Computer-based Scaffolds. *Instructional Science*, *33*(5), 367–379. https://doi.org/10.1007/s11251-005-1272-9

Baars, M., Leopold, C., & Paas, F. (2018). Self-explaining Steps in Problem-solving Tasks to Improve Self-regulation in Secondary Education. *Journal of Educational Psychology*, *110*(4), 578–595. https://doi.org/10.1037/edu0000223

Baars, M., & Wijnia, L. (2018). The relation between task-specific motivational profiles and training of self-regulated learning skills. *Learning and Individual Differences*, *64*, 125–137. https://doi.org/10.1016/j.lindif.2018.05.007

Bail, F. T., Zhang, S., & Tachiyama, G. T. (2008). Effects of a Self-Regulated Learning Course on the Academic Performance and Graduation Rate of College Students in an Academic Support Program. *Journal of College Reading and Learning*, *39*(1), 54–73. https://doi.org/10.1080/10790195.2008.10850312

Baker, S. (2018). Cognitive skills for active learning in the early years. *Impact: The Journal of the Chartered College of Teaching*. https://impact.chartered.college/article/baker-cognitive-skills-active-learning-early-years/

Bakkenes, I., Vermunt, J. D., & Wubbels, T. (2010). Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers. *Learning and Instruction*, *20*(6), 533–548. https://doi.org/10.1016/j.learninstruc.2009.09.001

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory* (Vol. xiii). Prentice-Hall, Inc.

Bandura, A. (1991). Self-regulation of motivation through anticipatory and self-reactive mechanisms. In R. Dienstbier (Ed.), *Perspectives on Motivation* (pp. 69–164). U of Nebraska Press.

Bandura, A. (1993). Perceived Self-Efficacy in Cognitive Development and Functioning. *Educational Psychologist*, *28*(2), 117–148. https://doi.org/10.1207/s15326985ep2802_3

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology*, *41*(3), 586–598. https://doi.org/10.1037/0022-3514.41.3.586

Bannert, M., & Reimann, P. (2012). Supporting self-regulated hypermedia learning through prompts. *Instructional Science*, *40*(1), 193–211. https://doi.org/10.1007/s11251-011-9167-4

Barbosa, J., Silva, Á., Ferreira, M. A., & Severo, M. (2018). Do reciprocal relationships between academic workload and self-regulated learning predict medical freshmen's achievement? A longitudinal study on the educational transition from secondary school to medical school. *Advances in Health Sciences Education*, 1–16. https://doi.org/10.1007/s10459-018-9825-2

Barnard-Brak, L., Paton, V. O., & Lan, W. Y. (2010). Profiles in Self-Regulated Learning in the Online Learning Environment. *International Review of Research in Open and Distributed Learning*, *11*(1), 61–80. https://doi.org/10.19173/irrodl.v11i1.769

Barrett, J., & Fleming, A. S. (2011). Annual Research Review: All mothers are not created equal: neural and psychobiological perspectives on mothering and the importance of individual differences. *Journal of Child Psychology and Psychiatry*, *52*(4), 368–397. https://doi.org/10.1111/j.1469-7610.2010.02306.x

Barron, K. E., & Harackiewicz, J. M. (2001). Achievement goals and optimal motivation: Testing multiple goal models. *Journal of Personality and Social Psychology*, *80*(5), 706–722. https://doi.org/10.1037/0022-3514.80.5.706

Becker, L. L. (2013). Self-Regulated Learning Interventions in the Introductory Accounting Course: An Empirical Study. *Issues in Accounting Education*, *28*(3), 435–460. https://doi.org/10.2308/iace-50444

Bell, M. A., & Deater-Deckard, K. (2007). Biological systems and the development of self-regulation: Integrating behavior, genetics, and psychophysiology. *Journal of Developmental and Behavioral Pediatrics*, *28*(5), 409–420. https://doi.org/10.1097/DBP.0b013e3181131fc7

Bellhäuser, H., Lösch, T., Winter, C., & Schmitz, B. (2016). Applying a web-based training to foster self-regulated learning—Effects of an intervention for large numbers of participants. *The Internet and Higher Education*, *31*, 87–100. https://doi.org/10.1016/j.iheduc.2016.07.002

Benner, A. D., & Graham, S. (2009). The transition to high school as a developmental process among multiethnic urban youth. *Child Development*, *80*(2), 356–376. https://doi.org/10.1111/j.1467-8624.2009.01265.x

BERA. (2011). *Ethical Guidelines for Educational Research*. https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2011

Bereiter, C. (1990). Aspects of an Educational Learning Theory. *Review of Educational Research*, *60*(4), 603–624. https://doi.org/10.3102/00346543060004603

Bidjerano, T., & Dai, D. Y. (2007). The relationship between the big-five model of personality and self-regulated learning strategies. *Learning and Individual Differences*, *17*(1), 69–81. https://doi.org/10.1016/j.lindif.2007.02.001

Bjork, R. A., Dunlosky, J., & Kornell, N. (2013). Self-Regulated Learning: Beliefs, Techniques, and Illusions. *Annual Review of Psychology*, *64*(1), 417–444. https://doi.org/10.1146/annurev-psych-113011-143823

Black, T. R. (1999). *Doing Quantitative Research in the Social Sciences: An Integrated Approach to Research Design, Measurement and Statistics*. SAGE.

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology*, *20*(3), 899–911. https://doi.org/10.1017/S0954579408000436

Boekaerts, M. (1991). Subjective competence, appraisals and self-assessment. *Learning and Instruction*, *1*(1), 1–17.

Boekaerts, M. (1997). Self-regulated learning: A new concept embraced by researchers, policy makers, educators, teachers, and students. *Learning and Instruction*, *7*(2), 161–186. https://doi.org/10.1016/S0959-4752(96)00015-1

Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research*, *31*(6), 445–457. https://doi.org/10.1016/S0883-0355(99)00014-2

Boekaerts, M., & Cascallar, E. (2006). How Far Have We Moved Toward the Integration of Theory and Practice in Self-Regulation? *Educational Psychology Review*, *18*(3), 199–210. https://doi.org/10.1007/s10648-006-9013-4

Boekaerts, M., & Corno, L. (2005). Self-Regulation in the Classroom: A Perspective on Assessment and Intervention. *Applied Psychology: An International Review*, *54*(2), 199–231. https://doi.org/10.1111/j.1464-0597.2005.00205.x

Boekaerts, M., Koning, E. de, & Vedder, P. (2006). Goal-Directed Behavior and Contextual Factors in the Classroom: An Innovative Approach to the Study of Multiple Goals. *Educational Psychologist*, *41*(1), 33–51. https://doi.org/10.1207/s15326985ep4101_5

Bolhuis, S., & Voeten, M. J. M. (2001). Toward self-directed learning in secondary schools: What do teachers do? *Teaching and Teacher Education*, *17*(7), 837–855. https://doi.org/10.1016/S0742-051X(01)00034-8

Borkowski, J. G., & Cavanaugh, J. C. (1981). Metacognition and Intelligence Theory. In *Intelligence and Learning* (pp. 253–258). Springer, Boston, MA. https://doi.org/10.1007/978-1-4684-1083-9_24

Bornstein, R. F. (1996). Face validity in psychological assessment: Implications for a unified model of validity. *American Psychologist*, *51*(9), 983–984. https://doi.org/10.1037/0003-066X.51.9.983

Bouffard, T., & Couture, N. (2003). Motivational profile and academic achievement among students enrolled in different schooling tracks. *Educational Studies*, *29*(1), 19–38.

Bouffard, T., Parent, S., & Lavirée, S. (1993). Self-Regulation on a Concept-Formation Task among Average and Gifted Students. *Journal of Experimental Child Psychology*, *56*, 115–134. https://doi.org/10.1006/jecp.1993.1028

Bowerman, B. L., & O'Connell, R. T. (1990). *Linear Statistical Models*. Thomson Wadsworth.

Branch, J. L. (2000). Investigating the Information-Seeking Processes of Adolescents. *Library & Information Science Research*, *22*(4), 371–392. https://doi.org/10.1016/S0740-8188(00)00051-7

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain. Mind, experience and school*. National Academies Press.

Bråten, I., & Strømsø, H. I. (2004). Epistemological beliefs and implicit theories of intelligence as predictors of achievement goals. *Contemporary Educational Psychology*, *29*(4), 371–388. https://doi.org/10.1016/j.cedpsych.2003.10.001

Braungart, J. M., Plomin, R., DeFries, J. C., & Fulker, D. W. (1992). Genetic influence on tester-rated infant temperament as assessed by Bayley's Infant Behavior Record: Nonadoptive and adoptive siblings and twins. *Developmental Psychology*, *28*(1), 40–47. https://doi.org/10.1037/0012-1649.28.1.40

Breslow, L., Pritchard, D. E., DeBoer, J., Stump, G. S., Ho, A. D., & Seaton, D. T. (2013). Studying Learning in the Worldwide Classroom Research into edX's First MOOC. *Research & Practice in Assessment*, *8*, 13–25.

Broadbent, J. (2017). Comparing online and blended learner's self-regulated learning strategies and academic performance. *The Internet and Higher Education*, *33*, 24–32. https://doi.org/10.1016/j.iheduc.2017.01.004

Broadbent, J., Panadero, E., & Fuller-Tyszkiewicz, M. (2020). Effects of mobile-app learning diaries vs online training on specific self-regulated learning components. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-020-09781-6

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, *27*, 1–13. https://doi.org/10.1016/j.iheduc.2015.04.007

Brookhart, S. M. (1994). Teachers' Grading: Practice and Theory. *Applied Measurement in Education*, *7*(4), 279–301. https://doi.org/10.1207/s15324818ame0704_2

Brown, A. L. (1978a). Knowing when, where and, how to remember: A problem of metacognition. *Advances in Instructional Psychology*, *1*. http://ci.nii.ac.jp/naid/10012502747/

Brown, A. L. (1978b). Knowing when, where and, how to remember: A problem of metacognition. *Advances in Instructional Psychology*, *1*. http://ci.nii.ac.jp/naid/10012502747/

Brown, A. L. (1981). Metacognition: The development of selective attention strategies for learning from texts. *Directions in Reading: Research and Instruction*, 21–43.

Brown, A. L., Bransford, J. D., Ferrara, R. A., & Campione, J. C. (1983). Learning, remembering, and understanding. In J. H. Flavell & E. M. Markman (Eds.), *Handbook of Child Psychology, Cognitive Development* (pp. 77–166). Wiley.

Brown, A. L., Campione, J. C., & Day, J. D. (1981). Learning to Learn: On Training Students to Learn from Texts. *Educational Researcher*, *10*(2), 14–21. https://doi.org/10.2307/1174401

Brown, A. L., & Palincsar, A. S. (1985). *Reciprocal Teaching of Comprehension Strategies: A Natural History of One Program for Enhancing Learning*. Ablex Publishing. https://eric.ed.gov/?id=ED257046

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, *18*(1), 32–42.

Brown, P. (2001). Skill formation in the twenty-first century. In P. Brown, A. Green, & H. Lauder (Eds.), *High Skills: Globalization, Competitiveness, and Skill Formation: Globalization, Competitiveness, and Skill Formation* (pp. 1–55). OUP Oxford.

Brown, R., Meter, P. V., Pressley, M., & Schuder, T. (1996). A Quasi-Experimental Validation of Transactional Strategies Instruction with Low-Achieving Second-Grade Readers. *Journal of Educational Psychology*, *88*(1), 18–37. https://doi.org/10.1037/0022-0663.88.1.18

Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research, Second Edition*. Guilford Publications.

Bruner, J. S. (Jerome S. (1960). *The process of education*. Harvard University Press,.

Brunstein, J. C., & Glaser, C. (2011). Testing a path-analytic mediation model of how self-regulated writing strategies improve fourth graders' composition skills: A randomized controlled trial. *Journal of Educational Psychology*, *103*(4), 922–938. https://doi.org/10.1037/a0024622

Bryman, A. (2012). *Social Research Methods*. OUP Oxford.

Burns, R. B. (2000). *Introduction to Research Methods*. SAGE Publications.

Butler, D. L., & Winne, P. H. (1995). Feedback and Self-Regulated Learning: A Theoretical Synthesis. *Review of Educational Research*, *65*(3), 245–281. https://doi.org/10.3102/00346543065003245

Butler, R. (1987). Task-involving and ego-involving properties of evaluation: Effects of different feedback conditions on motivational perceptions, interest, and performance. *Journal of Educational Psychology*, *79*(4), 474–482. https://doi.org/10.1037/0022-0663.79.4.474

Butler, R. (1988). Enhancing and Undermining Intrinsic Motivation: The Effects of Task-Involving and Ego-Involving Evaluation on Interest and Performance. *British Journal of Educational Psychology*, *58*(1), 1–14. https://doi.org/10.1111/j.2044-8279.1988.tb00874.x

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin*, *105*(3), 456–466. https://doi.org/10.1037/0033-2909.105.3.456

Calderhead, J. (1996). Teachers: Beliefs and knowledge. In *Handbook of Educational Psychology* (pp. 709–725). Macmillan. http://psycnet.apa.org/psycinfo/1996-98614-020

Calkins, S. D., & Fox, N. A. (2002). Self-regulatory processes in early personality development: A multilevel approach to the study of childhood social withdrawal and aggression. *Development and Psychopathology*, *14*(3), 477–498. https://doi.org/10.1017/S095457940200305X

Callan, G. L., & Cleary, T. J. (2017). Multidimensional Assessment of Self-Regulated Learning With Middle School Math Students. *School Psychology Quarterly: The Official Journal of the Division of School Psychology, American Psychological Association*. https://doi.org/10.1037/spq0000198

Campbell, D. T. (1957). Factors relevant to the validity of experiments in social settings. *Psychological Bulletin*, *54*(4), 297–312. https://doi.org/10.1037/h0040950

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review*, *97*(1), 19–35. https://doi.org/10.1037/0033-295X.97.1.19

Casey, B. J., Heller, A. S., Gee, D. G., & Cohen, A. O. (2019). Development of the emotional brain. *Neuroscience Letters*, *693*, 29–34. https://doi.org/10.1016/j.neulet.2017.11.055

Cattell, R. B. (1966). The Scree Test For The Number Of Factors. *Multivariate Behavioral Research*, *1*(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

Cazan, A.-M. (2012). Enhancing self regulated learning by learning journals. *Procedia - Social and Behavioral Sciences*, *33*, 413–417. https://doi.org/10.1016/j.sbspro.2012.01.154

Cazan, A.-M. (2020). An intervention study for the development of self-regulated learning skills. *Current Psychology*. https://doi.org/10.1007/s12144-020-01136-x

Check, J., & Schutt, R. K. (2021). *Research Methods in Education*. https://doi.org/10.4135/9781544307725

Chen, P., Chavez, O., Ong, D. C., & Gunderson, B. (2017). Strategic Resource Use for Learning: A Self-Administered Intervention That Guides Self-Reflection on Effective Resource Use Enhances Academic Performance. *Psychological Science*, *28*(6), 774–785. https://doi.org/10.1177/0956797617696456

Cho, M.-H., & Jonassen, D. (2009). Development of the human interaction dimension of the Self-Regulated Learning Questionnaire in asynchronous online learning environments. *Educational Psychology*, *29*(1), 117–138. https://doi.org/10.1080/01443410802516934

Chong, W. H. (2006). *Personal agency beliefs in self-regulation: The exercise of personal responsibility, choice and control in development*. Marshall Cavendish Academic,.

Clark, J., Laing, K., Leat, D., Lofthouse, R., Thomas, U., Tiplady, L., & Woolner, P. (2017). Transformation in interdisciplinary research methodology: The importance of shared experiences in landscapes of practice. *International Journal of Research & Method in Education*, *40*(3), 243–256. https://doi.org/10.1080/1743727X.2017.1281902

Clark, N. M., & Zimmerman, B. J. (2014). A social cognitive view of self-regulated learning about health. *Health Education & Behavior*, *41*(5), 485–491. https://doi.org/10.1177/1090198114547512

Claxton, G. (2008). *What's the point of school?: Rediscovering the heart of education*. Oneworld Publications,.

Cleary, T. J., Callan, G. L., Malatesta, J., & Adams, T. (2015). Examining the Level of Convergence Among Self-Regulated Learning Microanalytic Processes, Achievement, and a Self-Report Questionnaire. *Journal of Psychoeducational Assessment*, *33*(5), 439–450. https://doi.org/10.1177/0734282915594739

Cleary, T. J., Callan, G. L., & Zimmerman, B. J. (2012). Assessing self-regulation as a cyclical, context-specific phenomenon: Overview and analysis of SRL microanalytic protocols. *Education Research International*, *2012*. http://downloads.hindawi.com/journals/edu/2012/428639.pdf

Cleary, T. J., & Zimmerman, B. J. (2004). Self-regulation empowerment program: A school-based program to enhance self-regulated and self-motivated cycles of student learning. *Psychology in the Schools*, *41*(5), 537–550. https://doi.org/10.1002/pits.10177

Cobb, P., & Yackel, E. (1996). Constructivist, emergent, and sociocultural perspectives in the context of developmental research. *Educational Psychologist, 31*(3–4), 175–190. https://doi.org/10.1080/00461520.1996.9653265

Cohen, L., Manion, L., & Morrison, K. (2013). *Research Methods in Education*. Routledge.

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive Apprenticeship: Making Things Visible. *American Educator: The Professional Journal of the American Federation of Teachers*, *15*(3), 6–11.

Comrey, A. L., & Lee, H. B. (1992). *A First Course in Factor Analysis*. Psychology Press. https://doi.org/10.4324/9781315827506

Connolly, P., Biggart, A., Miller, D. S., O'Hare, L., & Thurston, A. (2017). *Using Randomised Controlled Trials in Education*. SAGE.

Connolly, P., Keenan, C., & Urbanska, K. (2018). The trials of evidence-based practice in education: A systematic review of randomised controlled trials in education research 1980–2016. *Educational Research*, *60*(3), 276–291. https://doi.org/10.1080/00131881.2018.1493353

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis for field settings*. Rand McNally.

Corno, L. (1993). The Best-Laid Plans Modern Conceptions of Volition and Educational Research. *Educational Researcher*, *22*(2), 14–22. https://doi.org/10.3102/0013189X022002014

Corno, L. (1994). Student volition and education: Outcomes, influences, and practices. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 229–251). Lawrence Erlbaum Associates, Inc.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE.

Crooks, T. J. (1988). The Impact of Classroom Evaluation Practices on Students. *Review of Educational Research*, *58*(4), 438–481. https://doi.org/10.3102/00346543058004438

Cuevas, K., Deater-Deckard, K., Kim-Spoon, J., Watson, A. J., Morasch, K. C., & Bell, M. A. (2014). What's mom got to do with it? Contributions of maternal executive function and caregiving to the development of executive function across early childhood. *Developmental Science*, *17*(2), 224–238. https://doi.org/10.1111/desc.12073

Day, C., Gu, Q., & Sammons, P. (2016). The Impact of Leadership on Student Outcomes: How Successful School Leaders Use Transformational and Instructional Strategies to Make a Difference. *Educational Administration Quarterly*, *52*(2), 221–258. https://doi.org/10.1177/0013161X15616863

De Bellis, M. D. (2005). The Psychobiology of Neglect. *Child Maltreatment*, *10*(2), 150–172. https://doi.org/10.1177/1077559505275116

De Corte, E., Verschaffel, L., & Masui, C. (2004). The CLIA-model: A framework for designing powerful learning environments for thinking and problem solving. *European Journal of Psychology of Education*, *19*(4), 365–384.

de Leeuw, M., Bohlken, M. M., Mandl, R. C., Hillegers, M. H., Kahn, R. S., & Vink, M. (2017). Changes in White Matter Organization in Adolescent Offspring of Schizophrenia Patients. *Neuropsychopharmacology*, *42*(2), 495–501. https://doi.org/10.1038/npp.2016.130

de Winter, J., Dodou, D., & Wieringa, P. (2009). Exploratory Factor Analysis With Small Sample Sizes. *Multivariate Behavioral Research*, *44*, 147–181. https://doi.org/10.1080/00273170902794206

Deater-Deckard, K. (2016). Is self-regulation "All in the family"? Testing environmental effects using within-family quasi-experiments. *International Journal of Behavioral Development*, *40*(3), 224–233. https://doi.org/10.1177/0165025415621971

Deci, E., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. Springer Science & Business Media.

Dent, A. L. (2013). *The Relation Between Self-Regulation and Academic Achievement: A Meta-Analysis Exploring Variation in the Way Constructs are Labeled, Defined, and Measured*. https://dukespace.lib.duke.edu/dspace/handle/10161/7265

Dent, A. L., & Hoyle, R. H. (2015). A framework for evaluating and enhancing alignment in self-regulated learning research. *Metacognition and Learning*, *10*(1), 165–179. https://doi.org/10.1007/s11409-015-9136-4

Dent, A. L., & Koenka, A. C. (2016). The Relation Between Self-Regulated Learning and Academic Achievement Across Childhood and Adolescence: A Meta-Analysis. *Educational Psychology Review*, *28*(3), 425–474. https://doi.org/10.1007/s10648-015-9320-8

Denzin, N. (1978). *The research art: A theoretical introduction to sociological methods*. McGraw-Hill.

Diamond, A. (2009). The Interplay of Biology and the Environment Broadly Defined. *Developmental Psychology*, *45*(1), 1–8. https://doi.org/10.1037/a0014601

DiBenedetto, M. K., & Zimmerman, B. J. (2013). Construct and predictive validity of microanalytic measures of students' self-regulation of science learning. *Learning and Individual Differences*, *26*, 30–41. https://doi.org/10.1016/j.lindif.2013.04.004

DiFrancesca, D., Nietfeld, J. L., & Cao, L. (2016). A comparison of high and low achieving students on self-regulated learning variables. *Learning and Individual Differences*, *45*, 228–236. https://doi.org/10.1016/j.lindif.2015.11.010

Dignath, C. (2016). Which components of teacher competence determine whether teachers enhance self-regulated learning? Predicting teachers' self-reported promotion of self-regulated learning by means of teacher beliefs, knowledge, and self-efficacy. *Frontline Learning Research*, *4*, 83–105.

Dignath, C., Buettner, G., & Langfeldt, H.-P. (2008). How can primary school students learn self-regulated learning strategies most effectively?: A meta-analysis on self-regulation training programmes. *Educational Research Review*, *3*(2), 101–129. https://doi.org/10.1016/j.edurev.2008.02.003

Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning*, *3*(3), 231–264. https://doi.org/10.1007/s11409-008-9029-x

Dignath, C., & Büttner, G. (2018). Teachers' direct and indirect promotion of self-regulated learning in primary and secondary school mathematics classes – insights from video-based classroom observations and teacher interviews. *Metacognition and Learning*, 1–31. https://doi.org/10.1007/s11409-018-9181-x

Dignath, C., & Veenman, M. V. J. (2020). The Role of Direct Strategy Instruction and Indirect Activation of Self-Regulated Learning—Evidence from Classroom Observation Studies. *Educational Psychology Review*. https://doi.org/10.1007/s10648-020-09534-0

Dignath-van Ewijk, C., Fabriz, S., & Buttner, G. (2015). Fostering self-regulated learning among students by means of an electronic learning diary: A training experiment.

Journal of Cognitive Education and Psychology, *14*(1), 77–97. https://doi.org/10.1891/1945-8959.14.1.77

Dignath-van Ewijk, C., & van der Werf, G. (2012). What Teachers Think about Self-Regulated Learning: Investigating Teacher Beliefs and Teacher Behavior of Enhancing Students' Self-Regulation. *Education Research International*, *2012*, e741713. https://doi.org/10.1155/2012/741713

Dinsmore, D. L., Alexander, P. A., & Loughlin, S. M. (2008). Focusing the conceptual lens on metacognition, self-regulation, and self-regulated learning. *Educational Psychology Review*, *20*(4), 391–409. https://doi.org/10.1007/s10648-008-9083-6

DiStefano, C., Zhu, M., & Mîndrilã, D. (2019). Understanding and Using Factor Scores: Considerations for the Applied Researcher. *Practical Assessment, Research, and Evaluation*, *14*(1). https://doi.org/10.7275/da8t-4g52

Donovan, M. S., Bransford, J. D., & Pellegrino, J. W. (1999). *How People Learn: Bridging Research and Practice*. National Academy Press, 2101 Constitution Avenue N. https://eric.ed.gov/?id=ED440122

Dörrenbächer, L. (2017). *MOSAIC: Modelling and training of self-regulated learning and analysis of individual differences in college students*. University of Saarland.

Dörrenbächer, L., & Perels, F. (2016a). More is more? Evaluation of interventions to foster self-regulated learning in college. *International Journal of Educational Research*, *78*, 50–65. https://doi.org/10.1016/j.ijer.2016.05.010

Dörrenbächer, L., & Perels, F. (2016b). Self-regulated learning profiles in college students: Their relationship to achievement, personality, and the effectiveness of an intervention to foster self-regulated learning. *Learning and Individual Differences*, *51*, 229–241. https://doi.org/10.1016/j.lindif.2016.09.015

Dresel, M., Schmitz, B., Schober, B., Spiel, C., Ziegler, A., Engelschalk, T., Jöstl, G., Klug, J., Roth, A., Wimmer, B., & Steuer, G. (2015). Competencies for successful self-regulated learning in higher education: Structural model and indications drawn from expert interviews. *Studies in Higher Education*, *40*(3), 454–470. https://doi.org/10.1080/03075079.2015.1004236

Duffy, T. M., & Jonassen, D. H. (1992). *Constructivism and the Technology of Instruction: A Conversation*. Psychology Press.

Duncan, T. G., & McKeachie, W. J. (2005). The Making of the Motivated Strategies for Learning Questionnaire. *Educational Psychologist*, *40*(2), 117–128. https://doi.org/10.1207/s15326985ep4002_6

Dunlosky, J., & Rawson, K. A. (2012). Overconfidence produces underachievement: Inaccurate self evaluations undermine students' learning and retention. *Learning and Instruction*, *22*(4), 271–280. https://doi.org/10.1016/j.learninstruc.2011.08.003

Dunn, K. E., & Lo, W.-J. (2015). Understanding the Influence of Learners' Forethought on Their Use of Science Study Strategies in Postsecondary Science Learning. *International Journal of Science Education*, *37*(16), 2597–2618. https://doi.org/10.1080/09500693.2015.1094589

Dunn, K. E., Lo, W.-J., Mulvenon, S. W., & Sutcliffe, R. (2012). Revisiting the Motivated Strategies for Learning Questionnaire: A Theoretical and Statistical Reevaluation of the Metacognitive Self-Regulation and Effort Regulation Subscales. *Educational and Psychological Measurement*, *72*(2), 312–331. https://doi.org/10.1177/0013164411413461

Dweck, C. S. (2000). *Self-theories: Their Role in Motivation, Personality, and Development*. Psychology Press.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist*, *48*(2), 90–101. https://doi.org/10.1037/0003-066X.48.2.90

Edossa, A. K., Schroeders, U., Weinert, S., & Artelt, C. (2018). The development of emotional and behavioral self-regulation and their effects on academic achievement in childhood. *International Journal of Behavioral Development*, *42*(2), 192–202. https://doi.org/10.1177/0165025416687412

Eekelen, I. M. V., Boshuizen, H. P. A., & Vermunt, J. D. (2005). Self-regulation in Higher Education Teacher Learning. *Higher Education*, *50*(3), 447–471. https://doi.org/10.1007/s10734-004-6362-0

Effeney, G., Carroll, A., & Bahr, N. (2013). Self-regulated learning and executive function: Exploring the relationships in a sample of adolescent males. *Educational Psychology*, *33*(7), 773–796. https://doi.org/10.1080/01443410.2013.785054

Elliott, A. C., & Woodward, W. A. (2007). *Statistical Analysis Quick Reference Guidebook: With SPSS Examples*. SAGE.

Entwistle, N., & McCune, V. (2004). The Conceptual Bases of Study Strategy Inventories. *Educational Psychology Review*, *16*(4), 325–345. https://doi.org/10.1007/s10648-004-0003-0

Ericsson, K. A., & Lehmann, and A. C. (1996). Expert and Exceptional Performance: Evidence of Maximal Adaptation to Task Constraints. *Annual Review of Psychology*, *47*(1), 273–305. https://doi.org/10.1146/annurev.psych.47.1.273

European Commission. (2008). *The european qualifications framework for lifelong learning (EFQ)*. Office for Official Publications of the European Communities.

European Council. (2002). Council resolution of 27 June 2002 on lifelong learning. *Official Journal of the European Communities*, *9*, 1–3.

Ewijk, C. D., Dickhäuser, O., & Büttner, G. (2013). Assessing how teachers enhance self-regulated learning: A multiperspective approach. *Journal of Cognitive Education and Psychology*, *12*(3), 338–358. https://doi.org/10.1891/1945-8959.12.3.338

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, *4*(3), 272.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexibile statistical power analysis programe for the social, behvaioural, and biomedical sciences. *Behvaiour Research Methods*, *39*(2), 175–191.

Feng, X., Hooper, E. G., & Jia, R. (2017). From compliance to self-regulation: Development during early childhood. *Social Development*, *26*(4), 981–995. https://doi.org/10.1111/sode.12245

Fernandez, J., & Jamet, E. (2017). Extending the testing effect to self-regulated learning. *Metacognition and Learning*, *12*(2), 131–156. https://doi.org/10.1007/s11409-016-9163-9

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. SAGE.

Field, A. P. (2000). *Discovering Statistics Using SPSS for Windows: Advanced Techniques for Beginners* (1st ed.). Sage Publications, Inc.

Finders, J. K., McClelland, M. M., Geldhof, G. J., Rothwell, D. W., & Hatfield, B. E. (2021). Explaining achievement gaps in kindergarten and third grade: The role of self-regulation and executive function skills. *Early Childhood Research Quarterly*, *54*, 72–85. https://doi.org/10.1016/j.ecresq.2020.07.008

Fischer, C. (2008). Strategien Selbstregulierten Lernens in der Begabtenförderung. *Diskurs Kindheits- und Jugendforschung*, *3*(1), 41–51.

Fitzsimons, G. M., & Finkel, E. J. (2011). The effects of self-regulation on social relationships. In K. D. Vohs, R. F. Baumeister, K. D. (Ed) Vohs, & R. F. (Ed)

Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications (2nd ed.)*. (2010-24692-022; pp. 407–421). Guilford Press.
Flavell, J. H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive–Developmental Inquiry. *American Psychologist*, *34*(10), 906.
Floyd, F., & Widaman, K. (1995). Factor Analysis in the Development and Refinement of Clinical Assessment Instruments. *Psychological Assessment*, *7*, 286–299. https://doi.org/10.1037/1040-3590.7.3.286
Fuchs, L. S., Fuchs, D., Prentice, K., Burch, M., Hamlett, C. L., Owen, R., & Schroeter, K. (2003). Enhancing third-grade student' mathematical problem solving with self-regulated learning strategies. *Journal of Educational Psychology*, *95*(2), 306–315. https://doi.org/10.1037/0022-0663.95.2.306
Gagne, P., & Hancock, G. R. (2006). Measurement Model Quality, Sample Size, and Solution Propriety in Confirmatory Factor Models. *Multivariate Behavioral Research*, *41*(1), 65–83. https://doi.org/10.1207/s15327906mbr4101_5
Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational Research: An Introduction*. Allyn and Bacon. https://books.google.co.uk/books?id=_rRhQgAACAAJ
Gan, Z., Liu, F., & Yang, C. C. R. (2020). Student-teachers' self-efficacy for instructing self-regulated learning in the classroom. *Journal of Education for Teaching*, *46*(1), 120–123. https://doi.org/10.1080/02607476.2019.1708632
Garcia, T., & Pintrich, P. R. (1996). Assessing students' motivation and learning strategies in the classroom context: The Motivated Strategies for Learning Questionnaire. In *Alternatives in assessment of achievements, learning processes and prior knowledge* (pp. 319–339). Springer. http://link.springer.com/chapter/10.1007/978-94-011-0657-3_12
Garner, R. (1990). Children's use of strategies in reading. *Children's Strategies, Contemporary Views of Cognitive Development*, 245–268.
Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function in preschoolers: A review using an integrative framework. *Psychological Bulletin*, *134*(1), 31–60. https://doi.org/10.1037/0033-2909.134.1.31
Gast, D. L. (2009). *Single Subject Research Methodology in Behavioral Sciences | Taylor & Francis Group*. Routledge. https://www.taylorfrancis.com/https://www.taylorfrancis.com/books/edit/10.4324/9780203877937/single-subject-research-methodology-behavioral-sciences-jennifer-ledford-david-gast
Ghasemi, A., & Zahediasl, S. (2012). Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. *International Journal of Endocrinology and Metabolism*, *10*(2), 486–489. https://doi.org/10.5812/ijem.3505
Goldberg, L. R., & Velicer, W. F. (2006). Principles of Exploratory Factor Analysis. In *Differentiating normal and abnormal personality, 2nd ed* (pp. 209–237). Springer Publishing Company.
Goldsmith, H. H., Buss, K. A., & Lemery, K. S. (1997). Toddler and childhood temperament: Expanded content, stronger genetic evidence, new evidence for the importance of environment. *Developmental Psychology*, *33*(6), 891–905. https://doi.org/10.1037//0012-1649.33.6.891
Gopalan, M., Rosinger, K., & Ahn, J. B. (2020). Use of Quasi-Experimental Research Designs in Education Research: Growth, Promise, and Challenges. *Review of Research in Education*, *44*(1), 218–243. https://doi.org/10.3102/0091732X20903302
Green, M. (1989). *Theories of human development: A comparative approach* (1989-97591-000). Prentice-Hall, Inc.

Greene, J. A., Bolick, C. M., & Robertson, J. (2010). Fostering historical knowledge and thinking skills using hypermedia learning environments: The role of self-regulated learning. *Computers & Education*, *54*(1), 230–243. https://doi.org/10.1016/j.compedu.2009.08.006

Greene, J., Mason Bolick, C., Jackson, W., M. Caprino, A., Oswald, C., & McVea, M. (2015). Domain-specificity of self-regulated learning processing in science and history. *Contemporary Educational Psychology*. https://doi.org/10.1016/j.cedpsych.2015.06.001

Greenhouse, S. W., & Geisser, S. (1959). On methods in the analysis of profile data. *Psychometrika*, *24*(2), 95–112. https://doi.org/10.1007/BF02289823

Greenough, W. T., Black, J. E., & Wallace, C. S. (1987). Experience and brain development. *Child Development*, *58*(3), 539–559.

Gresch, H., Hasselhorn, M., & Bögeholz, S. (2017). Enhancing Decision-Making in STSE Education by Inducing Reflection and Self-Regulated Learning. *Research in Science Education*, *47*(1), 95–118. https://doi.org/10.1007/s11165-015-9491-9

Grice, J. W. (2001). Computing and evaluating factor scores. *Psychological Methods, 6*(4), 430–450. https://doi.org/10.1037/1082-989X.6.4.430

Grice, J. W., & Harris, R. J. (1998). A comparison of regression and loading weights for the computation of factor scores. *Multivariate Behavioral Research*, *33*(2), 221–247. https://doi.org/10.1207/s15327906mbr3302_2

Griffiths, M. (1998). *Educational Research For Social Justice: Getting Off the Fence*. McGraw-Hill Education (UK).

Grossman, P. L., & Stodolsky, S. S. (1995). Content as Context: The Role of School Subjects in Secondary School Teaching. *Educational Researcher*, *24*(8), 5–23. https://doi.org/10.3102/0013189X024008005

Guilford, J. P. (1954). *Psychometric methods, 2nd ed*. McGraw-Hill.

Guthrie, J. T., Van Meter, P., Hancock, G. R., Alao, S., Anderson, E., & McCann, A. (1998). Does concept-oriented reading instruction increase strategy use and conceptual learning from text? - PsycNET. *Journal of Educational Psychology*, *90*(2), 261–278. https://doi.org/10.1037/0022-0663.90.2.261

Hacking, E. B., & Barratt, R. (2009). Children Researching their Urban Environment: Developing a methodology. *Education 3–13*, *37*(4), 371–383.

Hadwin, A. F., Nesbit, J. C., Jamieson-Noel, D., Code, J., & Winne, P. H. (2007). Examining trace data to explore self-regulated learning. *Metacognition and Learning*, *2*(2–3), 107–124. https://doi.org/10.1007/s11409-007-9016-7

Hadwin, A. F., & Winne, P. H. (2001). CoNoteS2: A Software Tool for Promoting Self-Regulation. *Educational Research and Evaluation*, *7*(2–3), 313–334. https://doi.org/10.1076/edre.7.2.313.3868

Hager, W., Patry, J.-L., & Brezing, H. (2000). *Evaluation psychologischer Interventionsmaßnahmen. Standards und Kriterien: Ein Handbuch*. https://uni-salzburg.elsevierpure.com/de/publications/evaluation-psychologischer-interventionsma%C3%9Fnahmen-standards-und-k

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (Seventh edition, Pearson new international edition.). Pearson. https://cam.ldls.org.uk/vdc_100048058311.0x000001

Hamilton, B. L. (1977). An empirical investigation of the effects of heterogeneous regression slopes in analysis of covariance. *Educational and Psychological Measurement*, *37*(3), 701–712. https://doi.org/10.1177/001316447703700313

Hammersley, M. (2004). Action Research: A Contradiction in Terms? *Oxford Review of Education*, *30*(2), 165–181.

Harackiewicz, J. M., Barron, K. E., & Elliot, A. J. (1998). Rethinking achievement goals: When are they adaptive for college students and why? *Educational Psychologist*, *33*(1), 1–21. https://doi.org/10.1207/s15326985ep3301_1

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. M. (2002). Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology*, *94*(3), 638–645. https://doi.org/10.1037/0022-0663.94.3.638

Harris, H., & Horst, S. (2019). A Brief Guide to Decisions at Each Step of the Propensity Score Matching Process. *Practical Assessment, Research, and Evaluation*, *21*(1). https://doi.org/10.7275/yq7r-4820

Hattie, J. A. C. (2009). *Visible learning: A synthesis of 800+ meta-analyses on achievement*. Routledge.

Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research*, *66*(2), 99–136. https://doi.org/10.2307/1170605

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112.

Hawe, E., & Dixon, H. (2017). Assessment for learning: A catalyst for student self-regulation. *Assessment & Evaluation in Higher Education*, *42*(8), 1181–1192. https://doi.org/10.1080/02602938.2016.1236360

Hayton, J. C., Allen, D. G., & Scarpello, V. (2004). Factor Retention Decisions in Exploratory Factor Analysis: A Tutorial on Parallel Analysis. *Organizational Research Methods*, *7*(2), 191–205. https://doi.org/10.1177/1094428104263675

Heath, N. L., & Glen, T. (2005). Positive Illusory Bias and the Self-Protective Hypothesis in Children With Learning Disabilities. *Journal of Clinical Child & Adolescent Psychology*, *34*(2), 272–281. https://doi.org/10.1207/s15374424jccp3402_6

Heinström, J. (2000). *The impact of personality and approaches to learning on information behaviour*. http://informationr.net/ir/5-3/paper78.html?em_x=22

Henter, R. (2014). Developing metacognitive skills as a foundation of learning a foreign language. *Romanian Journal of Experimental Applied Psychology*, *5*(1), 48–57.

Hessels-Schlatter, C., Hessels, M. G., Godin, H., & Spillmann, H. (2017). Fostering self-regulated learning: From clinical to whole class interventions. *Educational and Child Psychology*, *34*(1), 110–125.

Hill, J. R., & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. *Educational Technology Research and Development*, *49*(3), 37–52. https://doi.org/10.1007/BF02504914

Hofer, B. K., & Yu, S. L. (2003). Teaching Self-Regulated Learning Through a ‘Learning to Learn’ Course. *Teaching of Psychology*, *30*(1), 30–33. https://doi.org/10.1207/S15328023TOP3001_05

Hofer, B. K., Yu, S. L., & Pintrich, P. R. (1998). Teaching College Students to Be Self-Regulated Learners. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated Learning: From Teaching to Self-reflective Practice* (pp. 57–85). Guilford Publications.

Hollingsworth, H. H. (2016). An Analytical Investigation of the Effects of Heterogeneous Regression Slopes in Analysis of Covariance: *Educational and Psychological Measurement*. https://doi.org/10.1177/001316448004000306

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*(2), 179–185. https://doi.org/10.1007/BF02289447

Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. *Journal of Educational Psychology*, *24*(6), 417–441. https://doi.org/10.1037/h0071325

Hughes, J. N., Chen, Q., Thoemmes, F., & Kwok, O. (2010). An Investigation of the Relationship Between Retention in First Grade and Performance on High Stakes Tests in Third Grade. *Educational Evaluation and Policy Analysis*, *32*(2), 166–182. https://doi.org/10.3102/0162373710367682

Hutcheson, G. D., & Sofroniou, N. (1999). *The Multivariate Social Scientist: Introductory Statistics Using Generalized Linear Models*. SAGE.

Jackson, D. L., Voth, J., & Frey, M. P. (2013). A Note on Sample Size and Solution Propriety for Confirmatory Factor Analytic Models. *Structural Equation Modeling: A Multidisciplinary Journal*, *20*(1), 86–97. https://doi.org/10.1080/10705511.2013.742388

Jak, S. (2014). Testing strong factorial invariance using three-level structural equation modeling. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00745

James, M., & McCormick, R. (2009). Teachers learning how to learn. *Teaching and Teacher Education*, *25*(7), 973–982. https://doi.org/10.1016/j.tate.2009.02.023

Jansen, R. S., van Leeuwen, A., Janssen, J., Kester, L., & Kalz, M. (2017). Validation of the self-regulated online learning questionnaire. *Journal of Computing in Higher Education*, *29*(1), 6–27. https://doi.org/10.1007/s12528-016-9125-x

Jester, J. M., Nigg, J. T., Puttler, L. I., Long, J. C., Fitzgerald, H. E., & Zucker, R. A. (2009). Intergenerational transmission of neuropsychological executive functioning. *Brain and Cognition*, *70*(1), 145–153. https://doi.org/10.1016/j.bandc.2009.01.005

Johnson, B., & Christensen, L. (2008). *Educational Research: Quantitative, Qualitative, and Mixed Approaches*. SAGE.

Johnson, T. R. (2016). Violation of the homogeneity of regression slopes assumption in ANCOVA for two-group pre-post designs: Tutorial on a modified Johnson-Neyman procedure. *The Quantitative Methods for Psychology*, *12*(3), 253–263.

Jones, K. (2011). The Practice of Quantitative Methods. In B. Somekh & C. Lewin (Eds.), *Theory and Methods in Social Research*. SAGE.

Jönsson, A. (2013). Communicating expectations through the use of rubrics. *ResearchGate*. EARLI, Munich, Germany. https://www.researchgate.net/publication/266030204_Communicating_expectations_through_the_use_of_rubrics

Jönsson, A., & Panadero, E. (2017). The Use and Design of Rubrics to Support Assessment for Learning. In D. Carless, S. M. Bridges, C. K. Y. Chan, & R. Glofcheski (Eds.), *Scaling up Assessment for Learning in Higher Education* (pp. 99–111). Springer Singapore. https://doi.org/10.1007/978-981-10-3045-1_7

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning*, *15*(1). https://doi.org/10.19173/irrodl.v15i1.1651

Jordano, M. L., & Touron, D. R. (2018). How often are thoughts metacognitive? Findings from research on self-regulated learning, think-aloud protocols, and mind-wandering. *Psychonomic Bulletin & Review*. https://doi.org/10.3758/s13423-018-1490-1

Jung, S., & Lee, S. (2011). Exploratory factor analysis for small samples. *Behavior Research Methods*, *43*(3), 701–709. https://doi.org/10.3758/s13428-011-0077-9

Kahn, J. H. (2016). Factor Analysis in Counseling Psychology Research, Training, and Practice: Principles, Advances, and Applications. *The Counseling Psychologist*. https://doi.org/10.1177/0011000006286347

Kaiser, H. F. (1970). A second generation little jiffy. *Psychometrika*, *35*(4), 401–415. https://doi.org/10.1007/BF02291817

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31–36. https://doi.org/10.1007/BF02291575

Kaplan, A. (2008). Clarifying Metacognition, Self-Regulation, and Self-Regulated Learning: What's the Purpose? *Educational Psychology Review*, *20*(4), 477. https://doi.org/10.1007/s10648-008-9087-2

Kaplan, A., & Midgley, C. (1997). The Effect of Achievement Goals: Does Level of Perceived Academic Competence Make a Difference? *Contemporary Educational Psychology*, *22*(4), 415–435. https://doi.org/10.1006/ceps.1997.0943

Karpov, Y. V., & Haywood, C. H. (1998). Two ways to elaborate Vygotsky's concept of mediation. *American Psychologist, 53*(1), 27–36. https://doi.org/10.1037/0003-066X.53.1.27

Karreman, A., Tuijl, C. van, Aken, M. A. G. van, & Deković, M. (2006). Parenting and self-regulation in preschoolers: A meta-analysis. *Infant and Child Development*, *15*(6), 561–579. https://doi.org/10.1002/icd.478

Kärtner, J., Borke, J., Maasmeier, K., Keller, H., & Kleis, A. (2011). Sociocultural Influences on the Development of Self-Recognition and Self-Regulation in Costa Rican and Mexican Toddlers. *Journal of Cognitive Education and Psychology*, *10*(1), 96–112. https://doi.org/10.1891/1945-8959.10.1.96

Kaur, P., Saini, S., & Vig, D. (2018). Metacognition, self-regulation and learning environment as determinant of academic achievement. *Indian Journal of Health and Wellbeing; Hisar*, *9*(5), 735–739.

Keating, D. P. (1990). Charting pathways to the development of expertise. *Educational Psychologist*, *25*(3–4), 243–267. https://doi.org/10.1207/s15326985ep2503&4_6

Kellett, M., & Nind, M. (2001). Ethics in quasi-experimental research on people with severe learning disabilities: Dilemmas and compromises. *British Journal of Learning Disabilities*, *29*(2), 51–55. https://doi.org/10.1046/j.1468-3156.2001.00096.x

Kelly, B., & Perkins, D. F. (2012). *Handbook of Implementation Science for Psychology in Education*. Cambridge University Press.

Kettle, B., & Sellars, N. (1996). The Development of Student Teachers Practical Theory of Teaching. *Teaching and Teacher Education*, *12*(1), 1–24.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching. *Educational Psychologist*, *41*(2), 75–86. https://doi.org/10.1207/s15326985ep4102_1

Kistner, S., Rakoczy, K., Otto, B., Dignath-van Ewijk, C., Büttner, G., & Klieme, E. (2010). Promotion of self-regulated learning in classrooms: Investigating frequency, quality, and consequences for student performance. *Metacognition and Learning*, *5*(2), 157–171. https://doi.org/10.1007/s11409-010-9055-3

Kitsantas, A., & Zimmerman, B. J. (2002). Comparing Self-Regulatory Processes Among Novice, Non-Expert, and Expert Volleyball Players: A Microanalytic Study. *Journal of Applied Sport Psychology*, *14*(2), 91–105. https://doi.org/10.1080/10413200252907761

Kitsantas, A., Zimmerman, B. J., & Cleary, T. (2000). The role of observation and emulation in the development of athletic self-regulation. *Journal of Educational Psychology*, *92*(4), 811–817. https://doi.org/10.1037/0022-0663.92.4.811

Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effect of direct instruction and discovery learning. *Psychological Science*, *15*(10), 661–667. https://doi.org/10.1111/j.0956-7976.2004.00737.x

Kline, P. (2013). *Handbook of psychological testing*. Routledge.

Klug, J., Ogrin, S., Keller, S., Ihringer, A., & Schmitz, B. (2011). A plea for self-regulated learning as a process: Modelling, measuring and intervening. *Psychological Test and Assessment Modeling*, *53*(1), 51–72.

Kokkinos, C. M., Kargiotidis, A., & Markos, A. (2015). The relationship between learning and study strategies and big five personality traits among junior university student teachers. *Learning and Individual Differences*, *43*, 39–47. https://doi.org/10.1016/j.lindif.2015.08.031

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, *18*(2), 199–214. https://doi.org/10.1037/0012-1649.18.2.199

Korthagen, F. A. J., & Kessels, J. P. A. M. (1999). Linking Theory and Practice: Changing the Pedagogy of Teacher Education ,
Linking Theory and Practice: Changing the Pedagogy of Teacher Education. *Educational Researcher*, *28*(4), 4–17. https://doi.org/10.3102/0013189X028004004

Kostons, D., van Gog, T., & Paas, F. (2010). Self-assessment and task selection in learner-controlled instruction: Differences between effective and ineffective learners. *Computers & Education*, *54*(4), 932–940. https://doi.org/10.1016/j.compedu.2009.09.025

Kostons, D., van Gog, T., & Paas, F. (2012). Training self-assessment and task-selection skills: A cognitive approach to improving self-regulated learning. *Learning and Instruction*, *22*(2), 121–132. https://doi.org/10.1016/j.learninstruc.2011.08.004

Kovas, Y., Haworth, C. M. A., Dale, P. S., & Plomin, R. (2007). The genetic and environmental origins of learning abilities and disabilities in the early school years. *Monographs of the Society for Research in Child Development*, *72*(3), vii, 1–144. https://doi.org/10.1111/j.1540-5834.2007.00439.x

Kramarski, B., Desoete, A., Bannert, M., Narciss, S., & Perry, N. (2013). New Perspectives on Integrating Self-Regulated Learning at School. *Education Research International*, *2013*, 498214. https://doi.org/10.1155/2013/498214

Kramarski, B., & Michalsky, T. (2010). Preparing preservice teachers for self-regulated learning in the context of technological pedagogical content knowledge. *Learning and Instruction*, *20*(5), 434–447. https://doi.org/10.1016/j.learninstruc.2009.05.003

Kramarski, B., & Revach, T. (2009). The Challenge of Self-Regulated Learning in Mathematics Teachers' Professional Training. *Educational Studies in Mathematics*, *72*(3), 379–399.

Krebbers, L. (2015). *The first steps towards a quantitative measurement scale of Causation and Effectuation in a non-entrepreneurial student context*. University of Twente.

Kuhl, J. (1985). From Cognition to Behavior: Perspectives for Future Research on Action Control. In P. D. J. Kuhl & D. J. Beckmann (Eds.), *Action Control* (pp. 267–275). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_12

Kuhl, J. (2000). A functional-design approach to motivation and self-regulation: The dynamics of personality systems and interactions. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 111–169). Academic Press.

Laing, K., & Todd, L. (2015). *Theory-based methodology: Using theories of change in educational development, research and evaluation. Research Centre for Learning and Teaching, Newcastle University*. https://doi.org/10.13140/RG.2.1.1607.4964

Lavasani, M. G., Mirhosseini, F. S., Hejazi, E., & Davoodi, M. (2011). The Effect of Self-regulation Learning Strategies Training on the Academic Motivation and Self-efficacy. *Procedia - Social and Behavioral Sciences*, *29*, 627–632. https://doi.org/10.1016/j.sbspro.2011.11.285

Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping*. Springer Publishing Company.

Lee, J., & Shute, V. J. (2010). Personal and Social-Contextual Factors in K–12 Academic Performance: An Integrative Perspective on Student Learning. *Educational Psychologist*, *45*(3), 185–202. https://doi.org/10.1080/00461520.2010.493471

Lee, M. K., Baker, S., & Whitebread, D. (2018). Culture-specific links between maternal executive function, parenting, and preschool children's executive function in South Korea. *British Journal of Educational Psychology*, *88*(2), 216–235. https://doi.org/10.1111/bjep.12221

Lehmann, T., Hähnlein, I., & Ifenthaler, D. (2014). Cognitive, metacognitive and motivational perspectives on preflection in self-regulated online learning. *Computers in Human Behavior*, *32*, 313–323. https://doi.org/10.1016/j.chb.2013.07.051

Leidinger, M., & Perels, F. (2012). Training self-regulated learning in the classroom: Development and evaluation of learning materials to train self-regulated learning during regular mathematics lessons at primary school. *Education Research International*, *2012*. http://downloads.hindawi.com/journals/edu/2012/735790.pdf

Lemery, K. S., & Goldsmith, H. H. (2002). Genetic and environmental influences on preschool sibling cooperation and conflict: Associations with difficult temperament and parenting style. *Marriage & Family Review*, *33*(1), 77–99.

Lenhard, W., & Lenhard, A. (2014). *Hypothesis Tests for Comparing Correlations*. Psychometrica; Unpublished. https://www.psychometrica.de/correlation.html

Lerner, M. D., & Lonigan, C. J. (2014). Executive Function Among Preschool Children: Unitary Versus Distinct Abilities. *Journal of Psychopathology and Behavioral Assessment*, *36*(4), 626–639. https://doi.org/10.1007/s10862-014-9424-3

Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues*, *2*(4), 34–46.

Ley, K., & Young, D. B. (1998). Self-Regulation Behaviors in Underprepared (Developmental) and Regular Admission College Students. *Contemporary Educational Psychology*, *23*(1), 42–64. https://doi.org/10.1006/ceps.1997.0956

Lichtinger, E., & Kaplan, A. (2011). Purpose of engagement in academic self-regulation. *New Directions for Teaching and Learning*, *2011*(126), 9–19. https://doi.org/10.1002/tl.440

Lim, C. L., Jalil, H. A., Ma'rof, A. M., & Saad, W. Z. (2020). Peer Learning, Self-Regulated Learning and Academic Achievement in Blended Learning Courses: A Structural Equation Modeling Approach. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(03), 110–125.

Lin, X. (2001). Designing metacognitive activities. *Educational Technology Research and Development*, *49*(2), 23–40. https://doi.org/10.1007/BF02504926

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting & task performance* (Vol. xviii). Prentice-Hall, Inc.

Lodewyk, K. R., Winne, P. H., & Jamieson-Noel, D. L. (2009). Implications of task structure on self-regulated learning and achievement. *Educational Psychology*, *29*(1), 1–25. https://doi.org/10.1080/01443410802447023

Lombaerts, K., Backer, F. D., Engels, N., Braak, J. van, & Athanasou, J. (2009). Development of the self-regulated learning teacher belief scale. *European Journal of Psychology of Education*, *24*(1), 79–96. https://doi.org/10.1007/BF03173476

Lombaerts, K., Engels, N., & Braak, J. van. (2009). Determinants of Teachers' Recognitions of Self-Regulated Learning Practices in Elementary Education. *The Journal of Educational Research*, *102*(3), 163–174. https://doi.org/10.3200/JOER.102.3.163-174

Lommen, M. J. J., van de Schoot, R., & Engelhard, I. M. (2014). The experience of traumatic events disrupts the measurement invariance of a posttraumatic stress scale. *Frontiers in Psychology*, *5*, 1304. https://doi.org/10.3389/fpsyg.2014.01304

Lompscher, J. (1996). Erfassung von Lernstrategien auf der Reflexionsebene. *Empirische Pädagogik*, *10*(3), 245–275.

Lopez, E. J., Nandagopal, K., Shavelson, R. J., Szu, E., & Penn, J. (2013). Self-regulated learning study strategies and academic performance in undergraduate organic chemistry: An investigation examining ethnically diverse students. *Journal of Research in Science Teaching*, *50*(6), 660–676. https://doi.org/10.1002/tea.21095

Lourenço, O. (2012). Piaget and Vygotsky: Many resemblances, and a crucial difference. *New Ideas in Psychology*, *30*(3), 281–295. https://doi.org/10.1016/j.newideapsych.2011.12.006

Luftenegger, M., Schober, B., van de Schoot, R., Wagner, P., Finsterwald, M., & Spiel, C. (2012). Lifelong Learning as a Goal—Do Autonomy and Self-Regulation in School Result in Well Prepared Pupils? *Learning and Instruction*, *22*(1), 27–36. https://doi.org/10.1016/j.learninstruc.2011.06.001

Lumley, T., Diehr, P., Emerson, S., & Chen, L. (2002). The Importance of the Normality Assumption in Large Public Health Data Sets. *Annual Review of Public Health*, *23*(1), 151–169. https://doi.org/10.1146/annurev.publhealth.23.100901.140546

MacCallum, R. C., Widaman, K. F., Preacher, K. J., & Hong, S. (2001). Sample Size in Factor Analysis: The Role of Model Error. *Multivariate Behavioral Research*, *36*(4), 611–637. https://doi.org/10.1207/S15327906MBR3604_06

MacCallum, R., Widaman, K., Zhang, S., & Hong, S. (1999). Sample Size in Factor Analysis. *Psychological Methods - PSYCHOL METHODS*, *4*, 84–99. https://doi.org/10.1037/1082-989X.4.1.84

Magno, C. (2011). Validating the Academic Self-regulated Learning Scale with the Motivated Strategies for Learning Questionnaire (MSLQ) and Learning and Study Strategies Inventory (LASSI). *The International Journal of Educational and Psychological Assessment*, *7*(2), 56–73.

Manke, B., Saudino, K. J., & Grant, J. D. (2001). Extremes analyses of observed temperament dimensions. In *Infancy to early childhood: Genetic and environmental influences on developmental change* (pp. 52–72). Oxford University Press.

Mannion, J. (2018). *Metacognition, self-regulation, oracy: A mixed methods case study of a complex, whole-school Learning to Learn intervention* [Thesis, University of Cambridge]. https://doi.org/10.17863/CAM.36395

Martinez-Pons, M. (2002). Parental Influences on Children’s Academic Self-Regulatory Development. *Theory Into Practice*, *41*(2), 126–131. https://doi.org/10.1207/s15430421tip4102_9

Masui, C., & De Corte, E. (2005). Learning to reflect and to attribute constructively as basic components of self-regulated learning. *British Journal of Educational Psychology*, *75*(3), 351–372. https://doi.org/10.1348/000709905X25030

Matzat, U., & Vrieling, E. M. (2016). Self-regulated learning and social media – a ‘natural alliance’? Evidence on students’ self-regulation of learning, social media use, and student–teacher relationship. *Learning, Media and Technology*, *41*(1), 73–99. https://doi.org/10.1080/17439884.2015.1064953

McCardle, L., & Hadwin, A. F. (2015). Using multiple, contextualized data sources to measure learners’ perceptions of their self-regulated learning. *Metacognition and Learning*, *10*(1), 43–75. https://doi.org/10.1007/s11409-014-9132-0

McClelland, M. M., & Cameron, C. E. (2012). Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives*, *6*(2), 136–142. https://doi.org/10.1111/j.1750-8606.2011.00191.x

McClelland, M. M., & Cameron, C. E. (2019). Developing together: The role of executive function and motor skills in children's early academic lives. *Early Childhood Research Quarterly*, *46*, 142–151. https://doi.org/10.1016/j.ecresq.2018.03.014
McDaniel, M. A., & Schlager, M. S. (1990). Discovery Learning and Transfer of Problem-Solving Skills. *Cognition and Instruction*, *7*(2), 129–159. https://doi.org/10.1207/s1532690xci0702_3
McInerney, D. M., Cheng, R. W., Mok, M. M. C., & Lam, A. K. H. (2012). Academic Self-Concept and Learning Strategies: Direction of Effect on Student Academic Achievement. *Journal of Advanced Academics*, *23*(3), 249–269. https://doi.org/10.1177/1932202X12451020
McInnes, K., Howard, J., Miles, G. E., Crowley, K., & Kevin McInnes, J. H., Gareth Miles and Kevin Crowley. (2010). Differences in adult-child interactions during playful and formal practice conditions: An initial investigation. *Psychology of Education Review*, *34*(1), 14–20.
McIntyre, D. (2005). Bridging the gap between research and practice. *Cambridge Journal of Education*, *35*(3), 357–382.
McKeachie, W. J., Pintrich, P. R., & Lin, Y.-G. (1985). Teaching learning strategies. *Educational Psychologist*, *20*(3), 153–160.
McKernan, J. (2013). *Curriculum Action Research: A Handbook of Methods and Resources for the Reflective Practitioner*. Routledge.
Mcmahon, M., & Oliver, R. (2001). Promoting self-regulated learning in an on-line environment. *ECU Publications Pre. 2011*. https://ro.ecu.edu.au/ecuworks/4816
McPherson, G. E., Osborne, M. S., Evans, P., & Miksza, P. (2017). Applying self-regulated learning microanalysis to study musicians' practice. *Psychology of Music*, 0305735617731614. https://doi.org/10.1177/0305735617731614
Meadows, S. (2004). Models of cognition in childhood: Metaphors, achievements and problems. In H. Daniels & A. Edwards 1946- (Eds.), *The RoutledgeFalmer reader in psychology of education* (pp. 135–183). RoutledgeFalmer,.
Meer, J. van der, Jansen, E., & Torenbeek, M. (2010). 'It's almost a mindset that teachers need to change': First-year students' need to be inducted into time management. *Studies in Higher Education*, *35*(7), 777–791. https://doi.org/10.1080/03075070903383211
Mellenbergh, G. J. (1989). Item bias and item response theory. *International Journal of Educational Research*, *13*(2), 127–143. https://doi.org/10.1016/0883-0355(89)90002-5
Mendoza, J. L., Toothaker, L. E., & Crain, B. R. (1976). Necessary and Sufficient Conditions for F Ratios in the L × J × K Factorial Design with Two Repeated Factors. *Journal of the American Statistical Association*, *71*(356), 992–993. https://doi.org/10.1080/01621459.1976.10480983
Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, *58*(4), 525–543. https://doi.org/10.1007/BF02294825
Meredith, W., & Teresi, J. A. (2006). An Essay on Measurement and Factorial Invariance. *Medical Care*, *44*(11), S69–S77. JSTOR.
Mevarech, Z. R., & Amrany, C. (2008). Immediate and Delayed Effects of Meta-Cognitive Instruction on Regulation of Cognition and Mathematics Achievement. *Metacognition and Learning*, *3*(2), 147–157. https://doi.org/10.1007/s11409-008-9023-3
Michalsky, T., & Schechter, C. (2018). Teachers' Self-Regulated Learning Lesson Design: Integrating Learning from Problems and Successes. *The Teacher Educator*, *53*(2), 101–123. https://doi.org/10.1080/08878730.2017.1399187

Middleton, M. J., & Midgley, C. (1997). Avoiding the demonstration of lack of ability: An underexplored aspect of goal theory. *Journal of Educational Psychology*, *89*(4), 710–718. https://doi.org/10.1037/0022-0663.89.4.710

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: Good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology*, *93*(1), 77–86. https://doi.org/10.1037/0022-0663.93.1.77

Millsap, R. E. (2012). *Statistical Approaches to Measurement Invariance*. Routledge.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex ‘Frontal Lobe’ tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Montague Marjorie. (2007). Self-Regulation and Mathematics Instruction. *Learning Disabilities Research & Practice*, *22*(1), 75–83. https://doi.org/10.1111/j.1540-5826.2007.00232.x

Montalvo, F. T., & Torres, M. C. G. (2004). Self-Regulated Learning: Current and Future Directions. *Electronic Journal of Research in Educational Psychology*, *2*(1), 1–34.

Moos, D. C., & Ringdal, A. (2012, August 5). *Self-Regulated Learning in the Classroom: A Literature Review on the Teacher’s Role* [Review Article]. Education Research International; Hindawi. https://doi.org/10.1155/2012/423284

Moreno, R. (2004). Decreasing Cognitive Load for Novice Students: Effects of Explanatory versus Corrective Feedback in Discovery-Based Multimedia. *Instructional Science*, *32*(1–2), 99–113. https://doi.org/10.1023/B:TRUC.0000021811.66966.1d

Mornell, A., Osborne, M. S., & McPherson, G. E. (2018). Evaluating practice strategies, behavior and learning progress in elite performers: An exploratory study Evaluating practice strategies, behavior and learning progress in elite performers: An exploratory study. *Musicae Scientiae*, 1029864918771731. https://doi.org/10.1177/1029864918771731

Morrissey, D. (2014). An autoethnographic inquiry into the role of serendipity in becoming a teacher educator/researcher. *International Journal of Qualitative Studies in Education*, *27*(7), 837–849. https://doi.org/10.1080/09518398.2013.820857

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children’s motivation and performance. *Journal of Personality and Social Psychology*, *75*(1), 33–52. https://doi.org/10.1037/0022-3514.75.1.33

Muijs, D., Kyriakides, L., Werf, G. van der, Creemers, B., Timperley, H., & Earl, L. (2014). State of the art – teacher effectiveness and professional learning. *School Effectiveness and School Improvement*, *25*(2), 231–256. https://doi.org/10.1080/09243453.2014.885451

Mulaik, S. A. (1971). *The foundations of factor analysis*. McGraw-Hill.

Myers, R. H. (1990). *Classical and Modern Regression with Applications*. PWS-KENT.

Mykkänen, A., Perry, N., & Järvelä, S. (2017). Finnish students’ reasons for their achievement in classroom activities: Focus on features that support self-regulated learning. *Education 3-13*, *45*(1), 1–16. https://doi.org/10.1080/03004279.2015.1025802

National Research Council. (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. https://doi.org/10.17226/13165

Nawastheen, F. M., Jazeel, M. I. M., Sifani, K. C. R., & Ponniah, K. (2020). Teachers' roles in developing self-regulated learning strategies among students of Puttalam Division in Sri Lanka. *Journal of Critical Reviews, 7*(19), 5076–5084.

Nelson, C. A., & Bloom, F. E. (1997). Child Development and Neuroscience. *Child Development*, *68*(5), 970–987. https://doi.org/10.1111/j.1467-8624.1997.tb01974.x

Nelson, T. D., Nelson, J. M., James, T. D., Clark, C. A. C., Kidwell, K. M., & Espy, K. A. (2017). Executive control goes to school: Implications of preschool executive performance for observed elementary classroom learning engagement. *Developmental Psychology*, *53*(5), 836–844. https://doi.org/10.1037/dev0000296

Nese, J. F. T., Lai, C.-F., & Anderson, D. (2013). A Primer on Longitudinal Data Analysis in Education. Technical Report #1320. In *Behavioral Research and Teaching*. Behavioral Research and Teaching. https://eric.ed.gov/?id=ED545257

Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling Procedures: Issues and Applications*. SAGE Publications.

Nevo, B. (1985). Face Validity Revisited. *Journal of Educational Measurement*, *22*(4), 287–293. https://doi.org/10.1111/j.1745-3984.1985.tb01065.x

Niemivirta, M. (2002). Motivation and performance in context: The influence of goal orientations and instructional setting on situational appraisals and task performance. *Psychologia: An International Journal of Psychology in the Orient*, *45*(4), 250–270. https://doi.org/10.2117/psysoc.2002.250

Nigg, J. T. (2017). Annual Research Review: On the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *58*(4), 361–383. https://doi.org/10.1111/jcpp.12675

Nind, M. (1996). Efficacy of Intensive Interaction: Developing sociability and communication in people with severe and complex learning difficulties using an approach based on caregiver-infant interaction. *European Journal of Special Needs Education*, *11*(1), 48–66. https://doi.org/10.1080/0885625960110104

Ning, H. K., & Downing, K. (2015). A latent profile analysis of university students' self-regulated learning strategies. *Studies in Higher Education*, *40*(7), 1328–1346. https://doi.org/10.1080/03075079.2014.880832

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*(3), 231–259. https://doi.org/10.1037/0033-295X.84.3.231

Nolen, A. L., & Putten, J. V. (2007). Action Research in Education: Addressing Gaps in Ethical Principles and Practices. *Educational Researcher*, *36*(7), 401–407. https://doi.org/10.3102/0013189X07309629

Nolte, S., & Elsworth, G. R. (2014). Factorial Invariance. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 2146–2148). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_983

Nota, L., Soresi, S., & Zimmerman, B. J. (2004a). Self-regulation and academic achievement and resilience: A longitudinal study. *International Journal of Educational Research, 41*(3), 198–215. https://doi.org/10.1016/j.ijer.2005.07.001

Nota, L., Soresi, S., & Zimmerman, B. J. (2004b). Self-regulation and academic achievement and resilience: A longitudinal study. *International Journal of Educational Research*, *41*(3), 198–215. https://doi.org/10.1016/j.ijer.2005.07.001

Nottingham, J. (2013). *Encouraging Learning: How you can help children learn*. Routledge.

Nuckles, M., Hubner, S., & Renkl, A. (2009). Enhancing Self-Regulated Learning by Writing Learning Protocols. *Learning and Instruction*, *19*(3), 259–271. https://doi.org/10.1016/j.learninstruc.2008.05.002

Nückles, M., Schwonke, R., Berthold, K., & Renkl, A. (2004). The use of public learning diaries in blended learning. *Journal of Educational Media*, *29*(1), 49–66. https://doi.org/10.1080/1358165042000186271

Nunnally, & Bernstein. (2006). *Psychometric Theory*. Academic Internet Pub Incorporated.

Nunnally, J. C. (1978). *Psychometric theory*. McGraw-Hill.
Oates, S. (2019). The Importance of Autonomous, Self-Regulated Learning in Primary Initial Teacher Training. *Frontiers in Education*, *4*. https://doi.org/10.3389/feduc.2019.00102
OECD. (2009). *Creating Effective Teaching and Learning Environments*. OECD Publishing. https://doi.org/10.1787/9789264068780-en
Olakanmi, E. E., & Gumbo, M. T. (2017). The Effects of Self-Regulated Learning Training on Students' Metacognition and Achievement in Chemistry. *International Journal of Innovation in Science and Mathematics Education (Formerly CAL-Laborate International)*, *25*(2), Article 2. https://openjournals.library.sydney.edu.au/index.php/CAL/article/view/11341
Olson, C. L. (1974). Comparative Robustness of Six Tests in Multivariate Analysis of Variance. *Journal of the American Statistical Association*, *69*(348), 894–908. https://doi.org/10.1080/01621459.1974.10480224
Olson, C. L. (1976). On choosing a test statistic in multivariate analysis of variance. *Psychological Bulletin*, *83*(4), 579–586. https://doi.org/10.1037/0033-2909.83.4.579
Olson, C. L. (1979). Practical considerations in choosing a MANOVA test statistic: A rejoinder to Stevens. *Psychological Bulletin*, *86*(6), 1350–1352. https://doi.org/10.1037/0033-2909.86.6.1350
Osborne, J. W., Costello, A. B., & Kellow, J. T. (2008). Best Practices in Exploratory Factor Analysis. In J. Osborne, *Best Practices in Quantitative Methods* (pp. 86–99). SAGE Publications, Inc. https://doi.org/10.4135/9781412995627.d8
Öztuna, D., Elhan, A. H., & Tüccar, E. (2006). Investigation of Four Different Normality Tests in Terms of Type 1 Error Rate and Power under Different Distributions. *Turkish Journal of Medical Sciences*, *36*(3), 171–176.
Pahigiannis, K., & Glos, M. (2020). Peer influences in self-regulation development and interventions in early childhood. *Early Child Development and Care*, *190*(7), 1053–1064. https://doi.org/10.1080/03004430.2018.1513923
Pajares, F. (1997). Current Directions in Self-efficacy Research. *Advances in Motivation and Achievement*, *10*, 1–49.
Pajares, F. (2012). Motivational role of self-efficacy beliefs in self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and Self-Regulated Learning: Theory, Research, and Applications* (pp. 111–140). Routledge.
Pallant, J. (2013). *SPSS Survival Manual*. McGraw-Hill Education (UK).
Palmer, P. J. (2007). *The courage to teach: Exploring the inner landscape of a teacher's life* (10th anniversary). Jossey-Bass ;John Wiley [distributor],.
Panadero, E. (2011). *Instructional Help for Self-assessment and Self-regulation: Evaluation of the Efficacy of Self-assessment Scripts vs. Rubrics* [Universidad Autónoma de Madrid]. https://www.researchgate.net/publication/274708915_Instructional_Help_for_Self-assessment_and_Self-regulation_Evaluation_of_the_Efficacy_of_Self-assessment_Scripts_vs_Rubrics
Panadero, E., & Alonso-Tapia, J. (2013). Self-assessment: Theoretical and practical connotations. When it happens, how is it acquired and what to do to develop it in our students. *Electronic Journal of Research in Educational Psychology*, *11*(2), 551–576.
Panadero, E., & Alonso-Tapia, J. (2014). How do students self-regulate? Review of Zimmerman's cyclical model of self-regulated learning. *Anales de Psicología*, *30*(2), 450–462.
Panadero, E., Klug, J., & Järvelä, S. (2016). Third wave of measurement in the self-regulated learning field: When measurement and intervention come hand in hand. *Scandinavian*

Journal of Educational Research, *60*(6), 723–735. https://doi.org/10.1080/00313831.2015.1066436

Paris, S. G., & Byrnes, J. P. (1989). The Constructivist Approach to Self-Regulation and Learning in the Classroom. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-Regulated Learning and Academic Achievement* (pp. 169–200). Springer New York. https://doi.org/10.1007/978-1-4612-3618-4_7

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*(3), 293–316. https://doi.org/10.1016/0361-476X(83)90018-8

Paris, S. G., & Paris, A. H. (2001). Classroom Applications of Research on Self-Regulated Learning. *Educational Psychologist*, *36*(2), 89–101. https://doi.org/10.1207/S15326985EP3602_4

Paris, S. G., & Winograd, P. (1999). *The role of self-regulated learning in contextual teaching: Principles and practices for teacher preparation. Contextual teaching and learning: Preparig teachers to enhance student success in the workplace and beyond*. ERIC Clearinghouse on Teaching and Teacher Education.

Patrick, H., & Middleton, M. J. (2002). Turning the Kaleidoscope: What We See When Self-Regulated Learning is Viewed With a Qualitative Lens. *Educational Psychologist*, *37*(1), 27–39. https://doi.org/10.1207/S15326985EP3701_4

Patrick, H., Ryan, A. M., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology*, *99*(1), 83–98. https://doi.org/10.1037/0022-0663.99.1.83

Pearson, K. (1901). LIII. On lines and planes of closest fit to systems of points in space. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, *2*(11), 559–572. https://doi.org/10.1080/14786440109462720

Pedder, D. (2006). Are small classes better? Understanding relationships between class size, classroom processes and pupils' learning. *Oxford Review of Education*, *32*(2), 213–234. https://doi.org/10.1080/03054980600645396

Pedrotti, M., & Nistor, N. (2019). How Students Fail to Self-regulate Their Online Learning Experience. In M. Scheffel, J. Broisin, V. Pammer-Schindler, A. Ioannou, & J. Schneider (Eds.), *Transforming Learning with Meaningful Technologies* (pp. 377–385). Springer International Publishing. https://doi.org/10.1007/978-3-030-29736-7_28

Peeters, J., De Backer, F., Kindekens, A., Triquet, K., & Lombaerts, K. (2016). Teacher differences in promoting students' self-regulated learning: Exploring the role of student characteristics. *Learning and Individual Differences*, *52*, 88–96. https://doi.org/10.1016/j.lindif.2016.10.014

Peeters, J., De Backer, F., Reina, V. R., Kindekens, A., Buffel, T., & Lombaerts, K. (2014). The Role of Teachers' Self-regulatory Capacities in the Implementation of Self-regulated Learning Practices. *Procedia - Social and Behavioral Sciences*, *116*, 1963–1970. https://doi.org/10.1016/j.sbspro.2014.01.504

Perels, F., Dignath, C., & Schmitz, B. (2009a). Is it possible to improve mathematical achievement by means of self-regulation strategies? Evaluation of an intervention in regular math classes. *European Journal of Psychology of Education*, *24*(1), 17–31. https://doi.org/10.1007/BF03173472

Perels, F., Dignath, C., & Schmitz, B. (2009b). Is it possible to improve mathematical achievement by means of self-regulation strategies? Evaluation of an intervention in regular math classes. *European Journal of Psychology of Education*, *24*(1), 17. https://doi.org/10.1007/BF03173472

Perels, F., Gürtler, T., & Schmitz, B. (2005). Training of self-regulatory and problem-solving competence. *Learning and Instruction*, *15*(2), 123–139. https://doi.org/10.1016/j.learninstruc.2005.04.010

Perkins, D., & Salomon, G. (1989). Are Cognitive Skills Context-Bound? *Educational Researcher*, *18*(1), 16–25. https://doi.org/10.3102/0013189X018001016

Perry, N. E. (2002). Introduction: Using Qualitative Methods to Enrich Understandings of Self-Regulated Learning. *Educational Psychologist*, *37*(1), 1–3. https://doi.org/10.1207/S15326985EP3701_1

Perry, N. E., Hutchinson, L., & Thauberger, C. (2007). Mentoring Student Teachers to Design and Implement Literacy Tasks that Support Self-Regulated Reading and Writing. *Reading & Writing Quarterly*, *23*(1), 27–50. https://doi.org/10.1080/10573560600837636

Perry, N. E., & VandeKamp, K. O. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research*, *33*. https://doi.org/10.1016/S0883-0355(00)00052-5

Perry, N. E., VandeKamp, K. O., Mercer, L. K., & Nordby, C. J. (2002). Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist*, *37*(1), 5–15.

Perry, N., Phillips, L., & Dowler, J. (2004). Examining Features of Tasks and Their Potential to Promote Self-Regulated Learning. *Teachers College Record*, *106*(9), 1854–1878. https://doi.org/10.1111/j.1467-9620.2004.00408.x

Peterson, R. A. (1994). A Meta-analysis of Cronbach's Coefficient Alpha. *Journal of Consumer Research*, *21*(2), 381–391. https://doi.org/10.1086/209405

Peverly, S. T., Brobst, K. E., Graham, M., & Shaw, R. (2003). College adults are not good at self-regulation: A study on the relationship of self-regulation, note taking, and test taking. *Journal of Educational Psychology*, *95*(2), 335–346. https://doi.org/10.1037/0022-0663.95.2.335

Piaget, J. (1926). *The thought and language of the child*. Harcourt, Brace, and Company.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research*, *31*(6), 459–470. https://doi.org/10.1016/S0883-0355(99)00015-4

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451–502). Academic.

Pintrich, P. R., & de Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33–40. https://doi.org/10.1037/0022-0663.82.1.33

Pintrich, P. R., Marx, R. W., & Boyle, R. A. (1993). Beyond Cold Conceptual Change: The Role of Motivational Beliefs and Classroom Contextual Factors in the Process of Conceptual Change. *Review of Educational Research*, *63*(2), 167–199. https://doi.org/10.2307/1170472

Pintrich, P. R., McKeachie, W. J., & Lin, Y.-G. (1987). Teaching a course in learning to learn. *Teaching of Psychology*, *14*(2), 81–86.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ).* National Center for Research to Improve Postsecondary Teaching and Learning, The University of Michigan. http://eric.ed.gov/?id=ED338122

Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ).

Educational and Psychological Measurement, *53*(3), 801–813. https://doi.org/10.1177/0013164493053003024

Pintrich, P., Wolters, C., & Baxter, G. (2000). Assessing Metacognition and Self-Regulated Learning. In G. Schraw & J. Impara (Eds.), *Issues in the Measurement of Metacognition* (pp. 43–97). Buros Institute of mental Measurements. http://digitalcommons.unl.edu/burosmetacognition/3

Ployhart, R. E., & Vandenberg, R. J. (2010). Longitudinal Research: The Theory, Design, and Analysis of Change. *Journal of Management*, *36*(1), 94–120. https://doi.org/10.1177/0149206309352110

Poitras, E., & Lajoie, S. (2013). A domain-specific account of self-regulated learning: The cognitive and metacognitive activities involved in learning through historical inquiry. *Metacognition and Learning*, *8*. https://doi.org/10.1007/s11409-013-9104-9

Porter, S. R., Whitcomb, M. E., & Weitzer, W. H. (2004). Multiple surveys of students and survey fatigue. *New Directions for Institutional Research*, *2004*(121), 63–73. https://doi.org/10.1002/ir.101

Posner, M. I., & Rothbart, M. K. (2007). Research on Attention Networks as a Model for the Integration of Psychological Science. *Annual Review of Psychology*, *58*(1), 1–23. https://doi.org/10.1146/annurev.psych.58.110405.085516

Posner, M. I., & Rothbart, M. K. (2018). Temperament and brain networks of attention. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1744). https://doi.org/10.1098/rstb.2017.0254

Powell, R. R. (2006). Evaluation Research: An Overview. *Library Trends*, *55*(1), 102–120. https://doi.org/10.1353/lib.2006.0050

Prawat, R. S., & Floden, R. E. (1994). Philosophical perspectives on constructivist views of learning. *Educational Psychologist*, *29*(1), 37–48. https://doi.org/10.1207/s15326985ep2901_4

Preacher, K. J., & MacCallum, R. C. (2002). Exploratory Factor Analysis in Behavior Genetics Research: Factor Recovery with Small Sample Sizes. *Behavior Genetics*, *32*(2), 153–161. https://doi.org/10.1023/A:1015210025234

Pressley, M., Harris, K. R., & Marks, M. B. (1992). But good strategy instructors are constructivists! *Educational Psychology Review*, *4*(1), 3–31. https://doi.org/10.1007/BF01322393

Pressley, M., & McCormick, C. (1995). *Advanced Educational Psychology for Educators, Researchers, and Policymakers*. Harpercollins College Division.

Pressley, M., & Woloshyn, V. (1995). *Cognitive strategy instruction*. Cambridge, MA: Brookline Books.

Punch, K. F. (2013). *Introduction to Social Research: Quantitative and Qualitative Approaches*. SAGE.

Puustinen, M., & Pulkkinen, L. (2001). Models of Self-regulated Learning: A review. *Scandinavian Journal of Educational Research*, *45*(3), 269–286. https://doi.org/10.1080/00313830120074206

Raaijmakers, S. F., Baars, M., Paas, F., Merriënboer, J. J. G. van, & Gog, T. van. (2018). Training self-assessment and task-selection skills to foster self-regulated learning: Do trained skills transfer across domains? *Applied Cognitive Psychology*, *32*(2), 270–277. https://doi.org/10.1002/acp.3392

Raaijmakers, S. F., Baars, M., Schaap, L., Paas, F., Merriënboer, J. van, & Gog, T. van. (2018). Training self-regulated learning skills with video modeling examples: Do task-selection skills transfer? *Instructional Science*, *46*(2), 273–290. https://doi.org/10.1007/s11251-017-9434-0

Radnor, H. A. (2001). *Researching Your Professional Practice: Doing Interpretive Research*. Open University Press.

Rajulton, F. (2001). The Fundamentals of Longitudinal Research: An Overview. *Canadian Studies in Population [ARCHIVES]*, 169–185. https://doi.org/10.25336/P6W897

Randi, J. (2004). Teachers as Self-Regulated Learners. *Teachers College Record*, *106*(9), 1825–1853. https://doi.org/10.1111/j.1467-9620.2004.00407.x

Randi, J., & Corno, L. (2007). Theory Into Practice: A Matter of Transfer. *Theory Into Practice*, *46*(4), 334–342. https://doi.org/10.1080/00405840701593923

Rawson, K. A., & Dunlosky, J. (2007). Improving students' self-evaluation of learning for key concepts in textbook materials. *European Journal of Cognitive Psychology*, *19*(4–5), 559–579. https://doi.org/10.1080/09541440701326022

Reeves, T. D., & Stich, A. E. (2011). Tackling Suboptimal Bachelor's Degree Completion Rates Through Training in Self-Regulated Learning (SRL). *Innovative Higher Education*, *36*(1), 3–17. https://doi.org/10.1007/s10755-010-9152-x

Reise, S. P., Waller, N. G., & Comrey, A. L. (2000). Factor analysis and scale revision. *Psychological Assessment*, *12*(3), 287–297. https://doi.org/10.1037//1040-3590.12.3.287

Reschly, A. L., Coolong-Chaffin, M., Christenson, S. L., & Gutkin, T. (2007). Contextual Influences and Response to Intervention: Critical Issues and Strategies. In S. R. Jimerson, M. K. Burns, & A. M. VanDerHeyden (Eds.), *Handbook of Response to Intervention: The Science and Practice of Assessment and Intervention* (pp. 148–160). Springer US. https://doi.org/10.1007/978-0-387-49053-3_11

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, *138*(2), 353–387. https://doi.org/10.1037/a0026838

Robson, S. (2016a). Self-regulation and metacognition in young children: Does it matter if adults are present or not? *British Educational Research Journal*, *42*(2), 185–206. https://doi.org/10.1002/berj.3205

Robson, S. (2016b). Are there differences between children's display of self-regulation and metacognition when engaged in an activity and when later reflecting on it? The complementary roles of observation and reflective dialogue. *Early Years*, *36*(2), 179–194. https://doi.org/10.1080/09575146.2015.1129315

Robson, S., & Rowe, V. (2012). Observing young children's creative thinking: Engagement, involvement and persistence. *International Journal of Early Years Education*, *20*(4), 349–364. https://doi.org/10.1080/09669760.2012.743098

Roebers, C. M., Schmid, C., & Roderer, T. (2009). Metacognitive monitoring and control processes involved in primary school children's test performance. *British Journal of Educational Psychology*, *79*(4), 749–767. https://doi.org/10.1348/978185409X429842

Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching Students to Generate Questions: A Review of the Intervention Studies. *Review of Educational Research*, *66*(2), 181–221. https://doi.org/10.3102/00346543066002181

Roth, A., Ogrin, S., & Schmitz, B. (2016). Assessing self-regulated learning in higher education: A systematic literature review of self-report instruments. *Educational Assessment, Evaluation and Accountability*, *28*(3), 225–250. https://doi.org/10.1007/s11092-015-9229-2

Rothbart, M. K. (1981). Measurement of Temperament in Infancy. *Child Development*, *52*(2), 569–578. https://doi.org/10.2307/1129176

Rothbart, M. K., Ellis, L. K., & Posner, M. I. (2004). Temperament and self-regulation. In *Handbook of self-regulation: Research, theory, and applications* (pp. 357–370). The Guilford Press.

Rothbart, M. K., Posner, M. I., & Boylan, A. (1990). Regulatory mechanisms in infant development. In *The development of attention: Research and theory* (pp. 47–66). North-Holland. https://doi.org/10.1016/S0166-4115(08)60450-1

Rouanet, H., & Lépine, D. (1970). Comparison Between Treatments in a Repeated-Measurement Design: Anova and Multivariate Methods. *British Journal of Mathematical and Statistical Psychology*, *23*(2), 147–163. https://doi.org/10.1111/j.2044-8317.1970.tb00440.x

Rozendaal, J. S., Minnaert, A., & Boekaerts, M. (2005). The influence of teacher perceived administration of self-regulated learning on students' motivation and information-processing. *Learning and Instruction*, *15*(2), 141–160. https://doi.org/10.1016/j.learninstruc.2005.04.011

Rubie-Davies, C. (2014). Teachers instructional beliefs and the classroom climate. In H. Fives & M. G. Gill (Eds.), *International Handbook of Research on Teachers' Beliefs* (pp. 266–283). Routledge.

Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2005). The Development of Executive Attention: Contributions to the Emergence of Self-Regulation. *Developmental Neuropsychology*, *28*(2), 573–594. https://doi.org/10.1207/s15326942dn2802_2

Rutter, M., Moffitt, T. E., & Caspi, A. (2006). Gene–environment interplay and psychopathology: Multiple varieties but real effects. *Journal of Child Psychology and Psychiatry*, *47*(3–4), 226–261. https://doi.org/10.1111/j.1469-7610.2005.01557.x

Ryan, A. M., & Pintrich, P. R. (1997). 'Should I ask for help?' The role of motivation and attitudes in adolescents' help seeking in math class. *Journal of Educational Psychology*, *89*(2), 329–341. https://doi.org/10.1037/0022-0663.89.2.329

Sageder, J. (1994). Lernmotivation, Attributionstendenzen und Lernmethoden von Studienanfängern. = Motivation, attribution, and learning strategies of university students. *Psychologie in Erziehung Und Unterricht*, *41*(2), 120–133.

Salomon, G., & Perkins, D. N. (1989). Rocky Roads to Transfer: Rethinking Mechanism of a Neglected Phenomenon. *Educational Psychologist*, *24*(2), 113–142. https://doi.org/10.1207/s15326985ep2402_1

Salter, P. (2012). Developing Self-Regulated Learners in Secondary Schools. *Australian Association for Research in Education (NJ1)*.

Schmitz, B. (2001). Self-Monitoring zur Unterstützung des Transfers einer Schulung in Selbstregulation für Studierende. Eine prozessanalytische Untersuchung. *Zeitschrift Für Pädagogische Psychologie/German Journal of Educational Psychology*. http://psycnet.apa.org/psycinfo/2001-10144-005

Schmitz, B., Klug, J., & Schmidt, M. (2011). Assessing self-regulated learning using diary measures with university students. In D. H. Schunk & B. Zimmerman (Eds.), *Handbook of self-regulation of learning and performance* (pp. 251–266). Routledge. https://books.google.co.uk/books?hl=en&lr=&id=XfOYV0lwzGgC&oi=fnd&pg=PP1&dq=assessing+self-regulation+using+learning+diaries+university+schmitz&ots=4JGmGsjOaC&sig=xvawkyzEgBG5xrE69sD8DWBXi2g

Schmitz, B., & Perels, F. (2011). Self-monitoring of self-regulation during math homework behaviour using standardized diaries. *Metacognition and Learning*, *6*(3), 255–273. https://doi.org/10.1007/s11409-011-9076-6

Schmitz, B., & Wiese, B. S. (2006). New perspectives for the evaluation of training sessions in self-regulated learning: Time-series analyses of diary data. *Contemporary Educational Psychology*, *31*(1), 64–96. https://doi.org/10.1016/j.cedpsych.2005.02.002

Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

Schünemann, N., Spörer, N., Völlinger, V. A., & Brunstein, J. C. (2017). Peer feedback mediates the impact of self-regulation procedures on strategy use and reading comprehension in reciprocal teaching groups. *Instructional Science*, *45*(4), 395–415. https://doi.org/10.1007/s11251-017-9409-1

Schunk, D. H. (1982). Effects of effort attributional feedback on children's perceived self-efficacy and achievement. *Journal of Educational Psychology*, *74*(4), 548–556. https://doi.org/10.1037/0022-0663.74.4.548

Schunk, D. H. (2001). Social cognitive theory and self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives / edited by Barry J. Zimmerman, Dale H. Schunk.* (2nd ed., pp. 83–110). Lawrence Erlbaum.

Schunk, D. H. (2005a). Commentary on self-regulation in school contexts. *Learning and Instruction*, *15*(2), 173–177. https://doi.org/10.1016/j.learninstruc.2005.04.013

Schunk, D. H. (2005b). Self-Regulated Learning: The Educational Legacy of Paul R. Pintrich. *Educational Psychologist*, *40*(2), 85–94. https://doi.org/10.1207/s15326985ep4002_3

Schunk, D. H. (2008). *Learning theories: An educational perspective* (5th ed.). Pearson/Merrill Prentice Hall,.

Schunk, D. H. (2014). *Learning theories: An educational perspective / Dale H. Schunk.* (Sixth edition, new international edition.). Pearson, 2014, ©2014.

Schunk, D. H., & Zimmerman, B. J. (2011). *Handbook of Self-Regulation of Learning and Performance*. Taylor & Francis.

Schunk, D. H., & Zimmerman, B. J. (1998). *Self-regulated Learning: From Teaching to Self-reflective Practice*. Guilford Press.

Schunk, D. H., & Zimmerman, B. J. (2007). Influencing children's self-efficacy and self-regulation of reading and writing through modeling. *Reading & Writing Quarterly*, *23*(1), 7–25.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002a). *Experimental and quasi-experimental designs for generalized causal inference* (Vol. xxi). Houghton, Mifflin and Company.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002b). *Experimental and quasi-experimental designs for generalized causal inference* (pp. xxi, 623). Houghton, Mifflin and Company.

Sharp, L. M., & Frankel, J. (1983). Respondent Burden: A Test of Some Common Assumptions. *Public Opinion Quarterly*, *47*(1), 36–53. https://doi.org/10.1086/268765

Simon, H. A. (1979). *Models of Thought*. Yale University Press.

Simon, S. D. (1999). *From neo-behaviosism to social constructivism? The paradigmatic non-evolution of Albert Bandura* [Emory University]. http://www.uky.edu/~eushe2/Pajares/simon.html

Simpson, D. T. L. (2002). Dare I Oppose Constructivist Theory? *The Educational Forum*, *66*(4), 347–354. https://doi.org/10.1080/00131720208984854

Simpson, M. L., Hynd, C. R., Nist, S. L., & Burrell, K. I. (1997). College Academic Assistance Programs and Practices. *Educational Psychology Review*, *9*(1), 39–87. https://doi.org/10.1023/A:1024733706115

Smul, M. D., Heirweg, S., Devos, G., & Keer, H. V. (2020). It's not only about the teacher! A qualitative study into the role of school climate in primary schools' implementation of self-regulated learning. *School Effectiveness and School Improvement*, *31*(3), 381–404. https://doi.org/10.1080/09243453.2019.1672758

Snow, R. E., Corno, L., & Jackson III, D. (1996). Individual differences in affective and conative functions. In *Handbook of educational psychology* (pp. 243–310). Prentice Hall International.

Somekh, B., & Lewin, C. (2011). Action Research. In B. Somekh & C. Lewin (Eds.), *Theory and Methods in Social Research* (pp. 94–101). SAGE.

Sontag, C., & Stoeger, H. (2015). Can highly intelligent and high-achieving students benefit from training in self-regulated learning in a regular classroom context? *Learning and Individual Differences*, *41*, 43–53. https://doi.org/10.1016/j.lindif.2015.07.008

Souvignier, E., & Mokhlesgerami, J. (2006). Using self-regulation as a framework for implementing strategy instruction to foster reading comprehension. *Learning and Instruction*, *16*(1), 57–71. https://doi.org/10.1016/j.learninstruc.2005.12.006

Spearman, C. (1904). 'General Intelligence,' Objectively Determined and Measured. *The American Journal of Psychology*, *15*(2), 201–292. JSTOR. https://doi.org/10.2307/1412107

Spinath, B., & Spinath, F. M. (2005). Longitudinal analysis of the link between learning motivation and competence beliefs among elementary school children. *Learning and Instruction*, *15*(2), 87–102. https://doi.org/10.1016/j.learninstruc.2005.04.008

Spruce, R., & Bol, L. (2015). Teacher beliefs, knowledge, and practice of self-regulated learning. *Metacognition and Learning*, *10*(2), 245–277. https://doi.org/10.1007/s11409-014-9124-0

Stevens, J. P. (2012). *Applied Multivariate Statistics for the Social Sciences, Fifth Edition*. Routledge.

Stodolsky, S. S., & Grossman, P. L. (1995). The Impact of Subject Matter on Curricular Activity: An Analysis of Five Academic Subjects. *American Educational Research Journal*, *32*(2), 227–249. https://doi.org/10.3102/00028312032002227

Stoeger, H., Fleischmann, S., & Obergriesser, S. (2015). Self-regulated learning (SRL) and the gifted learner in primary school: The theoretical basis and empirical findings on a research program dedicated to ensuring that all students learn to regulate their own learning. *Asia Pacific Education Review*, *16*(2), 257–267. https://doi.org/10.1007/s12564-015-9376-7

Stoten, D. W. (2015). Managing the transition: A case study of self-regulation in the learning of first-term business and management undergraduate students at an English university. *Research in Post-Compulsory Education*, *20*(4), 445–459. https://doi.org/10.1080/13596748.2015.1081753

Stringer, E. T. (1996). *Action Research: A Handbook for Practitioners*. SAGE Publications.

Stutchbury, K., & Fox, A. (2009). Ethics in educational research: Introducing a methodological tool for effective ethical analysis. *Cambridge Journal of Education*, *39*(4), 489–504. https://doi.org/10.1080/03057640903354396

Styles, B., & Torgerson, C. (2018). Randomised controlled trials (RCTs) in education research –methodological debates, questions, challenges. *Educational Research*, *60*(3), 255–264. https://doi.org/10.1080/00131881.2018.1500194

Sutton, A. (1983). An introduction to Soviet developmetal psychology. In S. Meadows (Ed.), *Developing Thinking*. Meuthuen.

Szafran, R. (2019). Assessing Program Outcomes When Participation Is Voluntary: Getting More Out of a Static-Group Comparison. *Practical Assessment, Research, and Evaluation*, *12*(1). https://doi.org/10.7275/9bw1-m645

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (Vol. 5). Pearson Boston, MA.

Tashakkori, A., & Teddlie, C. (2003). *Handbook of Mixed Methods in Social & Behavioral Research*. SAGE.
Teddlie, C., & Yu, F. (2007). Mixed Methods Sampling: A Typology With Examples. *Journal of Mixed Methods Research*, *1*(1), 77–100. https://doi.org/10.1177/2345678906292430
Thiede, K. W., Redford, J. S., Wiley, J., & Griffin, T. D. (2017). How restudy decisions affect overall comprehension for seventh-grade students. *The British Journal of Educational Psychology*, *87*(4), 590–605. https://doi.org/10.1111/bjep.12166
Thoemmes, F. (2012). Propensity score matching in SPSS. *ArXiv:1201.6385 [Stat]*. http://arxiv.org/abs/1201.6385
Thoemmes, F. J., & West, S. G. (2011). The Use of Propensity Scores for Nonrandomized Designs With Clustered Data. *Multivariate Behavioral Research*, *46*(3), 514–543. https://doi.org/10.1080/00273171.2011.569395
Thomson, P., & Kamler, B. (2010). It's been said before and I'll say it again—Research is writing. In P. Thomson & M. Walker (Eds.), *The Routledge Doctoral Student's Companion: Getting to Grips with Research in Education and the Social Sciences* (pp. 149–160). Taylor & Francis.
Thurstone, L. L. (1931). The measurement of social attitudes. *The Journal of Abnormal and Social Psychology*, *26*(3), 249–269. https://doi.org/10.1037/h0070363
Thurstone, L. L. (1947). *Multiple-factor analysis; a development and expansion of The Vectors of Mind*. University of Chicago Press.
Tinsley, H. E., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology research. *Journal of Counseling Psychology*, *34*(4), 414–424. https://doi.org/10.1037/0022-0167.34.4.414
Toulmin, S. E. (2003). *The Uses of Argument*. Cambridge University Press.
Travers, J. F., Elliott, S. N., & Kratochwill, T. R. (1993). *Educational psychology: Effective teaching, effective learning* (1993-97097-000). Brown & Benchmark/Wm. C. Brown Publ.
Tuckman, B. (1999). *Conducting Educational Research*. Hart Court Brace College.
Turner, G. (2017). *Life-worthy Learning Skills: A Curriculum Intervention to Promote Self-Regulated Learning—Registration Portfolio*. University of Cambridge.
Van Breukelen, G. J. P. (2006). ANCOVA versus change from baseline had more power in randomized studies and more bias in nonrandomized studies. *Journal of Clinical Epidemiology*, *59*(9), 920–925. https://doi.org/10.1016/j.jclinepi.2006.02.007
Van De Schoot, R., Schmidt, P., De Beuckelaer, A., Lek, K., & Zondervan-Zwijnenburg, M. (2015). Editorial: Measurement Invariance. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.01064
van Dinther, M., Dochy, F., & Segers, M. (2011). Factors affecting students' self-efficacy in higher education. *Educational Research Review*, *6*(2), 95–108. https://doi.org/10.1016/j.edurev.2010.10.003
Van Oers, B. (1996). Learning mathematics as a meaningful activity. *Theories of Mathematical Learning*, 91–113.
Veenman, M. V. J. (2011). Alternative assessment of strategy use with self-report instruments: A discussion. *Metacognition and Learning*, *6*(2), 205–211. https://doi.org/10.1007/s11409-011-9080-x
Veenman, M. V. J. (2013). Assessing Metacognitive Skills in Computerized Learning Environments. In *International Handbook of Metacognition and Learning Technologies* (pp. 157–168). Springer, New York, NY. https://doi.org/10.1007/978-1-4419-5546-3_11

Veenman, M. V. J. (2018). *Final report TALENT EDUCATION project—Metacognition*. SCOL.

Veenman, M. V. J., Elshout, J. J., & Meijer, J. (1997). The generality vs domain-specificity of metacognitive skills in novice learning across domains. *Learning and Instruction*, *7*(2), 187–209. https://doi.org/10.1016/S0959-4752(96)00025-4

Veenman, M. V. J., & Spaans, M. A. (2005). Relation between intellectual and metacognitive skills: Age and task differences. *Learning and Individual Differences*, *15*(2), 159–176. https://doi.org/10.1016/j.lindif.2004.12.001

Veenman, M. V. J., Van Hout-Wolters, B., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and Learning*, *1*, 3–14. https://doi.org/10.1007/s11409-006-6893-0

Vermunt, J. D. (1998). The regulation of constructive learning processes. *British Journal of Educational Psychology*, *68*(2), 149–171. https://doi.org/10.1111/j.2044-8279.1998.tb01281.x

Vermunt, J. D., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and Instruction*, *9*(3), 257–280. https://doi.org/10.1016/S0959-4752(98)00028-0

Vink, M., Gladwin, T. E., Geeraerts, S., Pas, P., Bos, D., Hofstee, M., Durston, S., & Vollebergh, W. (2020). Towards an integrated account of the development of self-regulation from a neurocognitive perspective: A framework for current and future longitudinal multi-modal investigations. *Developmental Cognitive Neuroscience*, *45*, 100829. https://doi.org/10.1016/j.dcn.2020.100829

Vink, M., Zandbelt, B. B., Gladwin, T., Hillegers, M., Hoogendam, J. M., Wildenberg, W. P. M. van den, Plessis, S. D., & Kahn, R. S. (2014). Frontostriatal activity and connectivity increase during proactive inhibition across adolescence and early adulthood. *Human Brain Mapping*, *35*(9), 4415–4427. https://doi.org/10.1002/hbm.22483

Vos, H., & Graaff, E. de. (2004). Developing metacognition: A basis for active learning. *European Journal of Engineering Education*, *29*(4), 543–548. https://doi.org/10.1080/03043790410001716257

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Vygotsky, L. S. (1981). The Genesis of Higher Mental Functions. In J. V. Wertsch (Ed.), *The Concept of Activity in Soviet Psychology*. M. E. Sharpe.

Wackwitz, J. H., & Horn, J. L. (1971). On obtaining the best estimates of factor scores within an ideal simple structure. *Multivariate Behavioral Research*, *6*(4), 389–408. https://doi.org/10.1207/s15327906mbr0604_2

Wadsworth, B. J. (1971). *Piaget's theory of cognitive development: An introduction for students of psychology and education*. McKay.

Wagner, J. (2010). Ignorance in educational research: How not knowing shapes new knowledge. In P. Thomson & M. Walker (Eds.), *The Routledge Doctoral Student's Companion: Getting to Grips with Research in Education and the Social Sciences* (pp. 31–42). Routledge.

Wagner, P., Schober, B., Gradinger, P., Reimann, R., & Spiel, C. (2010). E-Learning unterstützte Förderung von selbstreguliertem Lernen an der Universität. In *Zeitschrift für pädagogische Psychologie* (Vol. 24, Issues 3–4, pp. 289–303).

Wallin, P., & Adawi, T. (2018). The reflective diary as a method for the formative assessment of self-regulated learning. *European Journal of Engineering Education*, *43*(4), 507–521. https://doi.org/10.1080/03043797.2017.1290585

Walser, T. (2019). Quasi-Experiments in Schools: The Case for Historical Cohort Control Groups. *Practical Assessment, Research, and Evaluation*, *19*(1). https://doi.org/10.7275/17hj-1k58

Wandler, J., & Imbriale, W. J. (2017). Promoting College Student Self-Regulation in Online Learning Environments. *Online Learning*, *21*(2), Article 2. https://doi.org/10.24059/olj.v21i2.881

Wang, A. Y. (1983). Individual differences in learning speed. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *9*(2), 300.

Wang, Z., Deater-Deckard, K., Petrill, S. A., & Thompson, L. A. (2012). Externalizing problems, attention regulation, and household chaos: A longitudinal behavioral genetic study. *Development and Psychopathology*, *24*(3), 755–769. https://doi.org/10.1017/S0954579412000351

Weiner, B. (1986). An Attributional Theory of Achievement Motivation and Emotion. In *An Attributional Theory of Motivation and Emotion* (pp. 159–190). Springer US. https://doi.org/10.1007/978-1-4612-4948-1_6

Weiner, B. (1992). *Human motivation: Metaphors, theories, and research* (Vol. xii). Sage Publications, Inc.

Weinstein, C. E. (1978). Elaboration skills as a learning strategy. *Learning Strategies*, 31–55.

Weinstein, C. E., Hanson, G., Powdrill, L., Roska, L., Dierking, D., Husman, J., & McCann, E. (1997, March). *The design and evaluation of a course in starategic learning*. National Association of Developmental Educators, Denver, CO.

Weinstein, C. E., Husman, J., & Dierking, D. R. (2000). Self-regulation interventions with a focus on learning strategies. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 727–747). Academic Press.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M. C. Wittrock (Ed.), *Handbook of research on teaching*. Macmillan.

Weinstein, C. E., Schulte, A., & Palmer, D. R. (1987). *Learning and Studies Strategy Inventory (LASSI)*. H & H Publishing: Clearwater, FL.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Harvard University Press,.

Whitebread, D., Anderson, H., Coltman, P., Page, C., Pasternak, D. P., & Mehta, S. (2005). Developing independent learning in the early years. *Education 3-13*, *33*(1), 40–50.

Whitebread, D., & Bingham, S. (2011). School readiness: A critical review of perspectives and evidence. *TACTYC Occasional Paper*, *2*.

Whitebread, D., Bingham, S., Grau, V., Pasternak, D. P., & Sangster, C. (2007). Development of metacognition and self-regulated learning in young children: Role of collaborative and peer-assisted learning. *Journal of Cognitive Education and Psychology*, *6*(3), 433–455. https://doi.org/10.1891/194589507787382043

Whitebread, D., Coltman, P., Pasternak, D. P., Sangster, C., Grau, V., Bingham, S., Almeqdad, Q., & Demetriou, D. (2009). The development of two observational tools for assessing metacognition and self-regulated learning in young children. *Metacognition and Learning*, *4*(1), 63–85. https://doi.org/10.1007/s11409-008-9033-1

Wigfield, A., & Eccles, J. S. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review*, *12*(3), 265–310. https://doi.org/10.1016/0273-2297(92)90011-P

Winne, P. H. (1995). Inherent details in self-regulated learning. *Educational Psychologist*, *30*(4), 173–187. https://doi.org/10.1207/s15326985ep3004_2

Winne, P. H. (1997). Experimenting to bootstrap self-regulated learning. *Journal of Educational Psychology*, *89*(3), 397–410. https://doi.org/10.1037/0022-0663.89.3.397

Winne, P. H. (2010). Improving measurements of self-regulated learning. *Educational Psychologist*, *45*(4), 267–276. https://doi.org/10.1080/00461520.2010.517150

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in Educational Theory and Practice* (pp. 277–304). Routledge.

Winne, P. H., & Jamieson-Noel, D. (2002). Exploring students' calibration of self reports about study tactics and achievement. *Contemporary Educational Psychology*, *27*(4), 551–572. https://doi.org/10.1016/S0361-476X(02)00006-1

Winne, P. H., Jamieson-Noel, D., & Muis, K. (2002). Methodological issues and advances in researching tactics, strategies, and self-regulated learning. *Advances in Motivation and Achievement: New Directions in Measures and Methods*, *12*, 121–155.

Winne, P. H., Nesbit, J. C., Kumar, V., Hadwin, A. F., Lajoie, S. P., Azevedo, R., & Perry, N. E. (2006). Supporting self-regulated learning with gStudy software: The Learning Kit Project. *Technology Instruction Cognition and Learning*, *3*(1/2), 105.

Winne, P. H., & Perry, N. E. (2000). Measuring self-regulated learning. In M. Boekaerts, P. R. Pintrich, M. Zeidner, M. (Ed) Boekaerts, P. R. (Ed) Pintrich, & M. (Ed) Zeidner (Eds.), *Handbook of self-regulation.* (2001-01625-015; pp. 531–566). Academic Press.

Wirth, J., & Leutner, D. (2008). Self-regulated learning as a competence: Implications of theoretical models for assessment methods. *Zeitschrift Für Psychologie/Journal of Psychology*, *216*(2), 102–110. https://doi.org/10.1027/0044-3409.216.2.102

Wolters, C. A. (2004). Advancing Achievement Goal Theory: Using Goal Structures and Goal Orientations to Predict Students' Motivation, Cognition, and Achievement. *Journal of Educational Psychology*, *96*(2), 236–250. https://doi.org/10.1037/0022-0663.96.2.236

Wolters, C. A., Benzon, M. B., & Arroyo-Giner, C. (2011). Assessing strategies for the self-regulation of motivation. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 298–312). Routledge. https://books.google.co.uk/books?hl=en&lr=&id=XfOYV0lwzGgC&oi=fnd&pg=PA298&dq=assessing+strategies+for+the+self-regukation+of+motivation&ots=4JGmHnjQ9C&sig=IzEwEcyT9LaAA63D9JpEvn55LQ8

Wolters, C. A., & Pintrich, P. R. (1998). Contextual differences in student motivation and self-regulated learning in mathematics, English, and social studies classrooms. *Instructional Science*, *26*(1), 27–47. https://doi.org/10.1023/A:1003035929216

Wolters, C. A., & Rosenthal, H. (2000). The relation between students' motivational beliefs and their use of motivational regulation strategies. *International Journal of Educational Research*, *33*(7–8), 801–820. https://doi.org/10.1016/S0883-0355(00)00051-3

Wong, J., Baars, M., Davis, D., Zee, T. V. D., Houben, G.-J., & Paas, F. (2019). Supporting Self-Regulated Learning in Online Learning Environments and MOOCs: A Systematic Review. *International Journal of Human–Computer Interaction*, *35*(4–5), 356–373. https://doi.org/10.1080/10447318.2018.1543084

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Child Psychology & Psychiatry & Allied Disciplines*, *17*(2), 89–100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Yamagata, S., Takahashi, Y., Kijima, N., Maekawa, H., Ono, Y., & Ando, J. (2005). Genetic and Environmental Etiology of Effortful Control. *Twin Research and Human Genetics*, *8*(4), 300–306. https://doi.org/10.1375/twin.8.4.300

Yan, Z. (2018). How teachers' beliefs and demographic variables impact on self-regulated learning instruction. *Educational Studies*, *44*(5), 564–577. https://doi.org/10.1080/03055698.2017.1382331

Yan, Z., & Cheng, E. C. K. (2015). Primary teachers' attitudes, intentions and practices regarding formative assessment. *Teaching and Teacher Education*, *45*, 128–136. https://doi.org/10.1016/j.tate.2014.10.002

Yan, Z., Chiu, M. M., & Ko, P. Y. (2020). Effects of self-assessment diaries on academic achievement, self-regulation, and motivation. *Assessment in Education: Principles, Policy & Practice*, *27*(5), 562–583. https://doi.org/10.1080/0969594X.2020.1827221

Zandbelt, B. B., & Vink, M. (2010). On the Role of the Striatum in Response Inhibition. *PLOS ONE*, *5*(11), e13848. https://doi.org/10.1371/journal.pone.0013848

Zeidner, M., Boekaerts, M., & Pintrich, P. R. (2000). Self-regulation: Directions and challenges for future research. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 749–768). Academic Press. https://doi.org/10.1016/B978-012109890-2/50052-4

Zeidner, M., & Stoeger, H. (2019). Self-Regulated Learning (SRL): A guide for the perplexed. *High Ability Studies*, *30*(1–2), 9–51. https://doi.org/10.1080/13598139.2019.1589369

Zimmerman, B. (2011). Motivational sources and outcomes of self-regulated learning and performance. In B. Zimmerman & D. H. Schunk (Eds.), *Handbook of Self-Regulation of Learning and Performance* (pp. 49–64). Taylor & Francis.

Zimmerman, B. J. (1986). Becoming a self-regulated learner: Which are the key subprocesses? *Contemporary Educational Psychology*, *11*(4), 307–313. https://doi.org/10.1016/0361-476X(86)90027-5

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, *81*(3), 329–339. https://doi.org/10.1037/0022-0663.81.3.329

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist*, *25*(1), 3–17. https://doi.org/10.1207/s15326985ep2501_2

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary models. In *Self-regulated learning. From teaching to self-reflective practice* (pp. 1–20). Guilford Press.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, M. Zeidner, M. (Ed) Boekaerts, P. R. (Ed) Pintrich, & M. (Ed) Zeidner (Eds.), *Handbook of self-regulation.* (2001-01625-001; pp. 13–39). Academic Press.

Zimmerman, B. J. (2001). Self-regulated Learning. In N. J. S. B. Baltes (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 13855–13859). Pergamon. http://www.sciencedirect.com/science/article/pii/B0080430767024657

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice*, *41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B. J. (2005). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-regulation* (pp. 13–39). Elsevier.

Zimmerman, B. J. (2006). Development and Adaptation of Expertise: The Role of Self-Regulatory Processes and Beliefs. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge Handbook of Expertise and Expert Performance* (pp. 705–722). Cambridge University Press. https://doi.org/10.1017/CBO9780511816796.039

Zimmerman, B. J. (2008a). Goal Setting: A key proactive source of academic self-regulation. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and Self-regulated Learning: Theory, Research, and Applications*. Routledge.

Zimmerman, B. J. (2008b). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal*, *45*(1), 166–183. https://doi.org/10.3102/0002831207312909

Zimmerman, B. J. (2013). From Cognitive Modeling to Self-Regulation: A Social Cognitive Career Path. *Educational Psychologist*, *48*(3), 135–147. https://doi.org/10.1080/00461520.2013.794676

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal*, *31*(4), 845–862. https://doi.org/10.2307/1163397

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology*, *82*(1), 51–59. https://doi.org/10.1037/0022-0663.82.1.51

Zimmerman, B. J., & Moylan, A. R. (2009). Self-regulation: Where metacognition and motivation intersect. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of Metacognition in Education* (pp. 299–316). Routledge.

Zimmerman, B. J., & Pons, M. M. (1986). Development of a Structured Interview for Assessing Student Use of Self-Regulated Learning Strategies. *American Educational Research Journal*, *23*(4), 614–628. https://doi.org/10.2307/1163093

Zimmerman, B. J., Schunk, D. H., & DiBenedetto, M. K. (2015). A personal agency view of self-regulated learning: The role of goal setting. In *Self-concept, motivation and identity: Underpinning success with research and practice* (pp. 83–114). IAP Information Age Publishing.

Zumbrunn, S., Tadlock, J., & Roberts, E. D. (2011). *Encouraging self-regulated learning in the classroom: A review of the literature*. Metropolitan Educational Research Consortium (MERC), Virginia Commonwealth University. http://www.self-regulation.ca/uploads/5/6/2/6/56264915/encouraging_self_regulated_learning_in_the_classroom.pdf

Zusho, A. (2017). Toward an Integrated Model of Student Learning in the College Classroom. *Educational Psychology Review*, *29*(2), 301–324. https://doi.org/10.1007/s10648-017-9408-4

Zusho, A., Pintrich, P. R., & Coppola, B. (2003). Skill and will: The role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education*, *25*(9), 1081–1094. https://doi.org/10.1080/0950069032000052207

Zwick, W., & Velicer, W. (1986). Comparison of Five Rules for Determining the Number of Components to Retain. *Psychological Bulletin*, *99*(3), 432–442.

Appendices

Appendix A – The Self-Regulated Learning Experimental Design Survey (SRLEDS)

Table A1

The Self-Regulated Learning Experimental Design Survey (SRLEDS)

Teddies Curriculum Component	Item
Resourcefulness and Research	1. I make effective use of the resources relevant to each subject.
	2. When studying, I often engage with further research to add information to that which I have already learnt.
	3. When I study, I pull together information from different sources such as lessons, notes, texts, and my own research.
Goal Setting	1. When I study, I set goals for myself in order to direct my activities in each study session.
	2. I have a clear idea about what I want achieve in my studies.
	3. Before I start revising, I know exactly which grade I want to achieve in a test.
Planning and Organisation	1. I usually plan my work before I begin studying.
	2. While studying, I consider carefully what I should do.
	3. With the help of effective planning I manage to work continuously.
Self-motivation and Resilience	1. I enjoy studying.
	2. Even when I am learning something really challenging, I keep working until I successfully complete the task.
	3. If I try hard enough, I can understand all of the subject material.
Communication	1. I am able to communicate what I have learnt effectively in writing.
	2. Although I might feel that I understand the material, I struggle to communicate this understanding to others.
	3. I have strong verbal communication skills.

Collaboration	1. Even if I have trouble learning the subject material, I try to do the work on my own without help from anyone.
	2. I prefer to work with other students in both lessons and prep to complete the tasks.
	3. I learn things much better when I work with other people.
Creativity	1. When studying, I find it easy to think of lots of different solutions to problems.
	2. I feel comfortable trying to complete tasks using a new strategy that I haven't used before.
	3. When thinking of new ideas, I worry that I might be wrong.
Critical Thinking	1. When studying, I find it easy to identify issues or problems.
	2. When studying, I check whether the theories, interpretations and conclusions that I am presented with are sufficiently proven and justified
	3. When justifying what I think, I try to use evidence or data to support my view.
Metacognition	1. While studying, I check my steps to ensure that I am completing the task correctly.
	2. While studying, I can protect myself from distractions and my thoughts rarely wander.
	3. While completing a task, I monitor whether my strategies are effective and adapt them if necessary.
Self-evaluation	1. After studying, I check whether I have achieved my goals.
	2. After completing a task, I consider what I can improve on next time.
	3. When I receive feedback from a teacher, I actively engage with the feedback by making improvements to the task.

The Teddies Curriculum 2.0

Appendix B

The development of life-worthy learning skills

Student meaning		Teacher meaning
As a learner I am always ready to learn and capitalise on all opportunities. I am able to learn in diferent ways and maximise my use of a range of resouces. I am academically curious and enjoy researching new information from a variety of sources.	Resourcefulness & Research	To plan learning activities where learners are given the opportunity to learn in different ways, making effective use of wide range of internal and external resources.
I need to develop my ability to set focused and aspirational targets relating to my own learning. These can be task specific or longer-term, learning skill or subject specific targets.	Goal Setting	Learners are supported in their setting of aspirational but achievable goals across a range of temporal scales. We have high expectations of all learners and model a 'growth mindset'.
Before starting a learning task, I plan my approach and organise my resources in a way that allows me to be successful. I understand that different tasks will require different strategies and I must develop the range of approaches I use.	Planning & Organisation	Learners are coached in the development of their ability to plan and organise their learning, including the identification and selection of task-specific learning strategies.
As a learner I need to develop the self-motivation and resilience needed to complete challenging learning activities. If I am resourceful, resilient and I control my learning, I can overcome difficulty and successfully complete all learning activities.	Self-Motivation & Resilience	We support the development of students' self-motivation and resilience. We actively send learners into 'The Learning Pit', where they are challenged through the engagement with carefully planned and differentiated learning activities.
Every learning activity is an oppportunity to improve my ability to communicate knowledge and understanding. Excellent learners are excellent communicators.	Communication	Learners are supported in the development of their verbal and written communication skills through opportunities to collaborate n conjunction with focused formative feedback.
I am able to capitalise on the opportunity to collaborate with others where I both add to and draw on the strength of others. The use of communication and listening skills are vital as I recognise and respect different views and ideas.	Collaboration	Learners are given the opportunity to collaborate with others during learning activities. The social construction of knowledge and understanding underpins our teachning philosophy and pedagogical approach
I am creative in the way that I think. and improve the different ways in which I am creative through divergent and convergent thinking.	Creativity	To plan and foster learning opportunities that encourage the production of something new and task appropriate. Creativity is both modelled and valued by teachers, and actively encouraged in learners.
I am able to critically examine information that I am presented with. I can apply, analyse, synthesise and evaluate information as a guide to developing my own beliefs and actions.	Critical Thinking	Learners are guided in the development of critical thinking skills. They are coached in the analysis and synthesis of information through questioning, feedback and collaboration.
I am aware of my own thinking and monitor my approach, adapting it as I progress through a task. I am able to assess the effectiveness of my strategies and change them if required.	Metacognition	Learning activities are structured in a way that encourages learners to monitor their own thinking and approach. Metacognition is modelled by teachers and developed through effective questioning techniques and prompts.
After a learning task I always reflect on both the outcome and the learning process. I refer back to goals set and make adjustments in advance of new learning experiences.	Self-Evaluation	Learners are given the opportunity to evaluate learning processes. They are encouraged to reflect on their goals and critically evaluate strategies feeding forward into the next task.

Appendix C – Ethics Checklist

Table C1

Ethical Considerations – External and Ecological

Focus	Number	Questions to consider	Commentary
Cultural Sensitivity	1	What are the values, norms and roles in the environment in which I am working and are they likely to be challenged by this research?	Values The five key values fostered and upheld by the school are respect, integrity, responsibility, kindness and courage. These roles will not be challenged by this research, if anything reinforced. Norms and Roles Norms and roles will not be challenge by the research as it is considered to be part of the school's normal way of working.
Awareness of all parts of the institution	2	What is the relationship between the group/individual I am working with and the institution as a whole? How does it affect the participant(s)?	The group/individuals that I am working with are members of Year 9 at the institution. I will teach Geography to a minority of students (20-23 students) from the sample. As a teacher-researcher my role does not affect participants.
Responsive communication – awareness of the wishes of others	3	How might my work be viewed/interpreted by others in the institution? How will the language I use be interpreted?	My research progress has been shared with the Common Room and they are aware of the proposed methods/intervention to begin at the start of the next academic year. I must be sensitive to the language I use as the of academia can seem inaccessible by practitioners (Griffiths, 1998).

Focus	Number	Questions to consider	Commentary
Responsibilities to sponsors	4	What are my responsibilities to the people paying for or supporting this research (local authority, my school, external bodies)?	My school have agreed to pay half of the fees for the EdD course. This contribution is viewed internally within the school as a contribution to Continuing Professional Development (CPD), rather than as sponsorship for which they expect something in return. That said, there is little doubt that the research findings will contribute to the quality of the learning environment fostered.
Codes of practice	5	Have I worked within the British Educational Research Association guidelines? Are there other relevant codes which might also be applicable? Am I aware of my rights and responsibilities through to publication?	This research strictly adheres to the guidelines published by the British Educational Research Association. Other relevant codes are the school's academic and pastoral policies. I remain aware of my rights and responsibilities through to publication.
Efficiency/ use of resources	6	Have I made efficient use of the resources available to me, including people's time?	Thus far, I have made efficient use of the resources available to me, including people's time. I must continue to be considerate with regard to demands on both students' and colleagues' time. Sustainable use of resources is of paramount importance.
Quality of evidence on which conclusions are based	7	Have I got enough evidence to back-up my conclusions and recommendations?	Yes. As a result of the proposed methods outlined in Paper 4, I will have access to a high quality of empirical evidence on which my conclusions will be based.

Focus	Number	Questions to consider	Commentary
The Law	8	What legal requirements relating to working with children do I need to comply with? Am I aware of my data protection responsibilities? Am I aware of the need for disclosure of criminal activity? Do I need written permissions?	It is a legal requirement to have successfully complete a DBS check for which I am in possession of the relevant certificate for my current place of employment. My data protection responsibilities are clearly outlined in the school's data protection policy. I am aware of the need for disclosure of criminal activity, however it is highly unlikely within the context of both the research and the school. Written permission has been sought from the Warden (Headteacher) of the school.
Risk	9	Are there any risks to anyone as a result of this research?	The risks involved in this research are minimal. They have been outlined and documented in the Risk Assessment Form (see Appendix E).

Table C2

Ethical Considerations – Consequential and Utilitarian

Focus	Number	Questions to Consider	Commentary
Benefits for individuals	10	What are the benefits of my doing this research to the participants? Would an alternative methodology bring greater individual benefits?	If the findings of the research show that students' self-regulated learning skills improved as a response to the intervention, this is of huge benefit to the participants and subsequent Year 9 students. This methodology has been chosen and justified in terms of its greatest potential benefits to participants, but also in terms of what is practically viable within the school.
Benefits for particular groups/organisation	11	What are the benefits of my doing my research to the school/department? Could these be increased in any way? How will I ensure that they know about my findings? Is my work relevant to the school development plan? Can I justify my choice of methods to my sponsors?	The school stands to benefit from this research as the findings will inform curriculum design moving forward therefore having a positive influence on the learning environment fostered at the school. Clear plans have been outlined for the dissemination of research findings which will inform professional development sessions held during school INSET time. The research is highly relevant to the school development plan and, as such, provides strong justification for the methods chosen.
Most benefits for society	12	Is this a worthwhile area to research? Am I contributing to the 'greater good'? Is it high quality and open to scrutiny?	I hope that this research will make a significant contribution to the field of self-regulated learning. This research contributes to the 'greater good' as it has the potential to inform future curriculum interventions targeting the development of self-regulated learning skills. The proposed research methods, analysis and discussion is of a high quality and is therefore open to scrutiny from others.

Focus	Number	Questions to Consider	Commentary
Avoidance of harm	13	Are there any sensitive issues likely to be discussed or aspects of the study likely to cause discomfort or stress?	No. As stated both above and in the Risk Assessment Form (see Appendix E), the risks associated with this research are minimal. Sensitive issues will not be discussed and the study is therefore unlikely to cause any discomfort or stress.
Benefits for the researcher	14	Am I going to be able to get enough data to write a good thesis or paper? Am I aware of my publication rights? What might I learn from this project? Will it help in my long-term life goals?	The proposed method is based on a sample size of 130 participants, which will yield enough data to write a detailed and comprehensive thesis. I am aware of my publication rights. I have learnt and will continue to learn a huge amount from this project, both in terms of my dualistic research and practice stances. I will develop an understanding of and be able to execute rigorous doctoral level research. This includes critical analysis of the relevant literature, detailed methodological understanding, statistical analysis and discussion of findings. It will support me in achieving my long-term life goal, which is to optimise the learning environment fostered in secondary schools. Whether this is as a senior manager or as a academic leading a PGCE course, the EdD and associated research skills will help me to achieve this goal.

Table C3

Ethical Considerations – Deontological

Focus	Number	Questions to consider	Commentary
Avoidance of wrong – honesty and candour	15	Have I been open and honest in advance with everyone who might be affected by this research? Are they aware that they can withdraw, in full or in part, if they wish?	Yes. I have been completely open and honest with all stakeholders affected by this research. The participants are aware that they can withdraw from the research at any time, without fear or judgement of repercussion.
Fairness	16	Have I treated all participants fairly? Am I using incentives fairly? Will I acknowledge everyone involved fairly? Can I treat all participants equally?	Yes, all participants have been treated fairly. As both Group 1 and 2 will receive exactly the same intervention, just at different times during the academic year, neither group benefits more than the other. No incentives are used in this research. I can and will treat all participants fairly, as is ethically and professionally expected.
Reciprocity	17	Have I explained all the implications and expectations to the participants? Have I negotiated mutually Beneficial arrangements? Have I made myself available when those involved might wish me to be? Are the participants clear about roles, including my own, as they relate to expectations?	The implications and expectations will be clearly outlined at the initially briefing to be delivered during Week 2 of term. Once these implications and expectations have been outlined, the participants will be asked to provide written informed consent. There are no mutually beneficial arrangements in this research. Participants will be clear about roles, including both mine and their own, in relation to the research expectations.

Focus	Number	Questions to consider	Commentary
Tell the truth	18	If there is any need for covert research how will I deal with this? What will I do if I find out something that the participants/school/ department do not like? How will I report unpopular findings?	There is no need for covert research. It is highly unlikely that I will discover something that the participants/school do not like. However, in the event that I do, I will immediately inform the Gatekeeper for this research and other relevant stakeholders at both the school and university. The findings of this research are unlikely to be unpopular in their nature.
Keep promises	19	Have I clarified access to the raw data and how I will share findings including at publication? How will I ensure confidentiality?	The raw data will be retained on a password-encrypted laptop that only the researcher has access to. Confidentially will be ensured throughout the research process. All data will be anonymised in the write-up and in any subsequent publications.
Do the most positive good	20	Is there any other way I could carry out this research that would bring more benefits to those involved?	No. Based on the proposed sample size, the time and resources available, the proposed method will generate the most positive good for the participants and the school.

Table C4

Ethical Considerations – Relational and Individual

Focus	No.	Questions to consider	Commentary
Genuine collaboration/trust established	21	Who are the key people involved? How can I build a constructive relationship with them?	The key people involved are the participants and myself, the researcher. There are other stakeholders, including staff at the school, parents and university staff. As is good professional practice, all relationships are constructive and positive, providing fertile grounds for learning and research.
Avoid imposition/ respect autonomy	22	Am I making unreasonable or sensitive demands on any individuals? Do they appreciate that participation is voluntary?	No, I am not making unreasonable or sensitive demands on individuals. Participants will be aware that participation is voluntary and that they can opt out of the research a any time without fear of judgement or repercussion.
Confirmation of findings	23	What steps will I take in my methodology to ensure the validity and reliability of my findings? Can I involve participants in validation? Will I report in an accessible way to those involved?	The proposed methods have been chosen because they will yield valid and reliable findings. The instruments being used to collect the data have high internal validity due to the constructs on which they are based. External validity is strong although because of the nature of the setting (co-educational 13-18 boarding school), findings might not be generalizable to other settings. I will report in an accessible way to all and this will require careful consideration moving forward. Findings must be communicated in a manner that is accessible to teachers, academics, but most importantly, the participants as this is whom the research is intended to improve the learning environment fostered at the school.
Respect persons equally	24	How will I demonstrate my respect for all participants? Have I treated pupils in the same way as teachers?	All participants and teachers will be treated with respect. This will be achieved through the underpinning principle of equality. Any sensitive information will be kept confidential and anonymity will be ensured throughout the research.

Appendix D - Research Ethics Review Checklist for Faculty of Education

Section A: Details of the Project

Student Name	Gavin Turner
Email	[Redacted]
Supervisor	Dr Michelle Ellefson
Supervisor email	[Redacted]
Registration Report Title	Life-worthy learning skills: A curriculum intervention to promote self-regulated learning.

Section B: Checklist

Code of Practice relating to Educational Research		
1a	Have you read the *Revised Ethical Guidelines for Educational Research* (2011) of the British Educational Research Association (BERA)? (if you have not read it, the latest version is available at http://www.bera.ac.uk/researchers-resources/publications/bera-ethical-guidelines-for-educational-research-2011	Yes
1b	Is this Code relevant to the conduct of your research? If you have answered 'no', please briefly explain why:	Yes
1c	Do you agree to subscribe to the Code in carrying out your own research?	Yes
2	Are there any aspects of your proposed research which, in the context of BERA's Code of Practice, might give rise to concern amongst other educational researchers?	No
If you have answered 'yes', please briefly list possible causes for concern below:		
a		
b		
c		
3a	Will you be analysing an existing data set that has already been collected by someone else?	No

3b	If you answered YES: can you confirm that the data you will be using is *either* Already available in the public domain for anyone to analyse Or You have been given permission by the owner of the data set to undertake your own analysis and results[1]	
4	Will you be collecting your own research data for the study (through such techniques as interviewing people, observing situations, issuing questionnaires etc)? ***nb. If you have answered NO to this question, you may proceed to Section C and need not answer any further questions in this section.***	Yes
Obtaining 'Informed Consent'		
5	Are you familiar with the concept of 'informed consent'? (if you are not familiar with this concept you should first consult the following source: page 5 of the BERA guidelines above).	Yes
6	Does your research involve securing participation from children, young people or adults where the concept of 'informed consent' might apply? *Permission is likely to be needed to report any information about people or institutions that is not in the public domain, and which you have been able to obtain due to your privileged access to the research site(s) in whatever capacity* [2]	Yes
If you have answered 'yes' to Question 6 above, please answer the following questions.		
7a	Do you believe that you are adopting suitable safeguards with respect to obtaining 'informed consent' from participants in your research in line with the Code of Practice?	Yes
7b	Will all the information about individuals and institutions be treated on an 'in confidence' basis at all stages of your research including writing up and publication?	Yes

[1] *this permission should only be given if the owner of the data can make it available for secondary analysis on the basis of the informed consent they obtained from their original participants*

[2] *Professional work (such as teaching) can involve the collection of evidence to better understand problems/issues and to evaluate innovative practice - leaving practitioners with the question of when these activities become formal research requiring informed consent. This comment is meant to highlight how the collection of data for public reporting **beyond the institution** (e.g. **in a thesis**) should be considered as a key criterion for deciding when informed consent is required.*

7c(i)	Will all the information collected about the institution(s) where research is based be presented in ways that guarantee the institution(s) cannot be identified from information provided in the report? *Note: in a thesis written by a researcher about a research context where they have a publicly acknowledged role, it is difficult to disguise the identity of the institution whilst also providing the expected detail of the researcher's relationship with the research context.*[3]	Yes
7c(ii)	If not, has the appropriate responsible person given approval for the research on the understanding that the identity of the institution cannot be protected in the report of the research?	
7c(iii)	Will all the information collected about individuals be presented in ways that guarantee their anonymity? *Note: a person with a named role, or having a specific set of reported characteristics that is unique in the research context, cannot be assured of the anonymity when the identity of the research site cannot be protected.*	Yes
7c(iv)	If not, have these issues been explained to the relevant participants (and appropriate gatekeepers in the case of children or other vulnerable participants)?	
The Involvement of Adults in the Research		
8a	Will your research involve adults?	Yes
If you have answered 'yes' to Question 8a above, please answer the following questions; otherwise move to Question 9.		
8b	Will these adults be provided with sufficient information *prior* to agreeing to participate in your research to enable them to exercise 'informed consent'?	Yes

[3] *At present the implicit assumption is that anonymity is always desirable*, and is always achievable. In many studies these assumptions are sound. However, a practitioner (e.g. teacher) reporting research into their own practice/institution in a thesis would normally need to be explicit about their professional relationship to the research context to give an authentic account of their research. As the staff lists of many educational institutions are in the public domain and often readily found by a web search, a thesis by a named member of staff allows the institution to be readily identified from the name of the thesis author.*
Given that an institution can readily be identified, this also has consequences for the degree of anonymity that can be promised to participants - for example those with named roles such as Head of Year 11, Student Voice Coordinator, Head Prefect, etc, or those identifiable from detailed reported characteristics.
** Some institutions or participants may welcome being acknowledged by name in a thesis, and their views should be taken into account and balanced against other considerations.*

8c	Will the adults involved in your research be in a position to give 'informed consent' themselves with respect to their participation?	Yes
8d	Will these adults be able to opt out of your research in its entirety if they wish to do so by, for example, declining to be interviewed or refusing to answer a questionnaire?	Yes
8e	Will these adults be able to opt out of parts of your research by, for example, declining to participate in certain activities or answer particular questions?	Yes
The Involvement of Children, Young People and other potentially Vulnerable Persons in the Research		
9a	Will your research involve children, young people or other potentially vulnerable persons (such as those with learning disabilities or your own students).	Yes
If you have answered 'yes' to Question 9a above, please answer the following questions; otherwise move to Question 10. In educational and social research 'informed consent' regarding access is often given by a 'gatekeeper' on behalf of a wider group of persons (e.g. a head or class teacher with respect to their pupils, a youth worker working with young people, another person in an 'authority' position).		
9b	Who will act as the 'gatekeeper(s)' in your research? Please list their position(s) briefly below and, where this is not self-evident, describe the nature of their relationship with those on whose behalves they are giving 'informed consent'. **The researcher cannot act as the gatekeeper (see 9g below)**	
i ii	Mr Matthew Albrighton – Deputy Head Academic, St Edward's School, Woodstock Road, Oxford, OX2 7NN	
iii		
9c	Will you be briefing your 'gatekeeper(s)' about the nature of the questions or activities you will be undertaking with the children, young people or other potentially vulnerable persons involved in your research?	Yes
9d	If another person (such as a teacher or parent of a child in your study) expressed concerns about any of the questions or activities involved in your research, would your 'gatekeeper(s)' have sufficient information to provide a brief justification for having given 'informed consent'?	Yes
9e	If unforeseen problems were to arise during the course of the research, would your 'gatekeeper(s)' be able to contact you at relatively short notice to seek advice, if they needed to do so?	Yes
9f	Could your 'gatekeeper(s)' withdraw consent during the research if, for whatever reason, they felt this to be necessary?	Yes

9g(i)	Are you undertaking research into your own professional context/institution (e.g. with students in a school where you work)? If you answered 'Yes' then you should identify (in 9b above) a suitable senior person who has agreed to act as an independent point of contact for participants to act as the gatekeeper, and answer the following two questions:	Yes
9g(ii)	Will you ensure that other people in the research context are aware of the identity of the gatekeeper?	Yes
9g(iii)	Will you take reasonable precautions to ensure that research participants (and where appropriate their parents/guardians) know that they should contact the gatekeeper (and not you) if they have any concerns about the research?	Yes
Other Ethical Aspects of the Research		
10	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (eg covert observation of people in public places)	No
11	Will the research involve the discussion of topics which some people may deem to be 'sensitive'? (e.g. sexual activity, drug use, certain matters relating to political attitudes or religious beliefs)	No
12	Does the research involve any questions or activities which might be considered inappropriate in an educational setting?	No
13	Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind? *If you have ticked 'Yes' it is vital to refer the matter to the Faculty Research Office for onward reference to the University Insurance Section.*	No
14	Will blood, tissue or other samples be taken from the bodies of participants?	No
15	Is pain or more than mild discomfort likely to result from the study?	No
16	Could the research involve psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	No
17	Are there any other aspects of the research which could be interpreted as infringing the norms and expectations of behaviour prevailing in educational settings?	No
18	Are there any other aspects of the research which could be to the participants' detriment?	No
19	Will the study involve prolonged or repetitive testing?	No

20	Will financial inducements (other than reasonable expenses or compensation for time) be offered to participants?	No

SECTION C: Interpretation of Results

If any of your answers coincide with the response options having a coloured background, then you should assume that further discussion involving Stage 2 procedures is required because some aspect of your proposed research is likely to be 'ethically sensitive'. In practice, many issues can be resolved at this stage. In practice, many issues can be resolved at this stage.

Members of staff should be especially careful about research involving their own students (question 9g).

If you have ticked 'yes' in response to one or more of questions 10 to 20, both Stage 2 ***and*** *Stage 3 clearance will definitely be required.*

Stage 2 Clearance
Any 'ethically sensitive' responses identified above should be discussed with a 'knowledgeable person of standing'. In the case of students within the Faculty, this person will, in almost every case, be the person supervising your research.

On completion of the discussion, the 'knowledgeable person of standing' is asked to choose one of the following three responses, to delete the other two and to affirm their views by adding their signature.	
a	I have discussed the ethical dimensions of this research and, as outlined to me, I do not foresee any ethical issues arising which require further clearance.
b	There may be some ethical issues arising from this research. I think it would be prudent for the researcher to seek further advice and, possibly, Stage 3 clearance.
c	Ethical issues arise in this research which require further discussion; my advice is that Stage 3 ethical clearance should be sought.

Supervisor Name/ Signature	[Redacted]
Date	1/11/16

Appendix: -

Further to the above ethics checklist and in the spirit of honesty and openness, I need to disclose an experience which requires retrospective ethical permission to be obtained.

Following a suggestion from my supervisor to gauge some initial perspectives on teachers and students' understanding of the ten key words that form the basis of my curriculum-based intervention, I created an online form on the school's intranet. The link to this was shared with Year 9 students along with the context of the research and the notion of informed consent in the form of 'voluntary opted in' consent. The intranet form was active for one week allowing students to complete the survey at their convenience, should they wish to take part in the research. Although students were asked to give their name when completing the form, this is purely for identification purposes and has been kept confidential from other staff and students. The data is stored on an encrypted and secure device to which I have the password.

Out of 132 Year 9 students at the school, 112 completed the form providing a large and potentially rich data set. This response rate was far greater than expected and, as a result, I would like to request ethical approval from the committee which would allow me to include this data in my research. I hope to disseminate the findings such that the work goes beyond causal pilot testing and forms part of an actual study that I had not expected at the time. It is worth noting that due to this ethical issue I am yet to survey staff perspectives and will await approval before conducting the next survey.

Appendix E – Risk Assessment Form for Faculty of Education, University of Cambridge

Student Name	Gavin Turner
Course	Doctor of Education (EdD)
Email	[Redacted]
Supervisor(s)	Dr Michelle Ellefson
Title of Registration Proposal	Life-worthy learning skills: A curriculum intervention to promote self-regulated learning.

Research activity to be undertaken	I intend to undertake action research during the academic year 2017-18 at the school where I am employed as a teacher. The research is scheduled to begin during Week 2 of the school year (September) and will be completed in Week 33 (July) The participants will be drawn from National Curriculum Year 9 (*N*= 132). Written informed consent will be required from all participants before research activities commence – participants have the opportunity to opt out of research activities without fear of judgement or repercussion. In terms of the research itself, all participants that have provided written informed consent will complete both the MSLQ and SRLEDS in Week 2 of the academic year 2017/18. The participants will then be divided into two groups using purposeful sampling through the use of their form groups. Group 1 (half of the participants) will receive a 10-week curriculum intervention designed to enhance students' self-regulated learning skills. This will be delivered within the school timetable during period 6 on a Wednesday between 3.30pm-4.30pm. During this time Group 2 will have supervised study (normal school practise). The MSLQ and SRLEDS will then be administered during the week following the completion of the intervention, Week 13 of term. As is normal school practise, the participants will complete end of term tests in all subject areas, the data for which is collated on the school's secure database to which I have access as a teacher. The Headmaster has given his permission for me to use this data in my research. After Christmas (Term 2) Groups 1 and 2 will swap round with Group 2 receiving the intervention for 10 weeks and Group 1 attending supervised study during P6 on Wednesdays. The MSLQ and SRLEDS with then be administered for the third and final time on completion of the intervention in Week 11 of term. All data, research materials and documents will be kept on a secure, password-encrypted laptop that only the researcher has access to.

Location of research	St Edward's School, Woodstock Road, Oxford, OX2 7NN. 01865 319204
If travelling abroad, date of	N/A

List particular hazards associated with the activity, for example, will there be any personal safety issues? ***List only hazards which you could reasonably expect to result in harm to you or others under the conditions in which you are working.***
I do not foresee any hazards beyond those that are considered to be part of the school's normal way of working. There are no personal safety issues attached to this research.
Are the risks adequately controlled? If so, list the existing controls: ***List the precautions you have already taken against the risks from the hazards you have identified, or make a note where this information may be found.***
Any risks are adequately controlled through adherence the school's safeguarding policies, along with the safety overview provided by the Headteacher and Research Gatekeeper.
List the risks which are not adequately controlled and the precautions to be taken. ***Can the risk be removed? Is there a less risky alternative? Can the risk be reorganised to reduce the hazard? Can protection be provided?***
N/A
Do any other Risk Assessments relate to this activity? If so please attach a copy
N/A

Emergency measures:
In the event of an emergency, the personnel listed below have responsibility for the emergency protocols and should be contacted immediately: - Matthew Albrighton, Deputy Head Academic, is acting as the Research Gatekeeper. James Cope, Deputy Head Pastoral, has responsibility for pupil welfare and as Designated Safeguarding Lead (DSL) oversees this important facet of school life. The Warden, Stephen Jones, as Headteacher of the school has overall responsibility for all activities that happen therein and should therefore be contacted immediately in the event of an emergency.

Checklist

Have you specified:

When the activity will take place? Yes

Who is involved? Yes

What the activity will involve? Yes

The purpose of the activity? Yes

If there are there any special risks? No

Have you:

Cross referenced to other risk assessments? N/A

Put travel arrangements in place? N/A

Checked health issues? N/A

Checked equipment requirements? N/A

Checked insurance issues? N/A

Where the information is kept/available Yes

Are all involved informed? Yes

Form completed by (signature): Date: 28/6/17
Name (in capitals): MR GAVIN TURNER

In the case of students, signed by Supervisor: Date: 28/6/17
Name (in capitals): DR MICHELLE ELLEFSON

Head of Institution or nominee: Date: 28/6/17
Name (in capitals): MR MATTHEW ALBRIGHTON

Please email this form to [Redacted] copying in your supervisor.

Appendix F – Descriptive Statistics

Table F1

Descriptive Statistics for the MSLQ-Motivation

Timepoint	Group	*N*	Minimum	Maximum	*M*	*SD*	Skewness	Kurtosis
Timepoint 1	A	54	1	7	4.9	1.3	-0.20	-0.13
	B	51	1	7	4.8	1.4	-0.63	0.39
Timepoint 2	A	55	1	7	4.8	1.3	-0.29	-0.25
	B	52	1	7	4.9	1.3	-0.26	-0.16
Timepoint 3	A	58	1	7	4.7	1.3	-0.27	-0.18
	B	53	1	7	5.1	1.3	-0.48	0.04

Note. *N* denotes number, *M* denotes mean and *SD* denotes standard deviation. Likert scale range 1 to 7.

Table F2

Descriptive Statistics for the MSLQ-Cognitive

Timepoint	Group	*N*	Minimum	Maximum	*M*	*SD*	Skewness	Kurtosis
Timepoint 1	A	54	1	7	4.3	1.4	-0.21	-0.19
	B	51	1	7	4.5	1.5	-0.42	0.01
Timepoint 2	A	55	1	7	4.6	1.4	-0.27	-0.39
	B	52	1	7	4.4	1.4	-0.23	0.04
Timepoint 3	A	58	1	7	4.5	1.3	-0.18	-0.21
	B	53	1	7	4.7	1.4	-0.19	-0.18

Note. *N* denotes number, *M* denotes mean and *SD* denotes standard deviation. Likert scale range 1 to 7.

Table F3

Descriptive Statistics for the SRLEDS

Timepoint	Group	*N*	Minimum	Maximum	*M*	*SD*	Skewness	Kurtosis
Timepoint 1	A	50	1	4	2.8	0.6	-0.35	0.48
	B	47	1	4	2.8	0.7	-0.48	0.84
Timepoint 2	A	52	1	4	2.8	0.7	-0.48	0.92
	B	49	1	4	2.9	0.6	-0.24	1.16
Timepoint 3	A	55	1	4	2.9	0.7	-0.34	0.40
	B	48	1	4	2.9	0.6	-0.07	0.30

Note. *N* denotes number, *M* denotes mean and *SD* denotes standard deviation. Likert scale range 1 to 4.

Appendix G – Correlation Matrices for MSLQ at Timepoints 1, 2 and 3

Table G1

Correlation Matrix for MSLQ at Timepoint 1, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	.44***									
Q3	-.01	.08								
Q4	.36*	.31***	.03							
Q5	.22*	.14	-.08	.13						
Q6	.16*	.28**	-.15	.17*	.28**					
Q7	.06	.20*	.09	.22*	.38***	.20*				
Q8	.11	.08	.33***	.13	.06	.02	.17*			
Q9	.38***	.40***	.14	.50***	.09	.19*	.12	.16*		
Q10	.32***	.41***	.06	.35***	.16	.13	.24**	.20*	.36***	
Q11	.24**	.24**	.21*	.21*	.33***	.00	.49***	.18*	.29**	.27**
Q12	.34***	.34***	-.01	.37***	.03	.06	.28**	.27**	.33***	.28**
Q13	.28**	.23**	.13	.27**	.37***	.08	.28**	.15	.19*	.21*
Q14	.08	.00	.26**	.14	-.01	-.16*	.16	.30***	.18*	.13
Q15	.40***	.19*	-.10	.07	.54***	.53***	.26***	.01	.18*	.09
Q16	.19*	.34***	-.08	-.01	.08	.37***	.07	.20*	.07	.19*
Q17	.37***	.46***	-.13	.17*	.42***	.35***	.31***	.01	.17*	.29***
Q18	.28**	.57***	-.01	.34***	.19*	.37***	.33***	.03	.29***	.43***
Q19	.03	.08	.22*	.11	-.18*	-.25**	.08	.26**	.11	.26**
Q20	.19*	.26**	-.03	.19*	.63***	.33***	.40***	.08	.25**	.31***
Q21	.30***	.48***	-.05	.24**	.55***	.25**	.31***	.17*	.26**	.36***
Q22	.38***	.34***	-.06	.23**	.25**	.14	.37***	.01	.37***	.19*
Q23	.39***	.37***	.14	.30***	.22*	.00	.36***	.12	.36***	.42***
Q24	.08	.13	-.08	.08	-.03	.08	-.08	-.04	.10	-.04
Q25	.20*	.24**	.03	.19*	.23**	.22*	.19*	.02	.27**	.17*
Q26	.42***	.43***	.02	.48***	.08	.29***	.09	-.04	.49***	.23**
Q27	.40***	.37***	.04	.31***	.09	.21*	.31***	.19*	.29***	.38***
Q28	.00	.17*	.16*	.03	-.22*	-.21*	.06	.06	.15	.04
Q29	.27**	.31***	.07	.25**	.29**	.40***	.33***	.13	.27**	.13
Q30	.21*	.31***	.21*	.32***	.25**	-.04	.35***	.09	.31***	.25**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table G1 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q31	.35*	.48***	-.15	.18*	.47***	.47***	.27**	-.08	.17*	.21*
Q32	.32***	.23**	.05	.26**	.28**	.18*	.11	.23**	.29***	.27**
Q33	.31***	.30***	-.17*	.16*	.19*	.22*	-.08	-.03	.18*	.12
Q34	.17*	.17*	.13	.08	.08	.02	-.03	.14	.06	-.10
Q35	.26**	.26**	.11	.31***	.14	.02	.23**	.20*	.27**	.18*
Q36	.17*	.08	.07	.15	.33***	.29***	.13	-.09	.13	.05
Q37	.17*	.16*	-.16	.23**	.10	.15	.12	-.02	.12	.12
Q38	.17*	.05	-.13	-.03	.23**	.16*	-.02	-.14	.20*	.09
Q39	.29***	.08	.14	.20*	.16*	.15	.17*	.03	.20*	.08
Q40R	-.23**	-.23**	-.05	.06	-.25**	-.28**	-.21*	-.16	-.12	-.23**
Q41	.35***	.45***	.02	.31***	.18*	.11	.10	.03	.24**	.18*
Q42	.23**	.27**	-.04	.17*	.30***	.26**	.25**	.20*	.17*	.08
Q43	.27**	.32***	-.12	.24**	.28***	.28**	.24**	.04	.19*	.13
Q44	.08	.05	.00	.14	-.09	.10	-.02	.08	.10	-.01
Q45	-.06	.22*	.12	-.01	-.08	-.05	.13	.04	.03	.05
Q46	.23**	.15	.16	.13	.21*	.07	.07	.15	.24**	.31***
Q47	.41***	.33***	.03	.21*	.12	.28**	.09	.14	.29**	.32***
Q48	.30***	.24**	-.10	.32***	.16*	.17*	.10	.11	.26**	.26**
Q49	.22*	.18*	.03	.33***	.13	.07	.06	.06	.27**	.07
Q50	-.03	.08	.05	.02	.23**	.17*	.17*	.04	-.04	.02
Q51	.22*	.17*	-.11	.21*	.13	.21*	.10	-.07	.17*	.15
Q52R	.07	.17*	-.08	.17*	.19*	.29**	.20*	-.06	.13	.08
Q53	.29***	.35***	-.06	.13	.11	.13	-.03	.14	.20*	.20*
Q54	.25***	-.01	.12	.07	.27**	.08	.04	.18*	.10	.12
Q55	.13	.05	.13	.21*	.18*	.29**	.01	.02	.12	.03
Q56	.24**	.16*	.03	.28**	.24**	.22*	.26**	-.12	.17*	-.02
Q57R	.08**	.10	-.15	.11	.22*	.23**	.03	-	.11	.03
Q58	.18*	.31***	.03	.19*	-.04	.01	.25**	.04	.20*	.31***
Q59	.24**	.15	-.16*	.14	.21*	.14	.28**	.09	.26**	.18*
Q60R	.15	.27**	-.15	.09	-.08	.13	.13	.09	.07	.19*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G1 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q61	.23**	.12	-.03	.13	.33***	.19*	.17*	-.01	.24**	.16
Q62	.04	.03	.01	.09	.34***	.09	.07	.02	-.02	-.08
Q63	.39***	.19*	.05	.27**	.21*	.07	.03	.08	.22*	.03
Q64	.34***	.37***	-.04	.25**	.27**	.29***	.24**	.14	.31***	.30***
Q65	.28**	.20*	.00	.31***	.05	.09	-.06	.05	.17*	-.06
Q66	.02	.10	.05	-.04	.18*	.09	-.09	-.01	-.02	-.09
Q67	.23**	.03	-	.22*	.19*	.20*	.14	-.05	.20*	.22*
Q68	.15	.49***	-.02	.17*	-.05	.03	.13	-.02	.21*	.33***
Q69	.43***	.30***	.14	.33***	.17*	.02	.02	.10	.31***	.18*
Q70	.39***	.36***	.02	.36***	.26**	.29***	.34***	.18*	.29***	.40***
Q71	.15	-.01	-.06	-.02	.14	.12	-.03	.00	-.03	.07
Q72	.10	.08	-.03	.07	.40***	.13	.34	.07	.09	.05
Q73	.37***	.33***	-.05	.30***	.10	.17*	-.02	.14	.23**	.29***
Q74	.21*	.18*	.15	.14	.00	-.08	-.06	.13	.14	.06
Q75	.29***	.30***	.10	.24**	-.16	.06	.02	.26**	.23**	.30***
Q76R	.10	.14	.05	.25**	-.02	-.14	.09	.16*	.13	.16
Q77	.30***	.17*	.06	.36***	.15	.24**	.11	.18*	.28**	.25**
Q78	.24**	.24**	-.10	.20*	.13	.11	.13	.01	.16*	.19*
Q79R	.21*	.16*	-.11	.17*	.08	.08	-.06	.06	.07	.15
Q80	.19*	.32***	.04	.09	.17	.16*	.20*	-.06	.07	.14

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G2

Correlation Matrix for MSLQ at Timepoint 1, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.19*									
Q13	.39***	.26**								
Q14	.07	.12	.02							
Q15	.19*	.11	.29***	-.09						
Q16	-.04	.13	-.03	.08	.25**					
Q17	.29***	.03	.09	.11	.31***	.43***				
Q18	.29***	.39***	.31***	-.13	.20*	.24**	.27**			
Q19	.09	.15	.16*	.38***	-.18*	-.06	-.02	-.01		
Q20	.23**	.13	.29***	-.01	.48***	.16	.45***	.32***	-.17*	
Q21	.43***	.19*	.35***	-.08	.35***	.10	.41***	.47***	-.05	.48**
Q22	.34***	.24**	.20*	.17*	.25**	.17*	.42***	.10	.09	.26**
Q23	.38***	.39***	.30***	.07	.14	.06	.22*	.51***	.12	.27**
Q24	-.09	-.09	.01	.06	.00	.24**	.23**	-.04	.05	.09
Q25	.22*	.03	.21*	.08	.12	.18*	.31***	.33***	-.09	.20*
Q26	.23**	.08	.16	-.06	.15	.07	.32***	.22*	-.05	.21*
Q27	.40***	.30***	.25**	.11	.23**	.24**	.36***	.37***	.22*	.12
Q28	.11	.20*	.08	.18*	-	.03	-.04	.06	.59***	-.17*
Q29	.38***	.28**	.35***	-.17*	.53***	.12	.20*	.39***	.03	.25**
Q30	.44***	.06	.52***	.19*	-.01	-.06	.29***	.29***	.20*	.29**
Q31	.12	.24**	.27**	.07	.53***	.30***	.54***	.41***	-.15	.47**
Q32	.22*	.28**	.16	-.01	.23**	.15	.34***	.33***	.14	.21*
Q33R	-.03	.21*	.04	-.17*	.10	.14	.25**	.16*	-.11	.14
Q34	.18*	.05	.20*	-.03	.11	.02	.07	.15	.03	-.13
Q35	.33***	.27**	.24**	.07	.03	.09	.34***	.27**	-.03	.22*
Q36	.19*	.02	.17*	.11	.25**	.18*	.39***	.13	.09	.11
Q37R	.11	.27**	.12	-.21*	.11	-.07	.12	.20*	.07	.18*
Q38	-.07	.02	.02	-.02	.26**	.11	.12	.02	.02	.23**
Q39	.07	.19*	.09	.14	.24**	.20*	.20*	.27**	.14	.17*
Q40R	-.12	-.04	-.06	-.03	-	-	-.25**	-.12	.12	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G2 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q41	.29**	.25**	.11	.04	.10	.07	.28**	.30***	-.07	.12
Q42	.12	.23**	.19*	.15	.33***	.24**	.29**	.24**	.11	.22*
Q43	.11	.25**	.08	.11	.22*	.15	.39***	.23**	-.09	.20*
Q44	-.11	.06	-.16*	.33***	-.07	.18*	.11	.00	.05	-.07
Q45	.18*	.12	.10	.21*	-.08	.14	.03	.19*	.12	-.05
Q46	.24**	-.05	.11	-.05	.12	.02	.27**	.14	.17*	.19*
Q47	.15	.29***	.20*	.01	.18*	.12	.23**	.38***	.05	.20*
Q48	.21*	.24**	.22*	.12	.22*	.13	.35***	.27**	.15	.08
Q49	.15	.19*	.13	-.06	.13	-.03	.13	.29***	.13	.00
Q50	.08	.03	.14	.06	.20*	.07	.14	.16*	.05	.06
Q51	.09	.07	.08	.07	.21*	.24**	.47***	.16	.04	.23**
Q52R	.01	.19*	.09	-.22*	.07	.24**	.29**	.20*	-.11	.21*
Q53	.15	.13	.08	.08	.13	.17*	.32***	.31***	.03	.23**
Q54	.18*	.07	.13	-.02	.33***	.10	-.02	.09	.03	.13
Q55	.18*	.03	.05	.08	.18*	.06	.25**	.04	.04	.08
Q56	.31***	.10	.08	-.10	.23**	.04	.24**	.16	-.13	.12
Q57R	-.01	.06	-.07	-.23**	.14	.08	.19*	.16	-.20*	.20*
Q58	.30***	.28**	.18*	.02	-.04	.19*	.25**	.32***	.16	.08
Q59	.19*	.20*	-.04	.23**	.21*	.24**	.28**	.20*	.04	.19*
Q60R	-.03	.22*	.02	-.05	-.03	.19*	.19*	.19*	.21*	.05
Q61	.19*	-.04	.13	.16*	.28**	.11	.36***	.01	.03	.33***
Q62	-.01	-.08	.18*	.14	.20*	.24**	.26**	.16*	-.07	.17*
Q63	.21*	.18*	.31***	.01	.20*	.01	.18*	.25**	.08	.07
Q64	.26**	.28**	.33***	-.03	.32***	.15	.26**	.43***	-.09	.31***
Q65	.08	.20*	-.03	.00	-.03	-.01	.16	.09	.00	.06
Q66	.06	-.05	.03	.10	.23**	.18*	.22*	.00	-.13	.12
Q67	.06	.22*	.08	-.03	.27**	.20*	.13	.12	-.06	.22*
Q68	.08	.26**	.13	.07	-.14	.18*	.30***	.41***	.06	.09
Q69	.19*	.25**	.33***	.04	.15	.12	.21*	.18*	.15	-.02
Q70	.30***	.31***	.26**	.15	.22*	.09	.33***	.36***	.04	.31***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G2 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q71	.06	-.13	-.07	.25**	.21*	.24**	.21*	-.13	-.04	.13
Q72	.30***	.13	.27***	.07	.29***	.11	.24**	.28**	.08	.27**
Q73	.10	.23**	.08	-.09	.15	.19*	.18*	.28**	.00	.27**
Q74	.15	.05	.05	.21*	-.01	.08	.18*	.13	.07	-.11
Q75	.09	.34***	.03	.24**	-.03	.12	.10	.14	.20*	.08
Q76R	.14	.31***	.00	.16	-.14	-.08	.15	-.02	.14	.02
Q77	.25**	.27***	.13	.02	.13	.25**	.24**	.28**	.10	.05
Q78	.26**	.13	.15	.07	.06	.05	.26**	.19*	.13	-.03
Q79R	.06	.08	.09	.03	.00	.09	.21*	.18*	.01	.12
Q80	.14	.12	.16	.22	.11	.15	.35***	.20*	.03	.27**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G3

Correlation Matrix for MSLQ at Timepoint 1, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q21										
Q22	.19*									
Q23	.38***	.19*								
Q24	-.01	.22*	.01							
Q25	.19*	.23**	.24**	.19*						
Q26	.25**	.44***	.13	.19*	.34***					
Q27	.38***	.37***	.50***	.02	.18*	.22*				
Q28	-.12	.17*	.08	.24**	-.02	.03	.20*			
Q29	.42***	.26**	.19*	-.08	.07	.21*	.31***	-.04		
Q30	.41***	.32***	.40***	.03	.16*	.29***	.21*	.10	.26**	
Q31	.39***	.36***	.10	.10	.36***	.21*	.15	-.10	.28**	.13
Q32	.34***	.23**	.36***	.01	.17*	.21*	.38***	.11	.20*	.16
Q33R	.28**	.06	.23**	.03	-.02	.17*	.14	-.09	.14	.13
Q34	.19*	.11	.27***	-.12	.08	.02	.29***	.00	.14	.06
Q35	.33***	.26**	.42	-.10	.10	.27**	.29***	-.06	.13	.37***
Q36	.12	.39***	.14***	.19*	.28**	.21*	.31***	.11	.16	.12
Q37R	.26**	.11	.29***	.10	-.09	.12	.14	.07	.23*	.12
Q38	.21*	.26**	.07	-.03	.07	.11	.16	-.04	.15	.02
Q39	.02	.20*	.30***	.06	.18*	.03	.33***	.22*	.15**	.15
Q40R	-.22*	-.23**	-.07	-.03	-.20*	-.11	-.10	.04	-.19	-.01
Q41	.27**	.34*	.29**	-.02	.20*	.45***	.30***	-.03	.15	.11
Q42	.20*	.19***	.27**	-.06	.07	.01	.30***	.07	.24	.18*
Q43	.17*	.34*	.28**	.22*	.10	.19*	.19*	.02	.01	.13
Q44	-.15	.22	.13	.19*	.12	.06	.09	.21*	-.08	.07
Q45	.13	.13	.06	.06	.10	-.14	.19*	.16*	-.02	.08
Q46	.30***	.10	.28**	-.06	.26**	.29***	.32***	.05	.07	.24**
Q47	.42***	.24**	.25**	-.10	.29***	.24**	.30***	.00	.26*	.08
Q48	.36***	.32***	.23**	.12	.02	.26**	.25**	.02	.22*	.22*
Q49	.31***	.13	.34**	.09	.19*	.11	.29**	.13	.22*	.12
Q50	.09	.03	.07	-.19*	.12	-.06	.08	.02	.14	.00

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G3 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q51	.08	.40***	.17*	.24**	.26**	.28**	.25**	.07	.11	.22*
Q52R	.11	.23**	.20*	.13	-.03	.07	.04	-.05	.16	.14
Q53	.29***	.11	.28**	.04	.21*	.23**	.26**	.01	.17*	.13
Q54	.23**	.11	.16	-.09	.01	.04	.18*	.03	.33***	.08
Q55	.05	.24**	.09	.11	.18*	.19*	.16*	.09	.06	.07
Q56	.03	.38***	.23**	-.02	.10	.22*	.23**	.01	.16*	.11
Q57R	.13	.14	.09	.01	.06	.11	.09	-	.17*	.03
Q58	.17*	.27**	.40***	.02	.01	.23**	.43***	.22*	.15	.33***
Q59	.13	.34***	.23**	-.04	.11	.16	.29***	.02	.16*	.09
Q60R	.21*	.16	.15	.03	-.18*	.05	.24**	.19*	.10	.15
Q61	.17*	.50***	.07	.05	.14	.25**	.16*	-.03	.13	.31***
Q62	.17*	.12	.06	.25**	.24**	-.02	.19*	.04	.12	.19*
Q63	.21*	.26**	.36***	.04	.18*	.17*	.34***	.10	.19*	.17*
Q64	.48***	.12	.40***	-.12	.13	.17*	.36***	-.09	.33***	.31***
Q65	.17*	.21*	.32***	.30***	.03	.19*	.27**	.14	.08	.09
Q66	.04	.15	.01	.19*	.24**	.01	.04	.02	.08	.00
Q67	.16	.20*	.28**	.09	.09	.13	.14	-.15	.12	.06
Q68	.30***	.20*	.28**	-.02	.05	.21*	.27**	.04	-.02	.27**
Q69	.31***	.28**	.32***	.08	.29***	.28**	.32***	.18*	.27**	.28**
Q70	.37***	.30***	.41***	.02	.03	.32***	.35***	-.07	.27**	.34***
Q71	.04	.09	-.09	.18*	.23**	.01	.03	.02	-.04	-.07
Q72	.31***	.26**	.35***	-.01	.16	.00	.29***	.06	.23**	.36
Q73	.29***	.16	.22*	.22*	.06	.28**	.22*	.08	.09	.01
Q74	.25**	.15	.12	-.07	.02	.19*	.30***	.00	.02	.11
Q75	.16*	.07	.27**	.01	.07	.18*	.31***	.12	.03	.09
Q76R	.10	.14	.14	-.05	-.16*	.13	.07	.00	-.01	.17*
Q77	.24**	.23**	.34***	.09	.12	.26**	.37***	.08	.28**	.14
Q78	.22*	.24**	.37***	.13	.13	.23**	.27**	.10	.16*	.18*
Q79R	.16*	-.08	.30***	.09	-.03	.04	.12	.00	.09	.13
Q80	.19*	.30***	.23**	-.10	.29***	.04	.21*	-.06	.10	.22*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G4

Correlation Matrix for MSLQ at Timepoint 1, Questions 31-40

	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q31										
Q32	.19*									
Q33R	.27**	.32***								
Q34	-.05	.25**	.16							
Q35	.11	.41***	.35***	.32***						
Q36	.20*	.49***	.16	.33***	.24**					
Q37R	.16*	.24**	.60***	.18*	.33***	.21*				
Q38	.19*	.08	.06	-.07	.08	.16*	-.03			
Q39	.06	.31***	.01	.26**	.19*	.42***	.06	.09		
Q40R	-.28**	-.15	.10	.11	-.08	-.06	.22*	-.20*	-.01	
Q41	.20*	.29**	.27**	.22*	.43***	.31***	.20*	.12	.15	-.04
Q42	.26**	.14	.25**	.29***	.30***	.18*	.25**	.22*	.35***	-.09
Q43	.38***	.19*	.32***	.17*	.37***	.19*	.33***	-.02	.26**	-.08
Q44	.10	.10	.13	-.06	.05	.26**	.05	.07	.28**	.06
Q45	.11	-.07	-.07	.20*	.01	-.02	-.04	-.03	.06	.12
Q46	.05	.37***	.17*	.17*	.28**	.31***	.23**	.16*	.16	.00
Q47	.34***	.39***	.21*	.22*	.27**	.23**	.15	.38***	.25**	-.17*
Q48	.27**	.38***	.31***	.23**	.44***	.39***	.24**	.07	.11	-.18*
Q49	.08	.43***	.11	.41***	.26	.39***	.21*	.08	.34***	-.02
Q50	.21*	.07	.10	.39***	.02**	.23***	.18*	-.01	.21*	.10
Q51	.23**	.35***	.18*	.14	.28*	.48***	.18*	.24**	.37***	-.08
Q52R	.23**	.17*	.42***	.02	.17*	.19*	.34***	.06	.00	.06
Q53	.18*	.35***	.38***	.40***	.33***	.23**	.32***	.23**	.24**	-.01
Q54	.03	.38***	.15	.20*	.01	.25**	.22*	.16	.17*	-.14
Q55	.21*	.39***	.30***	.26**	.29***	.56***	.25**	.10	.25**	.04
Q56	.24**	.21*	.13	.14	.29***	.30***	.18*	.10	.20*	-.20*
Q57R	.13	.11	.42***	.12	.13	.22*	.29***	.18*	.10	.14
Q58	.02	.20*	.19*	.25**	.36***	.14	.22*	.00	.25**	.01
Q59	.22*	.23**	.04	.08	.18*	.29***	.00	.33***	.36***	-.21*
Q60R	-.02	.22*	.40***	.07	.25**	.11	.48***	.00	.09	.01

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G4 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 31-40

	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q61	.34***	.30***	.12	.01	.17*	.39***	.13	.28**	.22*	-.20*
Q62	.16	.20*	.08	.23**	.11	.53***	.10	.12	.30***	-.05
Q63	.06	.45***	.25**	.49***	.39***	.46	.21*	.13	.42***	-.02
Q64	.31***	.39***	.40***	.23**	.32***	.14**	.29***	.13	.23**	-.09
Q65	.06	.35***	.26**	.17*	.31***	.28***	.27**	.03	.14	.08
Q66	.20*	.08	-.14	.14	.05	.34*	-.10	.34***	.17*	.01
Q67	.17*	.19*	.34***	.04	.13	.17	.46***	.23**	.23**	.02
Q68	.22*	.12	.34***	.16	.37***	-	.17*	-.11	.08	.07
Q69	.14	.42***	.27**	.38***	.23**	.42	.27**	.13	.35***	-.01
Q70	.24**	.30***	.38***	.10	.45***	.12	.31***	.00	.10	-.16*
Q71	.23**	.10	-.01	-.10	-.14	.15***	.03	.27**	.10	-.10
Q72	.22*	.36***	.10	.23**	.25**	.40*	.21*	.16	.40***	-.08
Q73	.23**	.30***	.32***	.00	.26**	.16	.46***	-.03	.10	.02
Q74	.04	.21*	.19*	.27**	.27**	.12	.02	.00	.17*	.16
Q75	.14	.25**	.12	.03	.17*	-.05	.14	.17*	.08	-.07
Q76R	.01	.19*	.36***	.20*	.31***	.09	.36***	-.23**	-.07	.17*
Q77	.09	.52***	.33***	.37***	.46***	.47***	.47***	.12	.19*	-.06
Q78	.10	.25**	.31***	.21*	.23**	.30***	.41***	-.12	.17*	.03
Q79R	-.04	.19*	.36***	.14	.19*	.03	.32***	-.03	.09	.16*
Q80	.38***	.11	.13	.17*	.30***	.21*	.11	.38***	.24**	-.22*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G5

Correlation Matrix for MSLQ at Timepoint 1, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q41										
Q42	.17*									
Q43	.33***	.41***								
Q44	.03	.35***	.22*							
Q45	.01	.15	.15	.10						
Q46	.22*	.11	.11	.06	-.11					
Q47	.35***	.18*	.09	.06	-.06	.24**				
Q48	.29***	.28**	.30***	.17*	-.17*	.14	.31***			
Q49	.24**	.22*	.16	.17*	.03	.14	.18*	.33***		
Q50	.09	.34***	.26**	.06	.24**	.18*	.10	.07	.10	
Q51	.29***	.25**	.29***	.32***	-.05	.37***	.28**	.42***	.12	.15
Q52R	.11	.10	.31***	.00	-.04	-.04	.10	.22*	.03	.16*
Q53	.40***	.34***	.13	.17*	.11	.23**	.41***	.23**	.25**	.11
Q54	.12	.19*	-.01	.07	-.01	.30***	.16*	.16*	.17*	.16*
Q55	.21*	.37***	.28**	.37***	.09	.34***	.26**	.26**	.19*	.22*
Q56	.32***	.23**	.44***	.16*	.04	.20*	-.01	.16	.27**	.26**
Q57R	.19*	.18*	.18*	.01	.09	.02	.15	.06	.06	.19*
Q58	.19*	.14	.22*	.01	.15	.13	.24**	.22*	.04	.00
Q59	.33***	.31***	.18*	.11	.05	.07	.28**	.23**	.19*	.11
Q60R	.12	.25**	.17*	.13	-.04	.16	.16*	.32***	.10	.06
Q61	.23**	.28**	.15	.33***	.00	.26**	.12	.30***	.16	.07
Q62	.00	.22*	.16	.22*	-.01	.15	.13	.16*	.26**	.16*
Q63	.41***	.31***	.21*	.21*	.01	.21*	.33***	.41***	.43***	.21*
Q64	.29***	.35***	.27**	-.05	.08	.20*	.45***	.26**	.25**	.24**
Q65	.31***	.03	.37***	.25**	-.01	.14	.26**	.16	.32***	-.08
Q66	.22*	.27	.06	.21*	.05	.05	.20*	.05	.14	.19*
Q67	.11	.43**	.28**	.21	.03	.24**	.18*	.22*	.11	.35***
Q68	.32***	.18*	.31***	.02*	.39***	.07	.22*	.20*	.11	.10
Q69	.27**	.27**	.12	.19	.03	.30***	.47***	.28**	.41***	.28***
Q70	.38***	.17*	.46***	.02	.03	.14	.19*	.41***	.19*	.02*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G5 Continued

Correlation Matrix for MSLQ at Timepoint 1, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q71	.03	.15	-.03	.25**	.16	.12	.22*	-.05	-.05	-
Q72	.11	.47***	.29***	.20*	.10	.24**	.15	.27**	.31***	.29
Q73	.26**	.14	.32***	.15	-.03	.32***	.24**	.30***	.15	.00
Q74	.33***	.16*	.21*	.08	.15	.10	.22*	.22*	.23**	.13
Q75	.21*	.19*	.14	.20*	.03	.17*	.34***	.05	.09	-.09
Q76R	.16	.18*	.25**	.03	-.06	.06	.05	.40***	.06	.09
Q77	.36***	.24**	.25**	.13	.05	.34***	.32***	.35***	.39***	.16
Q78	.27**	.25**	.41***	.35***	.03	.27**	.11	.33***	.33***	.23**
Q79R	.16*	.32***	.13	.22*	.04	.08	.00	.16	.15	.10
Q80	.25**	.35***	.17*	.20*	.24**	.05	.44***	.04	.11	.13

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G6

Correlation Matrix for MSLQ at Timepoint 1, Questions 51-60

	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60
Q51										
Q52R	.18*									
Q53	.34***	-.13								
Q54	.22*	.11	.22*							
Q55	.43***	.12	.18*	.19*						
Q56	.30***	.22*	.08	.06	.32***					
Q57R	.22*	.36***	.14	.02	.30***	.12				
Q58	.33***	.21*	.27**	.01	.17*	.21*	.09			
Q59	.33***	.15	.23**	.20*	.20*	.12	.15	.27**		
Q60R	.21*	.24**	.16	.11	.09	-.02	.27**	.27**	.10	
Q61	.46***	.05	.24**	.30***	.35***	.29***	-.03	.11	.37***	.11
Q62	.35***	.08	.19*	.26**	.24**	.06	.25**	.05	.12	.11
Q63	.33***	.12	.33***	.34***	.40***	.25**	.08	.19*	.24**	.17*
Q64	.10	.17*	.43***	.18*	.06	.15	.19*	.22	.18*	.15
Q65	.19*	.16	.10	.14	.34***	.24**	.09	.14	.05	.19*
Q66	.30***	.02	.23**	.18*	.27**	.03	.10	-.15	.24**	-.18*
Q67	.32***	.22*	.27**	.25**	.30***	.22*	.25**	.17*	.32***	.27**
Q68	.05	.18*	.28**	-.21*	.01	-.02	.19*	.45***	.16	.28**
Q69	.35***	.08	.30***	.33***	.29***	.18*	.11	.21*	.22*	.20*
Q70	.23**	.17*	.27**	.03	.13	.26**	.11	.31***	.20*	.25**
Q71	.19*	-.22*	.27**	.25**	.27**	-.11	-.06	-.12	.24**	-.07
Q72	.34***	.11	.17*	.22*	.35***	.33***	.23**	.26**	.42***	.22*
Q73	.30***	.03	.21*	.28**	.28**	.18*	-.02	.21*	.03	.26**
Q74	.16	.02	.24**	.06	.18*	.13	-.01	.21*	.18*	.01
Q75	.15	-.04	.34***	.18*	.11	.04	-.17*	.20*	.18*	.03
Q76R	.10	.25**	.00	.08	.19*	-.01	.21*	.22*	.01	.36***
Q77	.34***	.33***	.31***	.35***	.46***	.29***	.28**	.31***	.26**	.29***
Q78	.26**	.14	.27**	.13	.23**	.35***	.14	.34***	.03	.31***
Q79R	.08	.16*	.34***	.22*	.22*	.01	.10	.16	-.01	.31***
Q80	.29**	.11	.41***	-.02	.24**	.17*	.19*	.20*	.29***	.11

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G7

Correlation Matrix for MSLQ at Timepoint 1, Questions 61-70

	Q61	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70
Q61										
Q62	.21*									
Q63	.20*	.24**								
Q64	.16	.17*	.26**							
Q65	.06	.24**	.40***	.18*						
Q66	.20*	.39***	.24**	.09	.13					
Q67	.31***	.01	.26**	.36***	.03	.06				
Q68	-.05	-.13	.12	.31***	.08	-.14	.15			
Q69	.20*	.38***	.54***	.38***	.33***	.21*	.30***	.13		
Q70	.16	-.01	.21*	.35***	.25**	-.16	.13	.35***	.08	
Q71	.30***	.13	.02	.10	.04	.43***	.18*	-.15	.12	-.10
Q72	.29*	.32***	.43***	.29**	.14	.21*	.41***	.11	.33***	.14
Q73	.21*	.10	.22*	.17*	.43***	-.07	.26**	.13	.28**	.32***
Q74	.18*	.12	.21*	.22*	.09	.13	.04	.40***	.32***	.11
Q75	.22*	-.06	.09	.30***	.24**	.20*	.16	.12	.22*	.13
Q76R	-.03	.01	.17*	-.05	.17*	-.10	.11	.23**	.10	.33***
Q77	.17*	.26***	.46***	.30***	.43***	.09	.28**	.07	.39***	.39***
Q78	.13	.13	.36***	.27***	.36***	-.04	.33***	.28**	.36***	.31***
Q79R	.06	-.05	.34***	.14	.12	.03	.32***	.12	.07	.19*
Q80	.26**	.18*	.27**	.27	.11	.35***	.12	.26**	.19*	.18*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G8

Correlation Matrix for MSLQ at Timepoint 1, Questions 71-80

	Q71	Q72	Q73	Q74	Q75	Q76	Q77	Q78	Q79	Q80
Q71										
Q72	.08									
Q73	.14	.06								
Q74	-.01	.08	.11							
Q75	.23*	-.02	.34***	.27**						
Q76R	-.24**	.13	.20*	-.04	.05					
Q77	.10	.29***	.33***	.08	.15	.27**				
Q78	-.02	.26**	.32***	.18*	.20*	.19*	.38***			
Q79R	.14	.11	.21*	.07	.10	.23**	.23**	.25**		
Q80	.34***	.27**	-.11	.08	.25	.02	.18*	.14	.23**	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G9

Correlation Matrix for MSLQ at Timepoint 2, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	.26**									
Q3	-.11	-.01								
Q4	.52***	.29***	-.05							
Q5	.35***	.44***	-.22*	.32***						
Q6	.36***	.34***	.05	.32***	.48***					
Q7	.27**	.39***	.14	.26**	.35***	.30***				
Q8	.19*	.09	.22*	.20*	.09	.22**	.19*			
Q9	.35***	.21*	.08	.36***	.14	.28**	.22*	.04		
Q10	.29***	.54***	-.02	.33***	.49***	.42***	.44***	.25**	.19*	
Q11	.27**	.35***	.14	.27**	.42***	.20*	.59***	.11	.20*	.50***
Q12	.36***	.64***	-.01	.27**	.43***	.39***	.32***	.15	.14	.57***
Q13	.37***	.33***	-.06	.35***	.40***	.22*	.36***	.17*	.14	.44***
Q14	.09	.07	.34***	.00	.06	.18*	.22**	.41***	-.05	.32***
Q15	.38***	.36***	.03	.27**	.50***	.61***	.31***	.13	.26**	.37***
Q16	.43***	.30***	.00	.35***	.32***	.38***	.13	.34***	.16	.36***
Q17	.45***	.27**	-.06	.45***	.26**	.34***	.18*	.09	.24**	.35***
Q18	.43***	.57***	.11	.28**	.28**	.24**	.32***	-.08	.27**	.41***
Q19	-.02	.04	.41***	.00	-.11	.03	.18**	.14	.12	-.01
Q20	.31***	.46***	-.13	.30***	.58***	.50***	.23**	.10	.31***	.52***
Q21	.36***	.46***	-.25**	.28**	.62***	.42***	.28***	.15	.24**	.45***
Q22	.41***	.29***	.01	.36***	.47***	.34***	.45***	.15	.24**	.49***
Q23	.30***	.32	-.16*	.34***	.29***	.24**	.29***	.03	.15	.39
Q24	.37***	.11	.09	.38***	.11	.32***	.20*	.21*	.23**	.05
Q25	.30***	.12	-.19*	.24**	.26**	.24**	.18*	.18*	.27**	.10***
Q26	.36***	.22*	-.12	.60***	.29***	.27**	.29***	.05	.22**	.29***
Q27	.45***	.47***	.05	.35***	.51	.43***	.44***	.25**	.24**	.56
Q28	-.04	-.07	.09	.02	.02***	-.12	.28**	.10	-.03	.02***
Q29	.34***	.56***	-.03	.35***	.54	.62***	.43***	.10	.24**	.56***
Q30	.30***	.29***	.10	.23**	.24**	.23**	.44***	.29***	.18*	.36

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G9 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q31	.46***	.54***	-	.38***	.67***	.43***	.25**	.11	.16	.55***
Q32	.26**	.26**	.02	.34***	.31***	.31***	.38***	.13	.16	.26**
Q33	.27**	.07	-.04	.22*	.04	-.02	-.02	.01	.13	.12
Q34	.24**	.14	.14	.17*	.00	.20*	.18*	.21*	.10	.10
Q35	.29***	.39***	-.09	.31***	.23**	.20*	.18*	-.02	.07	.22*
Q36	.37***	-.03	.06	.18*	.21*	.19*	.08	.18*	.10	-.06
Q37	.11	.03	-.10	.06	.14	.02	-.02	.02	.05	.18*
Q38	.45***	.22*	-.17*	.31***	.31***	.25**	.26**	-.01	.16	.10
Q39	.44***	.19*	.03	.37***	.32***	.30***	.24**	.21*	.26*	.21*
Q40R	-	-.05	.10	-.22*	-	-.16	-.09	.04	-.20*	.01
Q41	.37***	.48***	-.06	.47***	.25**	.36***	.23**	.03	.24**	.26**
Q42	.23**	.24**	.05	.12	.05	.16*	.20*	.11	.05	.22**
Q43	.20*	.14	-.15	.37***	.15	.10	.18*	.16*	.13	.21*
Q44	.37***	.09	-.09	.34***	.28**	.09	.23**	-.12	.10	.09
Q45	-.09	.15	.18*	-.04	-.16	-.05	.14	.14	.00	.13
Q46	.14	.26**	-.06	.27**	.30***	.19*	.18*	-.06	.08	.08
Q47	.49***	.24**	-.21*	.42***	.25**	.30***	.19*	-.06	.15	.11
Q48	.41***	.41***	-.01	.35***	.33***	.28**	.45***	-.01	.21*	.33***
Q49	.14	.09	-.11	.22*	.21*	.16*	.29***	.03	.05	.11
Q50	.28**	-.02	.00	.14	.10	.16*	.03	.14	-.03	.04
Q51	.43***	.26**	-.02	.49***	.37***	.22*	.31***	.21*	.19*	.17*
Q52R	.12	.14	-.28**	.18*	.20*	.07	.13	-.11	-.03	.06
Q53	.38***	.37***	.12	.35***	.32***	.35***	.32***	.26**	.23**	.34**
Q54	.29***	.17*	-.17*	.39***	.14	.08	.23**	-.06	.14	.02
Q55	.34***	.11	-.05	.34***	.26**	.22*	.43***	.20*	.13	.07
Q56	.22*	.26**	.10	.19*	.28**	.17*	.28**	-.06	.05	.23**
Q57R	.16	.03	-.12	.23**	.07	.00	-.10	.08	.13	.05
Q58	.32***	.30***	-.04	.38***	.21*	.25**	.27**	.07	.19*	.37***
Q59	.40***	.41***	-.18*	.30***	.33***	.27**	.16*	.04	.06	.26**
Q60R	-.25**	-.21*	.22*	-.14	-	-.20*	-.14	.05	-.21*	-

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G9 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q61	.39***	.15	-	.24**	.36***	.11	.12	-.15	.03	.17*
Q62	.40***	.27**	-.10	.47***	.32***	.33***	.33***	.12	.17*	.14
Q63	.41***	.29***	.03	.31***	.23**	.24**	.25**	.04	.12	.24**
Q64	.35***	.39***	-.02	.25**	.27**	.26**	.17*	.12	.14	.23**
Q65	.12	.22**	.05	.17*	-.02	.12	.14	.12	.18*	.03
Q66	.39***	.14	-.08	.18*	.31***	.23**	.11	.01	.06	.21*
Q67	.23**	.21*	.07	-.01	.11	.14	.07	.04	-.04	.10
Q68	.10	.25**	.06	.13	-.05	.01	.19*	.15	.12	.19*
Q69	.45***	.28**	.00	.37***	.16	.30***	.15	.15	.26**	.19*
Q70	.20*	.49***	-.10	.30***	.33***	.29***	.33***	.06	.20*	.51***
Q71	.31***	.04	.00	.36***	.27**	.04	.26**	.18	.18*	.24**
Q72	.17*	.32***	-.14	.12	.31***	.09	.16	-.11	.03	.17*
Q73	.32***	.28**	-.06	.32****	.31***	.35***	.34***	.00	.11	.28**
Q74	.15	.43***	.17*	.28**	.02	.07	.16*	.26*	.16	.19*
Q75	.50***	.40***	-.02	.42***	.23**	.28**	.23**	.14	.23**	.30***
Q76R	-.15	-.06	.01	-.14	-.18*	-.12	-.11	-.05	.05	.08
Q77	.23**	.22*	-.14	.49***	.37***	.13	.37***	-.03	.11	.23**
Q78	.24**	.27**	-.15	.39***	.33**	.24**	.32***	.01	.17*	.22*
Q79R	.13	.20*	-.28**	.13	.13	.12	-.01	-.12	.01	.24**
Q80	.40***	.13	-.07	.34***	.20**	.26**	.19*	.21*	.06	.18*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G10

Correlation Matrix for MSLQ at Timepoint 2, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.35***									
Q13	.35***	.49***								
Q14	.18*	.23**	.21*							
Q15	.19*	.49***	.29***	.15						
Q16	.15	.38***	.21*	.15	.36***					
Q17	.20*	.31***	.32***	.18*	.24**	.21*				
Q18	.32***	.59***	.35***	.10	.31***	.29***	.29***			
Q19	.18*	-.02	.11	.24**	-.08	-.01	.16	.16		
Q20	.23**	.55***	.32***	.04	.50***	.44***	.28**	.40***	-.05	
Q21	.33***	.56***	.29***	.05	.52***	.32***	.26**	.33***	-.10	.63***
Q22	.53***	.49***	.42***	.25**	.36***	.27**	.32***	.38***	.08	.44***
Q23	.41***	.39***	.27**	.07	.17*	.13	.48***	.31***	.11	.30***
Q24	.19*	.08	.03	.15	.29***	.27**	.19*	.13	.10	.07
Q25	.14	.06	.24**	.13	.29***	.22*	.13	.15	.07	.29***
Q26	.32***	.23**	.23**	.09	.23**	.18*	.37***	.24**	-.01	.17*
Q27	.44***	.57***	.43***	.30***	.42***	.38***	.41***	.59***	.16*	.46***
Q28	.27**	-.13	.08	.20*	.02	.00	.02	-.04	.55***	-.14
Q29	.28***	.50***	.40***	.14	.60***	.37***	.29***	.40***	.04	.50***
Q30	.33***	.40***	.35***	.36***	.24**	.24**	.33***	.43***	.21*	.39***
Q31	.29***	.57***	.44***	.06	.51***	.41***	.30***	.36***	-.08	.55***
Q32	.32***	.21*	.18*	.03	.32***	.23**	.24**	.34***	.19*	.21*
Q33R	.04	.17*	.16	-.05	.20*	.03	.22*	.26**	-.04	.06
Q34	.19*	.05	-.01	.12	.18*	.24**	.08	.09	.01	.18*
Q35	.24**	.37***	.23**	-.09	.21*	.24**	.24**	.35***	.02	.29***
Q36	.12	-.03	.09	.19*	.32***	.21*	.22*	.11	.20*	.12
Q37R	.07	.09	.13	-.03	.12	.08	.14	.16*	-.03	.04
Q38	.19*	.26**	.19*	.13	.32***	.34***	.23**	.25**	-.05	.26**
Q39	.34***	.10	.26**	.17*	.22*	.34***	.28**	.15	.12	.33***
Q40R	-.11	-.11	-.17*	.07	-.21*	-	-.07	-.15	.00	-.20*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G10 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q41	.32***	.40***	.25**	-.10	.24**	.34***	.31***	.35***	.10	.34***
Q42	.23**	.23**	-.01	.10	.22*	.35***	.18*	.29***	.00	.13
Q43	.31***	.22*	.18*	.07	.19*	.28**	.23**	.14	.05	.14
Q44	.16*	.19*	.24**	.05	.24**	.11	.21*	.22*	.07	.19*
Q45	.20*	.06	-.17*	.19*	-.09	.09	-.09	.18*	.02	-.08
Q46	.22*	.06	.15	-.07	.30***	.12	.13	.17*	.10	.23**
Q47	.24**	.22*	.21*	.02	.35***	.31***	.31***	.21*	-.06	.21*
Q48	.56***	.37***	.31***	.05	.34***	.18*	.27**	.44***	.06	.28**
Q49	.27**	.01	.07	.08	.26**	.19*	.16	.01	.07	.14
Q50	.08	.08	.00	.06	.24**	.10	.09	.09	-.06	.13
Q51	.23**	.24**	.30***	.09	.24**	.33***	.25**	.21*	.07	.29***
Q52R	.05	.19*	.24**	-.11	.17*	.03	.28**	.22*	-.02	.17*
Q53	.42***	.31***	.15	.06	.30***	.29***	.35***	.28**	.00	.31***
Q54	.14	.04	.23**	-.11	.12	.14	.17*	.13	-.02	.09
Q55	.20*	.12	.31***	.11	.40***	.22*	.27**	.17*	.15	.21*
Q56	.32***	.30***	.22*	.28**	.22**	.27**	.16*	.36***	-.02	.17*
Q57R	-.02	.17*	.12	-.20*	.12	.16*	.01	.08	-.12	.08
Q58	.25**	.40***	.11	-.05	.31***	.24**	.09	.42***	-.06	.41***
Q59	.22*	.28**	.12	-.06	.21*	.32***	.32***	.31***	-.15	.26**
Q60R	-.22**	-.20*	-.09	.25**	-.15	-.18*	-.17*	-.19*	.14	-.25**
Q61	.20*	.15	.26	-.13	.30***	.11	.12	.18*	-.12	.19*
Q62	.19*	.21*	.17	.01	.38***	.27**	.32***	.11	-.02	.26**
Q63	.22**	.24**	.22*	.00	.26**	.25**	.30***	.42***	.16*	.27**
Q64	.35***	.34***	.08	.05	.31***	.43***	.31***	.43***	.01	.27**
Q65	.23**	.07	-.05	-.04	.13	.15	-.07	.09	.16	.10
Q66	.13	.23**	.20*	.14	.36***	.28**	.13	.24**	-.21*	.17*
Q67	-.02	.10	-.03	.05	.13	.30***	.10	.30***	.14	.14
Q68	.22**	.21*	.08	.14	.04	.10	.10	.26**	.05	.08
Q69	.26**	.21*	.14	.06	.26**	.24**	.39***	.29***	.13	.31***
Q70	.39***	.43***	.20*	-.01	.24***	.29***	.19*	.38***	-.03	.41***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G10 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q71	.27**	.07	.16*	.11	.16*	.28**	.07	.05	-.11	.31***
Q72	.25**	.20*	.09	.04	.07	.12	.17*	.27**	.03	.21*
Q73	.33***	.30***	.26**	.06	.39***	.21*	.20*	.33***	.08	.29***
Q74	.28***	.27**	.14	.01	.10	.19*	.05	.34***	.19*	.21*
Q75	.30***	.38***	.23**	.03	.46***	.51***	.26**	.38***	-.03	.38***
Q76R	-.01	.03	-.10	-.04	-.14	-.24**	-.05	.05	-.05	-.22*
Q77	.41***	.16	.35***	-.06	.23**	.17*	.20*	.15	.10	.21*
Q78	.34***	.16*	.08	-.09	.35***	.08	.24**	.20*	.19*	.31***
Q79R	-.01	.24**	.12	-.06	.15	.24**	.03	.16*	-.20*	.22*
Q80	.21*	.19*	.20*	.03	.04	.32***	.39***	.16	.03	.25**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G11

Correlation Matrix for MSLQ at Timepoint 2, Questions 21-30

	Q21	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**
Q21										
Q22	.39***									
Q23	.37***	.50***								
Q24	.08	.18*	.04							
Q25	.25**	.23**	.13	.21*						
Q26	.34***	.30***	.53***	.24**	.27**					
Q27	.46***	.54***	.48***	.24**	.15	.36***				
Q28	-.14	.08	.11	.07	.11	.10	.03			
Q29	.43***	.37***	.31***	.14	.25**	.34***	.48***	.09		
Q30	.36***	.38***	.41***	.30***	.19*	.28**	.47***	.16	.29***	
Q31	.66***	.38***	.33***	.08	.31***	.31***	.46***	-.08	.58***	.19*
Q32	.27**	.34***	.26**	.29***	.06	.32***	.28**	.29***	.38***	.31***
Q33R	.09	.26**	.13	.02	-.12	.04	.12	-.08	-.07	.09
Q34	.13	.12	.14	.13	.13	.20*	.02	.12	.15	.17*
Q35	.20*	.39***	.41***	.13	.10	.26**	.33***	-.08	.38***	.18*
Q36	.12	.26**	.18*	.30***	.22*	.28**	.10	.26**	.18*	.21*
Q37R	.07	.26**	.03	-.03	-.04	-.04	.10	.00	.06	.01
Q38	.25**	.34***	.24**	.25**	.46***	.42***	.30***	.05	.30***	.07
Q39	.26**	.26**	.21*	.24**	.29***	.25**	.23**	.19*	.30***	.32***
Q40R	-	-.20*	-.08	-.16	-.26**	-	-.16	.06	-.19*	-.13
Q41	.34***	.33***	.39***	.22**	.08	.43***	.39***	-.06	.37***	.16*
Q42	.17*	.24**	.12	.03	.07	.05	.15	.11	.13	.15
Q43	.27**	.29***	.27**	.18*	.16	.27**	.22*	.14	.20*	.17*
Q44	.17*	.27**	.26**	.16	.14	.38***	.12	.19*	.33***	.12
Q45	-.01	.06	.18*	.06	.00	.01	.20*	.11	-.05	.14
Q46	.29***	.13	.21*	.25**	.14	.31***	.09	.11	.33***	.27**
Q47	.24**	.26**	.23**	.30***	.26**	.35***	.20*	.07	.27**	.14
Q48	.37***	.49***	.40***	.20*	.19*	.36***	.43***	.06	.32***	.31***
Q49	.25**	.26	.24**	.23**	.15	.28**	.13	.21*	.23**	.09
Q50	.26**	-	.15	.10	.20*	.20*	.08	.01	.05	.11

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G11 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q51	.32***	.32***	.32***	.27**	.17*	.45***	.32***	.18*	.43***	.31***
Q52R	.24**	.31***	.25**	.03	.04	.16	.11	.08	.18*	.14
Q53	.32***	.41***	.43***	.15	.02	.21*	.38***	-.08	.32***	.22**
Q54	.14	.25**	.13	.03	.20*	.36***	.05	.16	.26**	.08
Q55	.28**	.33***	.24**	.23**	.32***	.33***	.23**	.30***	.37***	.34***
Q56	.24**	.29***	.24**	.16*	.06	.42***	.28**	.03	.34***	.30***
Q57R	.19*	.14	.02	-.08	-.13	-.05	.10	-.20*	-.06	-.02
Q58	.41***	.42***	.28**	.15	.10	.36***	.35***	-.11	.25**	.20*
Q59	.24**	.17*	.26**	.16	.08	.26**	.24**	-.01	.46***	.07
Q60R	-.20*	-.23**	-.11	-.02	-.01	-.04	-.20*	.06	-.29***	-.03
Q61	.17*	.24**	.24**	.27**	.23**	.20*	.10	.19*	.19*	.05
Q62	.32***	.28**	.22*	.30***	.14	.41***	.14	.07	.38***	.18*
Q63	.25**	.19*	.29***	.14	.07	.28***	.38***	.10	.40***	.22*
Q64	.36***	.19*	.31***	.21*	.07	.23**	.39***	-.02	.29***	.18*
Q65	.04	.11	.05	.37***	.25**	.15	.06	.07	.09	.12
Q66	.25**	.28***	.13	.22*	.12	.27**	.25**	-.11	.26**	-.01
Q67	.16*	.09	.05	-.04	.06	.05	.13	-.01	.14	.09
Q68	.17*	.07	.29***	.06	.03	.16*	.38***	-.01	.13	.21*
Q69	.27**	.31***	.39***	.16	.21*	.28**	.33***	-.07	.27**	.29***
Q70	.45***	.40***	.33***	.05	.03	.20*	.42***	.00	.42***	.26**
Q71	.17*	.39***	.19*	.15	.21*	.26**	.26**	.14	.18*	.11
Q72	.17*	.18*	.29***	.08	.19*	.22**	.16*	.13	.18*	.11
Q73	.37***	.44***	.24**	.18*	.30***	.28**	.25**	.07	.37***	.13
Q74	.21*	.11	.12	.11	.14	.16*	.29***	.08	.18*	.14
Q75	.34*	.30***	.20*	.33***	.26**	.30***	.35***	.00	.45***	.22*
Q76R	-.19*	-.15	.07	-.15	-.23**	-.15	-.06	-.10	-.26**	-.09
Q77	.28**	.36***	.32***	.19*	.06	.40***	.24**	.26**	.31***	.26**
Q78	.39***	.32***	.33***	.11	.32***	.33***	.16*	.19*	.34***	.15
Q79R	.27**	.21*	.18*	-.06	.00	.16*	.12	-.08	.14	.05
Q80	.23**	.35***	.38***	.03	.03	.37***	.27**	.00	.17*	.28*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G12

Correlation Matrix for MSLQ at Timepoint 2, Questions 31-40

	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q31										
Q32	.20*									
Q33R	.04	.20*								
Q34	.15	.31***	-.01							
Q35	.33***	.38***	.04	.25**						
Q36	.14	.49***	.23**	.41***	.23**					
Q37R	.01	.34***	.49***	-.11	.09	.17*				
Q38	.34***	.27**	-.02	.24**	.30***	.29***	-.08			
Q39	.25**	.38***	.13	.40***	.20*	.50***	.15	.18*		
Q40R	-.28**	-.19*	-.07	-.15	-.18*	-.32***	.04	-.36***	-.19*	
Q41	.33***	.36***	.18*	.21*	.49***	.20*	.20*	.25**	.28**	-.19*
Q42	.09	.47***	.17*	.41***	.27**	.22*	.25**	.18*	.34***	-.03
Q43	.09	.41***	.14	.13	.21*	.22*	.30***	.22*	.37***	.00
Q44	.22**	.33***	.12	.15	.37***	.37***	.01	.44***	.26**	-.33***
Q45	-.08	.08	.01	.39***	.07	-.07	-.15	-.03	-.01	.08
Q46	.27**	.43***	.12	.12	.19*	.31***	.11	.18*	.26**	-.21*
Q47	.33***	.37***	.19*	.35***	.41***	.31***	.07	.53***	.37***	-.26**
Q48	.36***	.36***	.28**	.18*	.39***	.21*	.20*	.33***	.14	-.28**
Q49	.08	.49***	-.03	.37***	.21*	.37***	.16	.31***	.36***	-.13
Q50	.24**	.27**	.09	.54***	.08	.40***	.04	.11	.31***	-.12
Q51	.42***	.43***	.10	.28**	.40***	.37***	-.03	.40***	.44***	-.24**
Q52R	.18*	.44***	.22*	-.05	.30***	.25**	.39***	.09	.06	-.06
Q53	.23**	.45***	.19*	.27**	.37***	.28**	.23**	.23**	.29***	-.15
Q54	.14	.31***	.11	.20*	.22**	.18*	.11	.41***	.30***	-.20*
Q55	.19*	.56***	.22*	.33***	.31***	.50***	.23**	.38***	.45***	-.23**
Q56	.30***	.32***	.09	.26**	.24**	.35***	.01	.44***	.29***	-.28**
Q57R	.16	.02	.53***	-.19*	.17*	-.05	.22*	-.04	-.03	-.08
Q58	.31***	.42***	.26**	.31***	.29***	.13	.15**	.23**	.17*	-.10
Q59	.37***	.41***	.05	.33***	.37***	.26**	.14	.33***	.39***	-.17*
Q60R	-.26**	-.18*	-.27**	.01	-.18*	.06	-.43***	.00	-.10	.15

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G12 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 31-40

	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q61	.34***	.24**	.16*	.00	.20*	.23**	.22*	.33***	.16	-.12
Q62	.34***	.51***	.13	.30***	.34***	.48***	.11	.43***	.42***	-.29***
Q63	.29***	.52***	.17*	.32***	.33***	.21*	.16	.28**	.26**	-.19*
Q64	.27**	.35***	.30***	.27**	.34***	.33***	.19*	.28**	.34***	-.18*
Q65	.12	.22*	-.12	.27**	.46***	.13	.00	.28***	.15	-.09
Q66	.37***	.33***	.23**	.22*	.17*	.38***	.11	.55*	.21*	-.20*
Q67	.17*	.31***	.03	.33***	.17*	.28**	.09	.18	.23**	-.20*
Q68	.15	.20*	.10	.39***	.33***	.09	.06	.13**	.25**	.09
Q69	.26**	.34***	.31***	.37***	.38***	.33***	.23**	.24	.42***	-.30***
Q70	.36***	.38***	.04	.17*	.34***	.12	.22*	.13***	.25**	-.05
Q71	.19*	.19*	.15	.15	.11	.20*	.00	.39***	.29***	-.21*
Q72	.16*	.42***	-.04	.20*	.27**	.37***	.14	.31***	.37***	-.16
Q73	.39***	.42***	.21*	.08	.30***	.29***	.30***	.33	.18*	-.22**
Q74	.17*	.17*	.02	.37***	.22*	.14	-.08	.08	.19*	.03
Q75	.39***	.40***	.21*	.40***	.44***	.43***	.15	.39***	.48***	-.27**
Q76R	-.17*	-.06	.31***	-.15	-.05	-.24**	.20*	-.22*	-.24**	.32***
Q77	.29***	.56***	.13	.23**	.39***	.30***	.21*	.20*	.37***	-.24**
Q78	.27**	.47***	.15	.29***	.30***	.32***	.25**	.30***	.26**	-.18*
Q79R	.25**	.27**	.15	.17*	.26**	.06	.33***	.19*	.00	-.04
Q80	.20*	.41***	.23**	.32***	.31***	.37***	.19*	.18*	.41***	-.29***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G13

Correlation Matrix for MSLQ at Timepoint 2, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q41										
Q42	.30***									
Q43	.28**	.24**								
Q44	.23**	.08	.24**							
Q45	.00	.22*	.08	-.10						
Q46	.32***	.08	.19*	.24**	-.13					
Q47	.45***	.37***	.33***	.42***	.05	.28**				
Q48	.39***	.31***	.16*	.27**	.10	.24**	.45***			
Q49	.14	.26**	.48***	.30***	.09	.33***	.37***	.24**		
Q50	.15	.20*	.11	.14	.24**	.19*	.27**	.11	.15	
Q51	.34***	.16	.26**	.52***	-.03	.35***	.47***	.33***	.29***	.10
Q52R	.18*	.19*	.30***	.16*	-.15	.19*	.18*	.20*	.26**	.01
Q53	.53***	.40***	.28**	.17*	.13	.21*	.33***	.44***	.23**	.19*
Q54	.29***	.16*	.33***	.36***	-.15	.26**	.47***	.24**	.35***	.06
Q55	.34***	.32***	.36***	.46***	.02	.27**	.49***	.36***	.50***	.24**
Q56	.19*	.15	.12	.41***	.09	.31***	.39***	.39***	.28**	.21*
Q57R	.21*	.12	.02	-.02	-.15	-.05	.12	.19*	-.09	-.14
Q58	.47***	.34***	.31***	.26**	.19*	.13	.28**	.36***	.18*	.32***
Q59	.42***	.32***	.36***	.34***	.08	.16	.42***	.29***	.29***	.21*
Q60R	-.29***	-.08	-.14	-.05	.10	-.02	-.18*	-.32***	-.03	.10
Q61	.13	.10	.11	.47***	-.13	.22*	.40***	.38***	.23**	.21*
Q62	.44***	.11	.27**	.50***	-.14	.43***	.48***	.29***	.39***	.35***
Q63	.35***	.41***	.18*	.37***	.20*	.27**	.44***	.38***	.37***	.27**
Q64	.52***	.41***	.30***	.24**	.15	.25**	.41***	.41***	.08	.31***
Q65	.21*	.13	.17*	.07	.13	.17*	.29*	.33***	.26**	-.03
Q66	.28**	.18*	.19*	.39***	.00	.18*	.52	.24**	.15	.29***
Q67	.15	.43***	.08	.23**	.12	.01	.19***	.16	.28**	.28**
Q68	.26**	.25**	.35***	-.11	.47***	.03	.14	.15	.14	.33***
Q69	.52***	.38***	.19*	.33***	.21*	.25**	.45	.44***	.27**	.26**
Q70	.41***	.37***	.39***	.01	.14	.18*	.15	.29***	.32***	.09

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G13 Continued

Correlation Matrix for MSLQ at Timepoint 2, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q71	.17*	.07	.18*	.31***	.11	.13	.32***	.15	.12	.06
Q72	.21*	.32***	.21*	.31***	.10	.19*	.29***	.18*	.34***	.16*
Q73	.49***	.30***	.32***	.26**	-.03	.33***	.35***	.48***	.32***	.17*
Q74	.41***	.20*	.32***	-.01	.34***	.03	.14	.22*	.14	.32***
Q75	.46***	.38***	.34***	.25**	.09	.28**	.49***	.38***	.32***	.30***
Q76R	-.04	.00	-.08	-.16	.08	-.19*	-.13	.07	-.33***	-.04
Q77	.37***	.20*	.40***	.49***	.04	.36***	.52***	.38***	.46***	.15
Q78	.49***	.24**	.36***	.34***	.01	.45***	.39***	.33***	.43***	.32***
Q79R	.33***	.26**	.13	.09	.02	.11	.35***	.20*	.15	.11
Q80	.45***	.32***	.30***	.27**	.14	.15	.35***	.31***	.15	.33***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G14

Correlation Matrix for MSLQ at Timepoint 2, Questions 51-60

	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60
Q51										
Q52R	.17*									
Q53	.31***	.09								
Q54	.35***	.28**	.11							
Q55	.52***	.31***	.37***	.42***						
Q56	.46***	.15	.14	.23**	.31***					
Q57R	.15	.21*	.03	.06	.01	-.04				
Q58	.19*	.22*	.37***	.13	.23**	.17*	.20*			
Q59	.34***	.26**	.46***	.33***	.43***	.34***	-.08	.23**		
Q60R	-.06	-.18*	-.26**	-.18*	-.12	.05	-.16*	-.14	-.39***	
Q61	.27**	.27**	.17*	.21*	.34***	.30***	.03	.14	.38***	-.21*
Q62	.47***	.23**	.28**	.47***	.45***	.42***	.07	.28**	.38***	-.17*
Q63	.46***	.25**	.49***	.28**	.49***	.31***	.00	.34***	.48***	-.22*
Q64	.26**	.10	.55***	.13	.34***	.32***	.15	.34***	.51***	-.20*
Q65	.22*	.08	.13	.17*	.12	.10	.07	.13	.12	-.10
Q66	.40***	.06	.31***	.15	.38***	.48***	.13	.35***	.37***	-.09
Q67	.19*	.17*	.24**	.10	.28**	.26**	-.07	.24**	.36***	-.04
Q68	.10	.07	.28**	.14	.23**	.13	-.06	.27**	.35***	-.07
Q69	.33***	.14	.53***	.22*	.47***	.17*	.11	.36***	.38***	-.28**
Q70	.17*	.29***	.37***	.23**	.23**	.15	.07	.37***	.35***	-.31***
Q71	.49***	.03	.21*	.18*	.39***	.30***	.18*	.24**	.22*	-.12
Q72	.25**	.25**	.29***	.20*	.21*	.38***	-.23**	.10	.48***	-.13
Q73	.20*	.42***	.27**	.28***	.38***	.23**	.17*	.46***	.24**	-.26**
Q74	.10	-.01	.28**	.12	.25**	.04	-.14	.34***	.38***	-.06
Q75	.46***	.12	.40***	.33***	.41***	.39***	.12	.29***	.54***	-.34***
Q76R	-.15	-.20*	.08	-.32***	-.22**	-.08	.09	-.01	-.17*	-.12
Q77	.48***	.36***	.34***	.40***	.50***	.34***	.10	.33***	.33***	-.24**
Q78	.26**	.28**	.41***	.27**	.47***	.13	.03	.37****	.35***	-.22*
Q79R	.16*	.22*	.20*	.21*	.11	.22*	.15	.20*	.18*	-.25**
Q80	.37***	.21*	.43***	.23**	.41***	.28**	.07	.33***	.40***	-.14

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G15

Correlation Matrix for MSLQ at Timepoint 2, Questions 61-70

	Q61	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70
Q61										
Q62	.34***									
Q63	.33***	.23**								
Q64	.22*	.29***	.39***							
Q65	.10	.24**	.14	.02						
Q66	.35***	.37***	.26**	.37***	.04					
Q67	.18*	.18*	.47***	.23**	.09	.23**				
Q68	-.12	.02	.28**	.31***	.19*	.08	.06			
Q69	.20*	.34***	.54***	.45***	.23**	.22*	.34***	.28**		
Q70	.14	.19*	.16*	.29***	.13	.04	.17*	.41***	.23**	
Q71	.30***	.27**	.16	.12	.04	.52***	.03	.09	.24**	.15
Q72	.30***	.29***	.30***	.24**	.12	.17*	.34***	.14	.15	.27**
Q73	.33***	.41***	.24**	.28**	.08	.26**	.17*	.10	.36***	.45***
Q74	.01	.12	.28**	.35***	.19*	.00	.24**	.58***	.31***	.41***
Q75	.26**	.50***	.47***	.49***	.36***	.34***	.28**	.35***	.43***	.36***
Q76R	.01	-.24**	-.08	.02	.04	.05	-.17*	.06	-.05	-.13
Q77	.34***	.55***	.46***	.25**	.25**	.20*	.10	.16*	.38***	.22*
Q78	.27**	.51***	.39***	.33***	.23**	.15	.21*	.21*	.44***	.28**
Q79R	.22*	.24**	.21*	.12	.23**	.35***	.16*	.08	.12	.15
Q80	.11	.43***	.36***	.33***	.11	.32***	.31***	.24**	.51***	.24**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G16

Correlation Matrix for MSLQ at Timepoint 2, Questions 71-80

	Q71	**Q72**	**Q73**	**Q74**	**Q75**	**Q76**	**Q77**	**Q78**	**Q79**	**Q80**
Q71										
Q72	.09									
Q73	.22**	.18*								
Q74	.09	.18*	.21*							
Q75	.30***	.46***	.31***	.44***						
Q76R	-.11	-.11	-.16*	-.12	-.19*					
Q77	.25**	.36***	.30***	.12	.39***	-.14				
Q78	.19*	.33***	.49***	.33***	.41***	-.10*	.52***			
Q79R	.09	.28**	.05	.00	.25**	.18	.30***	.19*		
Q80	.29***	.21*	.20*	.23***	.32***	.02	.33***	.30*	.26**	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G17

Correlation Matrix for MSLQ at Timepoint 3, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	.33***									
Q3	.11	.08								
Q4	.36***	.33***	-.13							
Q5	.41***	.41***	.06	.33***						
Q6	.37***	.27**	.03	.24**	.53***					
Q7	.21*	.25**	.06	.29***	.43***	.27**				
Q8	.14	.02	.37***	-.13	.15	.16*	-.08			
Q9	.31***	.50***	.01	.38***	.29***	.35***	.15	.10		
Q10	.32***	.49***	.06	.38***	.43***	.22*	.36***	.11	.35***	
Q11	.21*	.37***	-.11	.28***	.44***	.33***	.54***	-.21*	.32***	.39***
Q12	.36***	.63***	.11	.22**	.39***	.22**	.24**	.18*	.40***	.51***
Q13	.18*	.60***	.07	.33***	.37***	.18*	.36***	.04	.31***	.48***
Q14	.19*	.20*	.48***	-.01	.12	.07	.18*	.40***	.07	.29***
Q15	.54***	.31***	.11	.29***	.41***	.57***	.30***	.11	.35***	.20*
Q16	.44***	.36***	.22*	.12	.24**	.24**	.14	.22**	.21*	.42***
Q17	.22*	.29	.04	.49***	.10	.10	.14	-.17*	.26**	.28***
Q18	.41***	.66***	.06	.45***	.42***	.41***	.30***	.08	.46***	.39***
Q19	.05	.09	.39***	-.19*	-.03	.10	-.02	.26**	-.04	-.03
Q20	.34***	.46***	-.05	.42***	.46***	.38***	.26**	.01	.32***	.44***
Q21	.34***	.45***	-.01	.37***	.52***	.42***	.31***	.07	.34***	.38***
Q22	.49***	.43***	.05	.41***	.43***	.37***	.54***	.04	.45***	.41***
Q23	.28***	.47***	.08	.30***	.30***	.29***	.36***	-.04	.29***	.54***
Q24	.40***	.37***	.06	.33***	.36***	.37***	.28***	.08	.36***	.32***
Q25	.19*	.35***	.09	.14	.17*	.17*	.18*	.11	.30***	.12
Q26	.16*	.26**	-.15	.37***	.27**	.24**	.21*	-.08	.16*	.30***
Q27	.36***	.46***	.15	.44***	.50***	.29***	.38***	.03	.31***	.45***
Q28	-.08	.18*	.15	-.14	-.06	-.10	.14	.03	.00	-.04
Q29	.52***	.52***	.07	.42***	.51***	.43***	.34***	.08	.35***	.44***
Q30	.24**	.38***	.40***	.28***	.39***	.21*	.50***	.08	.24**	.35***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table G17 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q31	.50***	.45***	.04	.33***	.42***	.46***	.23**	.09	.37***	.42***
Q32	.38***	.34***	.14	.25**	.29***	.16*	.27**	.07	.19*	.46***
Q33	-.08	-.06	.32***	-.07	-.03	-.04	.13	.09	-.03	-.08
Q34	.15	.17*	.12	.18*	.18*	.12	.19*	.01	.00	.17*
Q35	.20*	.51***	.07	.30***	.30***	.08	.27**	-.02	.19*	.39***
Q36	.16*	.17*	.23**	.06	.10	.09	.10	.08	.09	.12
Q37	-.05	-.03	.31***	-.23**	.00	.03	-.06	.12	-.22*	-.10
Q38	.45***	.17*	.09	.27**	.22**	.22**	.15	.14	.07	.14
Q39	.16*	.27**	.26**	.03	.17*	.11	.22**	.23**	.05	.11
Q40R	.32***	.22*	.01	.08	.26**	.34***	.19*	.13	.30***	.19*
Q41	.24**	.34***	.03	.16*	.08	.19*	.19*	.01	.14	.17*
Q42	.25**	.30***	-.03	.36***	.36***	.22*	.33***	-.02	.17*	.34***
Q43	.17*	.36***	.00	.37***	.38***	.25**	.33***	.06	.20*	.43***
Q44	.20*	.32***	.24**	.22*	.20*	.19*	.34***	.08	.12	.20*
Q45	-.01	.19*	.09	.16*	.01	.07	.16	.10	.10	.06
Q46	.28**	.22**	.01	.26**	.39***	.16*	.32***	-.03	.20*	.28***
Q47	.29***	.36***	.02	.23**	.36***	.41***	.33***	.11	.29***	.39***
Q48	.36***	.53***	.07	.37***	.40***	.17*	.23**	-.02	.33***	.47***
Q49	.11	.01	.08	.13	.12	.02	.15	-.06	-.06	.12
Q50	.19*	.10	.11	.10	.17*	.01	.13	.10	.09	.08
Q51	.36***	.33***	.01	.22**	.29***	.22**	.24**	.08	.14	.20*
Q52R	-.04	-.05	.36***	-.22*	-.10	-.01	-.14	.28***	-.15	-.14
Q53	.37***	.35***	.08	.24**	.36***	.22**	.30***	.13	.14	.32***
Q54	.31***	.28***	.18*	.28**	.16*	.18*	.31***	.04	.28**	.23**
Q55	.40***	.20*	.20*	.32***	.21*	.24**	.24**	.08	.23**	.19*
Q56	.12	.07	.10	.04	.17*	.19*	.21*	.07	.10	.03
Q57R	.07	.05	.15	.04	.19*	.15	.30***	.05	-.03	.25**
Q58	.23**	.33***	-.04	.28***	.34***	.11	.30***	-.03	.20*	.33***
Q59	.26**	.27**	.02	.28**	.38***	.12	.34***	-.06	.04	.41***
Q60R	-.12	-.23**	.25**	-.12	-.12	-.06	.03	.14	-.05	-.20*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G17 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q61	.32***	.26**	.13	.27**	.24**	.22**	.28**	.26**	.23**	.30***
Q62	.19*	.22**	-.02	.19*	.29***	.14	.24**	.10	.02	.17*
Q63	.21*	.42***	.17*	.23**	.33***	.20*	.14	.10	.17*	.33***
Q64	.30***	.53***	.11	.30***	.36***	.11	.30***	.05	.19*	.42***
Q65	.19*	.35***	.04	.20*	.29***	.20*	.07	.01	.08	.22**
Q66	.45***	.20*	.17*	.12	.16*	.11	.10	.18*	.19*	.21*
Q67	.21*	.05	.05	.03	.13	.10	.07	.00	.07	.18*
Q68	.10	.31***	.17*	.09	.06	-.19*	.04	.15	.09	.22*
Q69	.24**	.46***	.06	.35***	.33***	.23**	.34***	.08	.28***	.45***
Q70	.22**	.42***	.12	.35***	.21*	.14	.23**	.02	.14	.45***
Q71	.31***	.28**	.05	.30***	.28**	.22**	.20*	-.02	.18*	.25**
Q72	.12	.16*	.08	.16*	.17*	.03	.15	.02	.09	.08
Q73	.35***	.45***	.05	.27**	.37***	.33***	.25**	.12	.38***	.34***
Q74	.31***	.38***	-.08	.35***	.17*	.05	.24**	.12	.19*	.33***
Q75	.34***	.34***	.28***	.38***	.31***	.29***	.30***	.10	.25**	.53***
Q76R	.08	.01	.21*	-.06	.08	.12	.12	.25**	.05	-.08
Q77	.28***	.20*	.08	.33***	.23**	.33***	.18*	.01	.21*	.19*
Q78	.24**	.30***	-.04	.35***	.35***	.25**	.30***	-.06	.28***	.36***
Q79R	.07	-.08	.35***	-.17*	-.04	.01	-.05	.32***	-.04	-.11
Q80	.19*	.16*	.14	.31***	.15	.12	.03	.03	.03	.22*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G18

Correlation Matrix for MSLQ at Timepoint 3, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.26**									
Q13	.32***	.49***								
Q14	.00	.10	.31***							
Q15	.17*	.31***	.27**	.16*						
Q16	.11	.29***	.18*	.38***	.23**					
Q17	.15	.21*	.25**	.05	.24**	.00				
Q18	.35***	.49***	.49***	.11	.37***	.33***	.15			
Q19	-.04	.02	.00	.37***	.01	.16*	-.05	.00		
Q20	.36***	.30***	.32***	.05	.33***	.26**	.23**	.44***	-.03	
Q21	.39***	.26**	.29***	.14	.37***	.35***	.17*	.43***	-.18*	.56***
Q22	.43***	.34***	.33***	.18*	.43***	.30***	.21*	.43***	.06	.41***
Q23	.36***	.30***	.32***	.13	.21*	.23**	.29***	.35***	.00	.52***
Q24	.45***	.26**	.35***	.14	.34***	.31***	.35***	.34***	.16*	.48***
Q25	.15	.21*	.16	.13	.20*	.08	.00	.27**	.20*	.22*
Q26	.28**	.28***	.25**	-.06	.19*	.03	.30***	.23**	-.21*	.37***
Q27	.36***	.41***	.40***	.19*	.33***	.26**	.20*	.49***	-.04	.39***
Q28	-.08	.08	.09	.15	.02	-.02	.00	-.02	.45***	.06
Q29	.30***	.45***	.43***	.05	.47***	.33***	.17*	.59***	-.04	.46***
Q30	.24**	.28***	.46***	.50***	.24**	.37***	.16*	.32***	.17*	.39***
Q31	.30	.34***	.33***	.18*	.47***	.37***	.30***	.41***	-.01	.55***
Q32	.23	.19*	.35***	.34***	.31***	.33***	.24**	.18*	.20*	.33***
Q33R	.04**	-.09	-.07	.17*	.05	-.03	-.10	-.05	.11	-.02
Q34	.14	.07	.14	.16*	.11	.08	.01	.11	.02	.26**
Q35	.26**	.34***	.32***	.13	.05	.22*	.10	.32***	.03	.32***
Q36	.10	-.02	.06	.23**	.10	.14	.02	.06	.17*	.12
Q37R	.01	-.12	-.04	.26**	-.02	-.08	-.16*	-.02	.19*	-.02
Q38	.12	.15	.20*	.17*	.24**	.31***	.06	.24**	.21*	.27**
Q39	.09	.22**	.25**	.25**	.13	.13	.13	.09	.16*	.22*
Q40R	.26**	.18*	.15	.15	.21*	.16*	.13	.15	.16	.17*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G18 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q41	.22**	.27**	.21*	.04	.17*	.16*	.21*	.22**	.03	.29***
Q42	.31***	.38***	.36***	-.01	.18*	.27**	.14	.46***	-.10	.40***
Q43	.34***	.28***	.24**	.09	.15	.27**	.14	.39***	.07	.46***
Q44	.19*	.18*	.22*	.33***	.25**	.38***	.06	.26**	.12	.16*
Q45	.08	.05	.14	.27**	.12	.16*	-.10	.24**	.15	.18*
Q46	.29***	.17*	.22*	.05	.22*	.13	.14	.24**	-.08	.29***
Q47	.44***	.31***	.29***	.07	.29***	.28***	.15	.47***	.05	.40***
Q48	.27**	.32***	.28***	.08	.20*	.28***	.28***	.41***	-.07	.46***
Q49	.09	-.06	.03	.15	.10	.12	.12	-.09	.14	.14
Q50	.08	.00	.02	.14	.16*	.01	-.02	.11	.11	.16*
Q51	.17*	.13	.23**	.15	.23**	.17*	.12	.26**	-.02	.30***
Q52R	-.29***	-.16*	-.08	.24**	.03	-.04	-.25**	-.08	.29***	-.07
Q53	.26**	.22**	.28**	.22**	.21*	.42***	.05	.39***	.02	.44***
Q54	.16*	.21*	.17*	.11	.34***	.27**	.28***	.28**	.09	.28**
Q55	.11	.12	.17*	.22*	.36***	.20*	.30***	.25**	.15	.23**
Q56	.19*	.01	.13	.24**	.24**	.08	.05	.08	.18*	.27**
Q57R	.31***	.08	.27**	.31***	.11	.03	.04	.06	.16*	.15
Q58	.45***	.26**	.18*	.13	.19*	.18*	.19*	.24**	-.24**	.30***
Q59	.37***	.33***	.41***	.17*	.12	.25**	.11	.33***	-.05	.40***
Q60R	-.05	-.19*	-.14	.09	.10	-.14	-.15	-.14	.16*	.00
Q61	.14	.29***	.20*	.14	.29***	.29***	.14	.37***	.11	.39***
Q62	.18*	.09	.29***	.13	.34***	.09	.20*	.16	.03	.29***
Q63	.18*	.39***	.36***	.14	.27**	.26**	.15	.47***	-.01	.44***
Q64	.27**	.38***	.37***	.32***	.11	.40***	.30***	.29***	-.01	.41***
Q65	.06	.23**	.26**	.18*	.22*	.22*	.24**	.30***	.16*	.28**
Q66	.07	.16*	.20*	.22*	.35***	.35***	.07	.24**	.10	.23**
Q67	.16*	-.03	.00	.16*	.14	.05	.11	-.01	.00	.15
Q68	.10	.21*	.35***	.30***	-.07	.24**	-.09	.20*	.16*	.18*
Q69	.31***	.30***	.48***	.26**	.34***	.32***	.20*	.36***	.00	.37***
Q70	.26**	.36***	.39***	.09	.15	.33***	.29***	.36***	-.01	.43***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G18 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 11-20

	Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
Q71	.20*	.21*	.30***	.12	.39***	.26**	.05	.24**	.05	.33***
Q72	.13	.14	.20*	.18*	.08	.14	.12	.16*	-.03	.29***
Q73	.30***	.35***	.30***	.13	.28**	.31***	.14	.46***	.05	.46***
Q74	.14	.29***	.31***	.21*	.11	.31***	.19*	.38***	.05	.37***
Q75	.24**	.30***	.31	.27**	.22*	.36	.31***	.42***	.10	.42***
Q76R	.09	.05	.07	.19*	.28***	.02	-.25**	.14	.15	.04
Q77	.18*	.10	.15	.11	.28**	.13	.33***	.31***	-.02	.40***
Q78	.32***	.12	.14	-.01	.23**	.12	.19*	.29***	.02	.42***
Q79R	-.16*	-.14	-.04	.29***	.12	.09	-.15	-.09	.34***	-.01
Q80	.10	.07	.33***	.24**	.09	.11	.29***	.17*	.00	.27**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G19

Correlation Matrix for MSLQ at Timepoint 3, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q21										
Q22	.40***									
Q23	.42***	.35***								
Q24	.32***	.42***	.29***							
Q25	.19*	.35***	.19*	.34***						
Q26	.36***	.28***	.16*	.35***	.14					
Q27	.49***	.51***	.35***	.42***	.28***	.24**				
Q28	-.06	.14	-.03	.08	.29***	.17*	.05			
Q29	.55***	.43***	.35***	.42***	.12	.28***	.51***	.01		
Q30	.36***	.43***	.30***	.34***	.18*	.14	.43***	.20*	.38***	
Q31	.56***	.41***	.47***	.43***	.25**	.27**	.42***	.01	.41***	.33***
Q32	.19*	.39***	.33***	.39***	.23**	.15	.27**	.16*	.31***	.32***
Q33R	.00	.01	.12	-.06	.13	-.10	.06	.14	-.06	.07
Q34	.24**	.33***	.38***	.18*	.12	.07	.25**	.03	.14	.24**
Q35	.31***	.33***	.40***	.14	.24**	.28***	.34***	.15	.28***	.30***
Q36	.16*	.20*	.13	.23**	.24**	.26**	.13	.41***	.10	.18*
Q37R	-.05	-.11	.03	-.05	.07	-.14	-.03	.17*	-.10	-.04
Q38	.25**	.38***	.14	.33***	.22**	.16*	.28**	.26**	.30***	.18*
Q39	.21*	.33***	.31***	.23**	.21*	.15	.28**	.23**	.19*	.39***
Q40R	.10	.22*	.15	.38***	.25**	.30***	.16*	.13	.23**	.11
Q41	.36***	.35***	.29***	.32***	.19*	.34***	.29***	.12	.31***	.21*
Q42	.33***	.37***	.30***	.35***	.09	.17*	.36***	-.15	.40***	.26**
Q43	.41***	.29***	.32***	.37***	.20*	.38***	.37***	.16	.34***	.23**
Q44	.26**	.31***	.20*	.27**	.19*	.13	.37***	.18*	.29***	.29***
Q45	.15	.29***	.08	.07	.25**	-.09	.14	.10	.05	.18*
Q46	.36***	.27**	.22*	.31***	.35***	.29***	.37***	.13	.32***	.26**
Q47	.28**	.48***	.21*	.48***	.18*	.32***	.37***	-.03	.35***	.18*
Q48	.39***	.41***	.44***	.50***	.33***	.32***	.56***	.06	.49***	.35***
Q49	.07	.20*	.03	.19*	.05	.20*	.13	.27**	.09	.10
Q50	.04	.25**	.08	.17*	.29***	.14	.17*	.23**	.08	.22*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G19 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q51	.36***	.35***	.33***	.27**	.29***	.39***	.25**	.22**	.32***	.20*
Q52R	-.12	-.11	-.03***	-.09	.17*	-.19*	-.06	.13	-.12	.05
Q53	.43***	.40***	.30*	.30***	.14	.19*	.45***	.13	.34***	.27**
Q54	.10	.39***	.18**	.45***	.20*	.28***	.17*	.27**	.18*	.30***
Q55	.27**	.33***	.27*	.45***	.26**	.25**	.23**	.18*	.29***	.24**
Q56	.08	.27**	.20*	.19*	.19*	.16*	.04	.20*	.11	.32***
Q57R	-.06	.23**	.19***	.17*	.03	.08	.09	.15	.09	.26**
Q58	.31***	.35***	.28*	.21*	.11	.34***	.28***	-.01	.23**	.15
Q59	.25**	.37***	.21*	.26**	.17*	.24**	.34***	.02	.22*	.26**
Q60R	-.06	-.02	-.03	-.01	.16*	-.10	-.10	.19*	-.12	-.04
Q61	.27**	.37***	.36***	.39***	.28***	.15	.38***	.04	.32***	.31***
Q62	.16*	.36***	.13	.35***	.24**	.33***	.26**	.22*	.19*	.16*
Q63	.37***	.19*	.32***	.30***	.10	.17*	.40***	.01	.39***	.33***
Q64	.40***	.34***	.38***	.25**	.13	.20*	.28***	.03	.30***	.28***
Q65	.12	.28***	.30***	.29***	.17*	.08	.38***	.07	.12	.23**
Q66	.19*	.27**	.18	.36***	.24**	.12	.25**	.19*	.31***	.23**
Q67	.18*	.19*	.31***	.21*	.04	.12	.10	.06	.07	.03
Q68	.08	.18*	.13***	.03	.15	-.14	.14	.07	.16*	.23**
Q69	.37***	.35***	.33**	.46***	.34***	.37***	.37***	.03	.33***	.32***
Q70	.35***	.38***	.38*	.31***	.19*	.32***	.41***	.07	.35***	.38***
Q71	.31***	.41***	.27**	.28**	.17*	.14	.20*	.08	.33***	.20*
Q72	.22**	.29***	.17*	.21*	.14	.01	.27**	.13	.15	.26**
Q73	.32***	.42***	.26**	.46***	.42***	.27**	.34***	.20*	.37***	.38***
Q74	.27**	.40	.34***	.19*	.11	.07	.23**	.10	.28***	.24**
Q75	.41***	.36***	.50***	.37***	.12	.18*	.44***	-.01	.38***	.29***
Q76R	.02	.14***	-.06	-.03	.14	-.08	.00	.08	.14	.08
Q77	.42***	.35***	.15	.41***	.24**	.31***	.41***	.14	.27**	.30***
Q78	.31***	.36***	.32***	.29***	.24**	.34***	.34***	.09	.30***	.09
Q79R	-.10	.00	.04	.07	.16*	-.14	-.03	.13	-.13	.12
Q80	.23**	.21*	.28***	.22**	.09	.12	.25**	.00	.11	.25**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G20

Correlation Matrix for MSLQ at Timepoint 3, Questions 31-40

	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
Q31										
Q32	.26**									
Q33R	.06	.08								
Q34	.13	.26**	.06							
Q35	.14	.41***	.01	.42***						
Q36	.13	.40***	.03	.33***	.27**					
Q37R	.10	.05	.52***	-.04	-.02	.21*				
Q38	.29***	.42***	.18*	.26**	.30***	.35***	.20*			
Q39	.19*	.32***	.09	.40***	.24**	.36***	.12	.14		
Q40R	.18*	.31***	.04	.04	.20*	.35***	.06	.29***	.24**	
Q41	.15	.22**	-.21*	.40***	.31***	.24**	-.24**	.14	.47***	.13
Q42	.18*	.37***	-.05	.32***	.32***	-.03	-.16*	.26**	.33***	.06
Q43	.14	.38***	.00	.29***	.55***	.19*	-.10	.26**	.17*	.26***
Q44	.17*	.44***	.18*	.43***	.43***	.36***	.15	.42***	.26**	.30***
Q45	.15	.08	.17	.30***	.23**	-.02	.07	.06	.03	-.17*
Q46	.30***	.27**	.08	.10	.26**	.34***	.00	.18*	.20*	.35***
Q47	.29***	.28***	-.04	.22*	.21*	.13	-.08	.28***	.15	.38***
Q48	.33***	.47***	-.04	.30***	.46***	.26**	-.05	.20*	.34***	.24**
Q49	.15	.39***	.16*	.11	.09	.40***	.16*	.30***	.30***	.28**
Q50	.17*	.18*	.29***	.45***	.20*	.31***	.04	.14	.22**	.09
Q51	.18*	.42***	.16*	.42***	.48***	.44***	.13	.56***	.28**	.41***
Q52R	-.03	.05	.29	.11	.05	.28**	.36***	.09	.09	.09
Q53	.30***	.47***	.05	.32***	.51***	.23**	.08	.54***	.27**	.23**
Q54	.25**	.43***	.12	.20*	.09	.39***	-.02	.35***	.27**	.26**
Q55	.26**	.42***	.01	.36***	.20*	.45***	-.08	.30***	.31***	.34***
Q56	.20*	.30***	.01	.31***	.10	.32***	-.05	.17*	.40***	.21*
Q57R	.14	.31***	.35***	.04	.15	.11	.36***	.16*	.11	.29***
Q58	.21*	.26**	.21*	.24**	.35***	.06	.01	.11	.18*	.14
Q59	.17*	.47***	-.02	.22**	.40***	.09	-.01	.34***	.30***	.22**
Q60R	.06	-.02	.60***	.11	-.20*	.16*	.50***	.08	.17*	.13

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G20 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 31-40

	Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
Q61	.34***	.29***	.11	.22**	.12	-.02	-.04	.23**	.39***	.10
Q62	.12	.41***	-.01	.26	.17*	.23**	-.10	.30***	.30***	.20*
Q63	.39***	.25**	.03	.18**	.24**	.04	.00	.14	.35***	-.03
Q64	.30***	.47***	.06	.23**	.46***	.06	-.04	.27**	.27**	.12
Q65	.30***	.16	-.16*	.27**	.23**	.05	-.07	.15	.24**	.10
Q66	.25**	.38***	.14	.19*	.19*	.37***	.00	.45***	.29***	.30***
Q67	.14	.42***	.03	.30***	.13	.40***	.12	.17*	.29***	.20*
Q68	.00	.29***	.10	.15	.40***	.02	.01	.06	.14	-.15
Q69	.27**	.55***	.02	.28**	.41***	.29***	-.07	.33***	.30***	.31***
Q70	.20*	.35***	-.11	.32***	.45***	.06	-.23**	.15	.39***	.07
Q71	.29***	.53***	.08	.39***	.41***	.33***	.13	.53***	.14	.15
Q72	.29***	.20*	.15	.27**	.06	.23**	.16*	.23**	.37***	.01
Q73	.31***	.33***	-.21*	.21*	.22*	.26**	-.23**	.28**	.15	.29***
Q74	.31***	.31***	.05	.34***	.38***	.05	.04	.31***	.24**	-.05
Q75	.38***	.47***	.10	.36***	.40***	.24**	-.02	.33***	.21*	.15
Q76R	.11	.13	.41***	-.10	.04	.07	.44***	.22**	.02	.05
Q77	.38***	.39***	.11	.16*	.20*	.31***	-.03	.37***	.22**	.30***
Q78	.28***	.37***	-.08	.25**	.39***	.21*	-.08	.22**	.22*	.20*
Q79R	.06	.20*	.31***	.18*	.04	.26**	.37***	.25**	.06	.23**
Q80	.24**	.37***	.04	.44***	.26**	.29***	.01	.30***	.26**	.06

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G21

Correlation Matrix for MSLQ at Timepoint 3, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q41										
Q42	.34***									
Q43	.29***	.52***								
Q44	.23**	.26**	.34***							
Q45	-.01	.16*	.23**	.27**						
Q46	.17*	.11	.23**	.16*	.07					
Q47	.26**	.36***	.39***	.32***	.15	.34***				
Q48	.28**	.37***	.43***	.28**	.05	.39***	.37***			
Q49	.20*	.02	.19*	.28***	-.08	.19*	.12	.15		
Q50	.05	.06	.06	.18*	.28**	.29***	.16*	.30***	.14	
Q51	.27**	.20*	.38***	.47***	.11	.34***	.36***	.37***	.31***	.39***
Q52R	-.12	-.31***	-.17*	.03	.13	.00	-.06	.00	-.01	.11
Q53	.38***	.45***	.45***	.49***	.14	.25**	.34***	.44***	.16*	.21*
Q54	.20*	.30***	.29***	.27**	-.02	.24**	.34***	.39***	.43***	.31***
Q55	.23**	.23**	.31***	.42***	-.01	.41***	.27**	.36***	.30***	.28**
Q56	.19*	.04	.12	.22*	.08	.27**	.25**	.13	.31***	.34***
Q57R	-.19*	-.02	.13	.10	.19*	.21*	.17*	.08	.19*	.19*
Q58	.24**	.28***	.28***	.22**	.15	.25**	.32***	.31***	.17*	.22**
Q59	.27**	.64***	.49***	.29***	.10	.23**	.38***	.33***	.22**	.09
Q60R	-.13	-.11	-.07	.13	.17*	.08	.01	-.08	.31***	.25**
Q61	.30***	.39***	.31***	.17*	.20*	.29***	.39***	.47***	.14	.32***
Q62	.27**	.14	.29***	.25**	.03	.22**	.41***	.22**	.25**	.29***
Q63	.33***	.53***	.40***	.15	.11	.09	.20*	.32***	.14	.09
Q64	.39***	.41***	.41***	.36***	.21*	.17*	.34***	.40***	.21*	-.02
Q65	.07	.21*	.19*	.00	.20*	.11	.23**	.25**	.08	.15
Q66	.15	.20*	.14	.33***	.07	.30***	.26**	.33***	.14	.31***
Q67	.22**	.13	.16*	.11	-.11	.23**	.10	.28***	.40***	.14
Q68	.22**	.28***	.27**	.12	.36***	-.02	.05	.18*	-.02	.06
Q69	.35***	.49***	.44***	.40***	.12	.37***	.50***	.53***	.22**	.27**
Q70	.52***	.45***	.54***	.22*	.19*	.18*	.27**	.43***	.11	.08

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G21 Continued

Correlation Matrix for MSLQ at Timepoint 3, Questions 41-50

	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
Q71	.25**	.41***	.33***	.46***	.15*	.16*	.31***	.25**	.21*	.20*
Q72	.25**	.25**	.08	.22**	.18	.32***	.15	.17*	.37***	.08
Q73	.38***	.28***	.38***	.25**	.13*	.36***	.42***	.44***	.14	.18*
Q74	.24**	.46***	.39***	.26**	.38	.03	.27**	.34***	.05	.17*
Q75	.33***	.48***	.46***	.40***	.14***	.16*	.36***	.38***	.23**	-.01
Q76R	-.16*	.07	-.02	.22**	.21	.08	.06	.07	.08	.22*
Q77	.22**	.17*	.26**	.21*	.12*	.51***	.38***	.38***	.31***	.19*
Q78	.29***	.33***	.45***	.15	.08	.34***	.36***	.55***	.32***	.15
Q79R	-.18*	-.21*	.03	.22**	.15	.13	.04	.02	.03	.24**
Q80	.34***	.22**	.19*	.23**	.08	.28***	.24**	.17*	.22*	.15

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G22

Correlation Matrix for MSLQ at Timepoint 3, Questions 51-60

	Q51	**Q52**	**Q53**	**Q54**	**Q55**	**Q56**	**Q57**	**Q58**	**Q59**	**Q60**
Q51										
Q52R	.09									
Q53	.51***	.00								
Q54	.35***	-.14	.26**							
Q55	.41***	-.12	.21*	.57***						
Q56	.31***	-.06	.20*	.41***	.38***					
Q57R	.19*	.31***	.09	.13	.06	.17*				
Q58	.36***	-.18*	.31***	.19*	.16*	.09	.28***			
Q59	.29***	-.18*	.57***	.25**	.18*	.22**	.24**	.33***		
Q60R	.10	.35***	-.04	.16*	.11	.18*	.31***	-.04	-.02	
Q61	.20*	.03	.41***	.44***	.32***	.28**	.14	.18*	.30***	.13
Q62	.51***	.00	.32***	.32***	.41***	.52***	.15	.27**	.36***	-.01
Q63	.09	-.09	.31***	.26**	.20*	.19*	.05	.25**	.49***	-.03
Q64	.31***	-.14	.52***	.22**	.14	.16*	.05	.50***	.51**	-.16*
Q65	.12	.02	.16	.19*	.20*	.15	.10	.05	.22**	-.09
Q66	.44***	.08	.28***	.43***	.48***	.29***	.13	.12	.23**	.04
Q67	.28**	-.04	.14	.34***	.42***	.22*	.21*	.17*	.24**	.18*
Q68	.06	.12	.17*	-.05	-.06	.04	.08	.21*	.28**	-.12
Q69	.54***	.03	.47***	.39***	.42***	.24**	.15	.34***	.52***	-.05
Q70	.24**	-.19*	.33***	.24**	.25**	.19*	.02	.27**	.39***	-.20*
Q71	.45***	.05	.49***	.32***	.32***	.29***	.16*	.29***	.43***	.11
Q72	.10	-.16*	.22**	.28**	.33***	.31***	.05	.28***	.25**	.18*
Q73	.35***	-.12	.36***	.42***	.39***	.38***	-.01	.24**	.33***	-.13
Q74	.33***	-.07	.39***	.19*	.16	.08	.14	.26**	.31***	-.05
Q75	.22*	.05	.36***	.23**	.39***	.04	.14	.28***	.41***	-.02
Q76R	.17*	.18*	.15	.15	.07	.18*	.24**	.13	.08	.46***
Q77	.39***	.00	.33***	.41***	.49***	.25**	.17*	.28***	.22**	.09
Q78	.31***	.04	.38***	.31***	.26**	.21*	.20*	.38***	.41***	.04
Q79R	.19*	.49***	.05	-.01	.13	.15	.29***	-.14	-.02	.42***
Q80	.32***	-.01	.27**	.25**	.36***	.30***	.14	.11	.34***	.01

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G23

Correlation Matrix for MSLQ at Timepoint 3, Questions 61-70

	Q61	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70
Q61										
Q62	.26**									
Q63	.46***	.27**								
Q64	.27**	.27**	.37***							
Q65	.28***	.29***	.30***	.12						
Q66	.27**	.34***	.25**	.13	.10					
Q67	.04	.18*	.18*	.12	.09	.20*				
Q68	.04	.14	.25**	.39***	.03	.19*	-.05			
Q69	.37***	.51***	.38***	.45***	.19*	.36***	.20*	.23**		
Q70	.35***	.32***	.43***	.45***	.25***	.24**	.12	.35***	.44***	
Q71	.26**	.31***	.24**	.35***	.06	.32***	.18*	.25**	.46***	.27**
Q72	.32***	.16*	.28**	.28***	.14	.15	.23**	.15	.08	.16*
Q73	.36***	.41***	.31***	.29***	.11	.35***	.10	.14	.42***	.42***
Q74	.36***	.22*	.24**	.44***	.23**	.19*	.01	.45***	.32***	.36***
Q75	.28**	.14	.40***	.47***	.18*	.18*	.32***	.23**	.44***	.49***
Q76R	.14	-.02	.06	-.02	-.16*	.18*	.06	.15	.12	-.07
Q77	.31***	.28***	.20*	.20*	.24**	.31***	.18*	-.08	.35***	.25**
Q78	.36***	.20*	.32***	.31***	.18*	.18*	.30***	.06	.44***	.26**
Q79R	.10	.08	-.07	-.17*	.05	.16*	.13	.07	.03	-.15
Q80	.14	.34***	.18*	.34***	.31***	.28***	.34***	.27**	.28**	.36***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Table G24

Correlation Matrix for MSLQ at Timepoint 3, Questions 71-80

	Q71	Q72	Q73	Q74	Q75	Q76	Q77	Q78	Q79	Q80
Q71										
Q72	.22**									
Q73	.27**	.29***								
Q74	.37***	.32***	.23**							
Q75	.30***	.28***	.33***	.39***						
Q76R	.32***	.16*	.04	.09	-.05					
Q77	.23**	.29***	.40***	.11	.31***	.00				
Q78	.24**	.17*	.35***	.28***	.47***	.06	.28**			
Q79R	.17*	.07	.05	.01	.03	.30***	.04	.04		
Q80	.37***	.39***	.26**	.26**	.36***	-.08	.39***	.05	.08	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R denotes reversed item. Q denotes question number.

Appendix H – Correlation Matrices for SRLEDS at Timepoints 1, 2 and 3

Table H1

Correlation Matrix for SRLEDS at Timepoint 1, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	-.18*									
Q3	.15	-.16								
Q4	.40***	-.05	.23*							
Q5	.14	.08	.03	.26**						
Q6	.31***	-.12	.13	.24**	.29**					
Q7	-.29**	.19*	-.19*	-.20*	-.01	-.17				
Q8	.36***	-.22*	.24**	.42***	.27**	.23*	-.11			
Q9	.51***	-.25**	.05	.22*	.14	.25**	-	.47***		
Q10	.23*	-.28**	.22*	.16	.16	.22**	-.24*	.18*	.26**	
Q11	.19*	-.17	.20*	.31***	.23*	.13	-.18*	.12	.16	.29**
Q12	.27**	-.10	.16	.04	.10	.22*	.00	.16	.33***	.10
Q13	-.01	-.03	.05	.12	.09	.28**	-.15	.10	.24**	.10
Q14	-.07	.33***	-.17*	.06	-.03	-.08	.02	-.13	-.20*	-.09
Q15	.05	-.12	.07	.05	-.01	-.07	.11	.27**	.24**	.07
Q16	-.17	-.06	.15	-.03	-.07	-.11	.03	.16	-.14	.11
Q17	-.14	.20*	-.20*	-.12	-.04	-.02	.22*	-.23*	-.04	-.29**
Q18	.02	.12	-.17	.01	.00	-.01	.11	.02	.05	-
Q19	.07	-.13	.32***	.33***	.00	.05	-.06	.17*	.09	.19*
Q20	.27**	-.05	.23*	.16	.09	.08	-.14	.28**	.31***	.13
Q21	-.12	.18*	-.29**	-.00	.10	-.03	.04	.05	-.042	-.18*
Q22	.11	-.21*	.16	.11	-.05	.14	.14	.15	.26**	.28**
Q23	.07	-.17	.10	.13	.04	.17	-.03	.28**	.18*	.26**
Q24	.20*	-.14	.30***	.14	.22*	.21*	.23*	.29**	.24**	.04
Q25	.02	-.04	.34***	.14	.20*	.09	.05	.18*	-.02	.27**
Q26	.27**	-.21*	.19*	.32***	.07	.19*	-	.30**	.31***	.29**
Q27	.15	-.09	.33***	.37***	.19*	.18*	-.26**	.36***	.21*	.19*
Q28	.37***	-.09	.22*	.41***	-.02	.10	-.16	.44***	.29**	.10
Q29	.25**	-.24**	.28**	.42***	.15	.36***	-.27**	.37***	.34***	.40***
Q30	.23*	-.33	.29**	.22*	.08	.12	-.24**	.37***	.32***	.22*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H2

Correlation Matrix for SRLEDS at Timepoint 1, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.15									
Q13	.16	.35***								
Q14	-.04	-.18*	-.19*							
Q15	.04	.17*	.23*	-						
Q16	.14	.01	-.09	.04	.03					
Q17	-.11	.10	.07	.00	.15	-				
Q18	-.02	.12	.05	.05	.12	-.09	.55***			
Q19	.31***	.01	.26**	-.07	.16	.03	-.09	.03		
Q20	.07	.16	.15	-.15	.20*	.18*	-.21*	-.12	.29**	
Q21	-.10	.06	-.05	.13	.02	.01	.32***	.29**	-.14	-.17
Q22	.18*	.15	.03	-.21*	.24**	.12	.05	-.10	.20*	.09
Q23	.07*	.09	.12	.03	.14	.15	-.06	.12	.14	.13
Q24	.01	.18*	.05	-.12	.28**	-.07	.06	.01	.06	.13
Q25	.24**	-.06	-.01	.17*	-.12	.16	-.18*	-.08	.32***	.23***
Q26	.04	.01	.12	-.00	-.08	.08	-.22*	-.033	.22*	.37*
Q27	.18*	-.08	.12	-.08	.06	.01	-.22*	-.03	.42***	.35***
Q28	.17	.10	.07	-.03	.06	.14	-.18*	.20	.32***	.24***
Q29	.22*	.13	.16	-.05	-.05	-.02	-.24**	-.07	.21*	.27*
Q30	.28**	.17	.15	-	.17	-.11	-.16	-.19	.17	.13

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H3

Correlation Matrix for SRLEDS at Timepoint 1, Questions 21-30

	Q21	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**
Q21										
Q22	-.14									
Q23	.05	.23*								
Q24	-.15	.29**	.12							
Q25	-.08	-.09	.07	.15						
Q26	.01	-.05	.24**	-.03	.31***					
Q27	-.05	.07	.13	-.01	.38***	.34***				
Q28	.01	.14	.25**	.17	.34***	.37***	.32***			
Q29	-.01	.14	.27**	.11	.30**	.40***	.37***	.42***		
Q30	-.14	.20	.12	.24**	.05	.28**	.24**	.27**	.35***	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H4
Correlation Matrix for SRLEDS at Timepoint 2, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	.03									
Q3	.26**	-.03								
Q4	.32***	.05	.21*							
Q5	-.07	-.12	.16	.19*						
Q6	.10	.07	.12**	.07	.42***					
Q7	-.14	.20*	.03	-.02	.00	.09				
Q8	.16	-.01	.15**	.20*	.32***	.20*	-.03			
Q9	.37***	.15	.25***	.29**	-.09	.15	-.04	.27**		
Q10	.15	-.04	.12	.08	.10	.24**	.19*	.10	.09	
Q11	.18*	.16	.24**	.29**	.25**	.21*	-.04	.31**	.30***	.15
Q12	.06	-.09	.36***	-.01	.28**	.05	-.01	.10	-.09	.03
Q13	.23**	.07	.22*	.35***	.24**	.26**	-.02	.28**	.23*	.05
Q14	-.17*	.04	-.09	-.26**	-.04	.05	.06	-.04	.02	.04
Q15	.00**	.10	-.08	.07	-.05	.01	.06	.07	-.09	-.17*
Q16	.10	.21*	.15	.08	.11	.20*	-.05	.06	.24**	.00
Q17	-.05*	-.02	-.02	-.02	.09	-	.05	.03	-.02	-.17*
Q18	.03	-.04	-.13	-.14	-.06	-.26**	.07	.06	-.06	-.10
Q19	.03	-.05	.22*	.19*	.13	.05	-.14	.12	.05	.22*
Q20	.14	.09	.23*	.20*	-.03	.16	-.01	.04	.23*	.24**
Q21	.01	-.01	-.19*	-.13	-.27**	-.06	.10	-.07	.02	-.05
Q22	.31***	-.03	-.05	.30***	.08	.16	-.15	.09	.08	.04
Q23	.18*	.13	.36***	.12	.14	.18*	-.15	.22*	.23**	.20*
Q24	.15	-.16	.04	.39***	.31***	.10	-.10	.27**	.10	-.03
Q25	.31***	.04	.32***	.33***	-.01	.12	-.09	.15	.28**	.02
Q26	.33***	.09	.18*	.17*	-.08	.30***	-.09	.11	.33***	.16
Q27	.18*	.11	.34***	.23**	.07	.17*	-.11	.23*	.35***	.16
Q28	.21*	.17*	.26**	.47***	.19*	.25**	.00	.30***	.42***	.00
Q29	.35***	-.13	.28**	.25*	.11	.16*	.08	.11	.16	.16
Q30	.22*	.10	.23**	.30***	-.01	.01	.06	.15	.24**	-.03

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H5

Correlation Matrix for SRLEDS at Timepoint 2, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.15									
Q13	.24**	.16								
Q14	-.18*	.06	-.16*							
Q15	.11	-.07	.09	-.18*						
Q16	.26**	.10	.09	.11	-.01					
Q17	.00	.10	.13	-.08	.20*	-.24**				
Q18	-.04	.09	-.06	-.15	.20*	-.25**	.62***			
Q19	.19*	.22*	.04	-.17*	.05	.06	-.10	-.13		
Q20	.42***	.19*	.22*	.07	.03	.30***	-.16	-.12	.18*	
Q21	-.23**	-.10	-.04	.14	-.13	.03	-.09	.00	-.11	-.08
Q22	-.06	-.07	.33***	-.13	.12	.06	.04	.06	.12	.06
Q23	.39***	.19*	.13	.01	.08	.24**	-.04	-.04	.29**	.26**
Q24	.18*	-.02	.25**	-.14	.18	-.04	.11	-.05	.26**	-.07
Q25	.08	.11	.37***	-	.06	.18*	.07	-.02	.16	.11
Q26	.26**	.05	.12	.00	-.03	.22*	-.18	-.13	.15	.37***
Q27	.19*	-.08	.24**	.03	-.15	.22*	-.09	-.16	.13	.18*
Q28	.32***	.01	.31***	-.15	.01	.27**	.00	-.10	.20*	.16
Q29	.10	.09	.31***	-.13	.06	.02	.16	.19*	.08	.19*
Q30	.20*	.11	.30***	-	.13	.14	.11	-.08	.10	.06

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H6

Correlation Matrix for SRLEDS at Timepoint 2, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q21										
Q22	.01									
Q23	-	-.09								
Q24	-.12	.26**	.11							
Q25	.07	.25**	.15	.28**						
Q26	-.10	.20*	.14	-.04	.09					
Q27	-.09	.20*	.22*	.04	.31***	.21*				
Q28	.01	.28**	.25**	.30***	.42***	.39***	.37***			
Q29	-.06	.22*	.12	.08	.35***	.18*	.18*	.36***		
Q30	.01	.04	.16	.24**	.34***	-.01	.02	.15	.15	

Note. * p < .05, ** p < .01, *** p < .001. Q denotes question number.

Table H7

Correlation Matrix for SRLEDS at Timepoint 3, Questions 1-10

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1										
Q2	-.14									
Q3	.23**	.00								
Q4	.25**	.10	.27**							
Q5	.27**	-.17	.15	.23**						
Q6	.18*	.14	.18*	.31***	.27**					
Q7	-.21*	.27**	-.15	-.24**	-.19*	-.14				
Q8	.29**	.15	.20*	.14	.24**	.07	-.08			
Q9	.26**	.02	.37***	.21*	.24**	.24**	-.14	.14		
Q10	.28**	-.10	.28**	.24**	.22*	.21*	-.07	.21*	.25**	
Q11	.29***	-.15	.26***	.37***	.13	.08	-.23**	.17*	.20*	.39***
Q12	.21*	-.11	.27**	.29**	.14	.26**	-.21*	.18*	.31***	.37***
Q13	.21*	.00	.21*	.28**	.27**	.19*	-.28**	.46***	.34***	.26**
Q14	-.13	.17*	-.20*	-.14	.06	-.07	.29***	-.10	.16	-.13
Q15	-.04	.09	.13	.16*	.11	.17*	-.17*	.02	.19*	.17*
Q16	.23*	.19*	.01	.09	.19*	.13	.01	.02	.01	.14
Q17	.02	.04	.06	.04	-.14	-.01	-.18*	.04	.12	-.14
Q18	-.05	.12	-.05	.08	-.12	-.10	.00	.02	.10	.03
Q19	.17*	-.14	.24**	.35***	.20*	.28**	-.16	.14	.16	.27**
Q20	.30***	.13	.30***	.35***	.16*	.11	-.09	.22*	.21*	.28**
Q21	.08	.23**	.02	.04	.14	.04	-.01	.28**	.06	.03
Q22	.15	-.08	.25**	.32***	.20*	.15	-.06	.10	.11	.34***
Q23	.37***	-.06	.31***	.50***	.35***	.28**	-.20*	.19*	.35***	.34***
Q24	.29***	-.09	.02	.35***	.21*	.27**	-.24**	.11	.11	.21*
Q25	.25**	.05	.18*	.17*	.25**	.16	-.12	.24**	.09	.24**
Q26	.34	.02	.18*	.35***	.29***	.25**	-.02	.00	.36***	.18*
Q27	.34***	.02	.19*	.47***	.30***	.19*	-.09	.32***	.17*	.28**
Q28	.34***	.10	.26**	.40***	.34***	.28**	-.11	.25**	.07	.18*
Q29	.35***	-.21*	.06	.28**	.20*	.13	-.05	.20*	.18*	.44***
Q30	.38***	-.17*	.17*	.11	.32***	.12	-.08	.17*	.20*	.24**

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H8

Correlation Matrix for SRLEDS at Timepoint 3, Questions 11-20

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q11										
Q12	.31***									
Q13	.38***	.26**								
Q14	-.11	-.12	-.14							
Q15	.27**	.11	.17*	-.02						
Q16	.09	.05	.00	.11	-.05					
Q17	.20*	-.03	.02	.13	.31***	-.02				
Q18	.01	.03	-.04	-.05	.24**	-.04	.45***			
Q19	.20*	.06	.29**	-.10	.09	.13	-.01	.01		
Q20	.46***	.14	.06	-.02	.05	.05	.02	.13	.32	
Q21	.06	-.04	.11	.12	.31***	.12	.30***	.19*	.03***	.00
Q22	.27**	.11	.21*	-.11	.05	-.04	-.06	.12	.35	.29***
Q23	.29***	.19*	.29***	-.14	.01	.13	-.01	-.04	.40***	.42***
Q24	.25**	.23**	.33***	-.10	.32***	.10	.14	.11	.17***	-.13
Q25	.21*	.09	.41***	-.10	.12	.07	.08	.13	.33*	.23**
Q26	.09	.10	.03	-.04	.02	.13	-.07	-.01	.28***	.40***
Q27	.15	.11	.31***	.03	.08	.06	.03	-.06	.39***	.34***
Q28	.17*	.16	.13	-.12	.04	.23**	.02	-.06	.34***	.38***
Q29	.35***	.27**	.26**	-.13	.04	.01	-.04	.00	.28*	.19*
Q30	.33***	.26**	.19	-.01	.20*	.11	.06	.10	.33***	.29***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Table H9

Correlation Matrix for SRLEDS at Timepoint 3, Questions 21-30

	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
Q21										
Q22	-.15									
Q23	-.03	.45***								
Q24	.13	.09	.21*							
Q25	.15	.15	.26**	.16*						
Q26	.08	.19*	.35***	.02	.20*					
Q27	.13	.19*	.32***	.23**	.36***	.32***				
Q28	.17*	.24**	.48***	.24**	.24**	.39***	.36***			
Q29	.11	.23*	.29**	.20*	.31***	.22*	.24**	.34***		
Q30	-.02	.15*	.22*	.31***	.28**	.21*	.26**	.36***	.39***	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Q denotes question number.

Appendix I – Results of Tests for Normality for MSLQ

Table I1
Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 1, Questions 1-30

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	*df*	*p*	Statistics	*df*	*p*
Q1	.18	105	< .001	.94	105	< .001
Q2	.18	105	< .001	.90	105	< .001
Q3	.14	105	< .001	.94	105	< .001
Q4	.22	105	< .001	.92	105	< .001
Q5	.21	105	< .001	.90	105	< .001
Q6	.20	105	< .001	.94	105	< .001
Q7	.17	105	< .001	.91	105	< .001
Q8	.14	105	< .001	.93	105	< .001
Q9	.16	105	< .001	.93	105	< .001
Q10	.19	105	< .001	.87	105	< .001
Q11	.16	105	< .001	.91	105	< .001
Q12	.20	105	< .001	.90	105	< .001
Q13	.18	105	< .001	.88	105	< .001
Q14	.14	105	< .001	.93	105	< .001
Q15	.18	105	< .001	.93	105	< .001
Q16	.15	105	< .001	.90	105	< .001
Q17	.22	105	< .001	.91	105	< .001
Q18	.19	105	< .001	.89	105	< .001
Q19	.16	105	< .001	.93	105	< .001
Q20	.18	105	< .001	.92	105	< .001
Q21	.21	105	< .001	.91	105	< .001
Q22	.17	105	< .001	.94	105	< .001
Q23	.21	105	< .001	.90	105	< .001
Q24	.17	105	< .001	.94	105	< .001
Q25	.19	105	< .001	.94	105	< .001
Q26	.21	105	< .001	.92	105	< .001
Q27	.21	105	< .001	.88	105	< .001
Q28	.13	105	< .001	.93	105	< .001
Q29	.18	105	< .001	.93	105	< .001
Q30	.21	105	< .001	.86	105	< .001

Note. *df* denotes degrees of freedom. Q denotes question number.

Table I2

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 1, Questions 31-60

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q31	.25	105	< .001	.87	105	< .001
Q32	.18	105	< .001	.94	105	< .001
Q33R	.19	105	< .001	.93	105	< .001
Q34	.14	105	< .001	.95	105	.001
Q35	.15	105	< .001	.90	105	< .001
Q36	.15	105	< .001	.93	105	< .001
Q37R	.16	105	< .001	.94	105	< .001
Q38	.15	105	< .001	.95	105	.001
Q39	.12	105	.001	.94	105	< .001
Q40R	.15	105	< .001	.94	105	< .001
Q41	.17	105	< .001	.93	105	< .001
Q42	.25	105	< .001	.89	105	< .001
Q43	.22	105	< .001	.89	105	< .001
Q44	.18	105	< .001	.93	105	< .001
Q45	.14	105	< .001	.93	105	< .001
Q46	.16	105	< .001	.94	105	< .001
Q47	.17	105	< .001	.94	105	< .001
Q48	.20	105	< .001	.93	105	< .001
Q49	.14	105	< .001	.94	105	< .001
Q50	.15	105	< .001	.93	105	< .001
Q51	.18	105	< .001	.94	105	< .001
Q52R	.13	105	< .001	.93	105	< .001
Q53	.18	105	< .001	.93	105	< .001
Q54	.15	105	< .001	.95	105	.001
Q55	.17	105	< .001	.94	105	< .001
Q56	.19	105	< .001	.94	105	< .001
Q57R	.15	105	< .001	.94	105	< .001
Q58	.15	105	< .001	.94	105	< .001
Q59	.17	105	< .001	.95	105	< .001
Q60R	.19	105	< .001	.92	105	< .001

Note. *df* degrees of freedom. R denotes reversed item. Q denotes question number.

Table I3

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 1, Questions 61-80

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q61	.21	105	< .001	.91	105	< .001
Q62	.19	105	< .001	.93	105	< .001
Q63	.17	105	< .001	.94	105	< .001
Q64	.19	105	< .001	.94	105	< .001
Q65	.13	105	< .001	.92	105	< .001
Q66	.20	105	< .001	.92	105	< .001
Q67	.12	105	< .001	.95	105	< .001
Q68	.20	105	< .001	.87	105	< .001
Q69	.18	105	< .001	.94	105	< .001
Q70	.22	105	< .001	.84	105	< .001
Q71	.20	105	< .001	.92	105	< .001
Q72	.14	105	< .001	.95	105	< .001
Q73	.17	105	< .001	.94	105	< .001
Q74	.16	105	< .001	.90	105	< .001
Q75	.20	105	< .001	.92	105	< .001
Q76R	.15	105	< .001	.94	105	< .001
Q77	.14	105	< .001	.94	105	< .001
Q78	.19	105	< .001	.93	105	< .001
Q79R	.17	105	< .001	.93	105	< .001
Q80	.20	105	< .001	.91	105	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I4

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 2, Questions 1-30

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q1	.16	107	< .001	.94	107	< .001
Q2	.21	107	< .001	.91	107	< .001
Q3	.13	107	< .001	.95	107	< .001
Q4	.18	107	< .001	.93	107	< .001
Q5	.19	107	< .001	.93	107	< .001
Q6	.17	107	< .001	.92	107	< .001
Q7	.20	107	< .001	.92	107	< .001
Q8	.16	107	< .001	.94	107	< .001
Q9	.15	107	< .001	.95	107	< .001
Q10	.19	107	< .001	.90	107	< .001
Q11	.16	107	< .001	.91	107	< .001
Q12	.22	107	< .001	.90	107	< .001
Q13	.17	107	< .001	.88	107	< .001
Q14	.13	107	< .001	.92	107	< .001
Q15	.17	107	< .001	.94	107	< .001
Q16	.14	107	< .001	.92	107	< .001
Q17	.19	107	< .001	.91	107	< .001
Q18	.21	107	< .001	.89	107	< .001
Q19	.14	107	< .001	.94	107	< .001
Q20	.20	107	< .001	.91	107	< .001
Q21	.20	107	< .001	.92	107	< .001
Q22	.20	107	< .001	.93	107	< .001
Q23	.16	107	< .001	.93	107	< .001
Q24	.19	107	< .001	.93	107	< .001
Q25	.17	107	< .001	.95	107	< .001
Q26	.19	107	< .001	.93	107	< .001
Q27	.19	107	< .001	.91	107	< .001
Q28	.15	107	< .001	.93	107	< .001
Q29	.19	107	< .001	.93	107	< .001
Q30	.23	107	< .001	.87	107	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I5

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 2, Questions 31-60

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q31	.18	107	< .001	.91	107	< .001
Q32	.14	107	< .001	.95	107	< .001
Q33R	.15	107	< .001	.94	107	< .001
Q34	.15	107	< .001	.94	107	< .001
Q35	.13	107	< .001	.93	107	< .001
Q36	.18	107	< .001	.93	107	< .001
Q37R	.14	107	< .001	.95	107	.001
Q38	.18	107	< .001	.93	107	< .001
Q39	.17	107	< .001	.94	107	< .001
Q40R	.17	107	< .001	.95	107	< .001
Q41	.17	107	< .001	.92	107	< .001
Q42	.17	107	< .001	.93	107	< .001
Q43	.19	107	< .001	.91	107	< .001
Q44	.20	107	< .001	.90	107	< .001
Q45	.16	107	< .001	.93	107	< .001
Q46	.20	107	< .001	.92	107	< .001
Q47	.16	107	< .001	.93	107	< .001
Q48	.19	107	< .001	.93	107	< .001
Q49	.14	107	< .001	.95	107	.001
Q50	.19	107	< .001	.92	107	< .001
Q51	.17	107	< .001	.94	107	< .001
Q52R	.13	107	< .001	.95	107	.001
Q53	.17	107	< .001	.93	107	< .001
Q54	.22	107	< .001	.92	107	< .001
Q55	.18	107	< .001	.93	107	< .001
Q56	.17	107	< .001	.94	107	< .001
Q57R	.21	107	< .001	.92	107	< .001
Q58	.16	107	< .001	.93	107	< .001
Q59	.18	107	< .001	.92	107	< .001
Q60R	.16	107	< .001	.94	107	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I6

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 3, Questions 61-80

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q61	.20	107	< .001	.92	107	< .001
Q62	.17	107	< .001	.93	107	< .001
Q63	.20	107	< .001	.93	107	< .001
Q64	.16	107	< .001	.93	107	< .001
Q65	.15	107	< .001	.93	107	< .001
Q66	.18	107	< .001	.93	107	< .001
Q67	.17	107	< .001	.94	107	< .001
Q68	.18	107	< .001	.92	107	< .001
Q69	.22	107	< .001	.90	107	< .001
Q70	.17	107	< .001	.90	107	< .001
Q71	.17	107	< .001	.93	107	< .001
Q72	.17	107	< .001	.94	107	< .001
Q73	.17	107	< .001	.93	107	< .001
Q74	.16	107	< .001	.90	107	< .001
Q75	.16	107	< .001	.93	107	< .001
Q76R	.14	107	< .001	.94	107	< .001
Q77	.14	107	< .001	.93	107	< .001
Q78	.17	107	< .001	.94	107	< .001
Q79R	.17	107	< .001	.95	107	< .001
Q80	.17	107	< .001	.93	107	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I7
Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 3, Questions 1-30

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q1	.17	111	< .001	.93	111	< .001
Q2	.20	111	< .001	.89	111	< .001
Q3	.15	111	< .001	.95	111	< .001
Q4	.16	111	< .001	.94	111	< .001
Q5	.22	111	< .001	.92	111	< .001
Q6	.16	111	< .001	.94	111	< .001
Q7	.15	111	< .001	.93	111	< .001
Q8	.17	111	< .001	.94	111	< .001
Q9	.15	111	< .001	.95	111	< .001
Q10	.21	111	< .001	.90	111	< .001
Q11	.18	111	< .001	.92	111	< .001
Q12	.21	111	< .001	.89	111	< .001
Q13	.22	111	< .001	.89	111	< .001
Q14	.14	111	< .001	.94	111	< .001
Q15	.16	111	< .001	.94	111	< .001
Q16	.20	111	< .001	.90	111	< .001
Q17	.21	111	< .001	.93	111	< .001
Q18	.16	111	< .001	.91	111	< .001
Q19	.15	111	< .001	.93	111	< .001
Q20	.17	111	< .001	.93	111	< .001
Q21	.20	111	< .001	.92	111	< .001
Q22	.22	111	< .001	.92	111	< .001
Q23	.17	111	< .001	.93	111	< .001
Q24	.15	111	< .001	.95	111	< .001
Q25	.15	111	< .001	.94	111	< .001
Q26	.16	111	< .001	.94	111	< .001
Q27	.21	111	< .001	.90	111	< .001
Q28	.12	111	< .001	.92	111	< .001
Q29	.16	111	< .001	.93	111	< .001
Q30	.25	111	< .001	.86	111	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I8

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 3, Questions 31-60

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q31	.19	111	< .001	.91	111	< .001
Q32	.15	111	< .001	.93	111	< .001
Q33R	.14	111	< .001	.94	111	< .001
Q34	.17	111	< .001	.93	111	< .001
Q35	.19	111	< .001	.90	111	< .001
Q36	.16	111	< .001	.95	111	< .001
Q37R	.17	111	< .001	.94	111	< .001
Q38	.18	111	< .001	.93	111	< .001
Q39	.16	111	< .001	.94	111	< .001
Q40R	.17	111	< .001	.95	111	< .001
Q41	.15	111	< .001	.92	111	< .001
Q42	.16	111	< .001	.93	111	< .001
Q43	.16	111	< .001	.92	111	< .001
Q44	.19	111	< .001	.92	111	< .001
Q45	.19	111	< .001	.92	111	< .001
Q46	.14	111	< .001	.94	111	< .001
Q47	.18	111	< .001	.93	111	< .001
Q48	.17	111	< .001	.93	111	< .001
Q49	.16	111	< .001	.94	111	< .001
Q50	.17	111	< .001	.95	111	< .001
Q51	.19	111	< .001	.93	111	< .001
Q52R	.17	111	< .001	.94	111	< .001
Q53	.18	111	< .001	.93	111	< .001
Q54	.16	111	< .001	.95	111	< .001
Q55	.19	111	< .001	.94	111	< .001
Q56	.20	111	< .001	.92	111	< .001
Q57R	.18	111	< .001	.93	111	< .001
Q58	.17	111	< .001	.93	111	< .001
Q59	.19	111	< .001	.93	111	< .001
Q60R	.17	111	< .001	.94	111	< .001

Note. *df* is denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Table I9

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for the MSLQ at Timepoint 3, Questions 61-80

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistics**	***df***	***p***
Q61	.18	111	< .001	.93	111	< .001
Q62	.17	111	< .001	.94	111	< .001
Q63	.16	111	< .001	.93	111	< .001
Q64	.18	111	< .001	.92	111	< .001
Q65	.14	111	< .001	.92	111	< .001
Q66	.19	111	< .001	.93	111	< .001
Q67	.15	111	< .001	.94	111	< .001
Q68	.17	111	< .001	.90	111	< .001
Q69	.18	111	< .001	.93	111	< .001
Q70	.17	111	< .001	.89	111	< .001
Q71	.18	111	< .001	.91	111	< .001
Q72	.19	111	< .001	.94	111	< .001
Q73	.20	111	< .001	.91	111	< .001
Q74	.15	111	< .001	.92	111	< .001
Q75	.18	111	< .001	.92	111	< .001
Q76R	.15	111	< .001	.95	111	< .001
Q77	.14	111	< .001	.93	111	< .001
Q78	.17	111	< .001	.94	111	< .001
Q79R	.14	111	< .001	.95	111	< .001
Q80	.19	111	< .001	.92	111	< .001

Note. *df* denotes degrees of freedom. R denotes reversed item. Q denotes question number.

Appendix J – Results of Tests for Normality for SRLEDS

Table J1

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for SRLEDS at Timepoint 1

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	***df***	***p***	**Statistic**	***df***	***p***
Q1	.42	97	< .001	.64	97	< .001
Q2	.31	97	< .001	.82	97	< .001
Q3	.36	97	< .001	.73	97	< .001
Q4	.29	97	< .001	.83	97	< .001
Q5	.33	97	< .001	.77	97	< .001
Q6	.27	97	< .001	.85	97	< .001
Q7	.27	97	< .001	.84	97	< .001
Q8	.36	97	< .001	.76	97	< .001
Q9	.40	97	< .001	.72	97	< .001
Q10	.25	97	< .001	.85	97	< .001
Q11	.34	97	< .001	.78	97	< .001
Q12	.34	97	< .001	.76	97	< .001
Q13	.35	97	< .001	.78	97	< .001
Q14	.31	97	< .001	.83	97	< .001
Q15	.27	97	< .001	.85	97	< .001
Q16	.26	97	< .001	.86	97	< .001
Q17	.29	97	< .001	.82	97	< .001
Q18	.26	97	< .001	.84	97	< .001
Q19	.33	97	< .001	.80	97	< .001
Q20	.31	97	< .001	.79	97	< .001
Q21	.33	97	< .001	.81	97	< .001
Q22	.35	97	< .001	.75	97	< .001
Q23	.33	97	< .001	.81	97	< .001
Q24	.40	97	< .001	.67	97	< .001
Q25	.37	97	< .001	.77	97	< .001
Q26	.24	97	< .001	.85	97	< .001
Q27	.37	97	< .001	.74	97	< .001
Q28	.35	97	< .001	.78	97	< .001
Q29	.32	97	< .001	.80	97	< .001
Q30	.32	97	< .001	.79	97	< .001

Note. *df* denotes degrees of freedom. Q denotes question number.

Table J2

Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for SRLEDS at Timepoint 2

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistic**	***df***	***p***
Q1	.40	101	< .001	.67	101	< .001
Q2	.30	101	< .001	.81	101	< .001
Q3	.37	101	< .001	.75	101	< .001
Q4	.32	101	< .001	.81	101	< .001
Q5	.36	101	< .001	.72	101	< .001
Q6	.27	101	< .001	.85	101	< .001
Q7	.24	101	< .001	.86	101	< .001
Q8	.41	101	< .001	.63	101	< .001
Q9	.35	101	< .001	.77	101	< .001
Q10	.24	101	< .001	.87	101	< .001
Q11	.34	101	< .001	.77	101	< .001
Q12	.34	101	< .001	.77	101	< .001
Q13	.37	101	< .001	.75	101	< .001
Q14	.28	101	< .001	.80	101	< .001
Q15	.27	101	< .001	.84	101	< .001
Q16	.31	101	< .001	.80	101	< .001
Q17	.25	101	< .001	.84	101	< .001
Q18	.31	101	< .001	.80	101	< .001
Q19	.34	101	< .001	.76	101	< .001
Q20	.27	101	< .001	.83	101	< .001
Q21	.32	101	< .001	.81	101	< .001
Q22	.39	101	< .001	.73	101	< .001
Q23	.36	101	< .001	.77	101	< .001
Q24	.36	101	< .001	.73	101	< .001
Q25	.39	101	< .001	.69	101	< .001
Q26	.31	101	< .001	.83	101	< .001
Q27	.44	101	< .001	.64	101	< .001
Q28	.37	101	< .001	.76	101	< .001
Q29	.38	101	< .001	.75	101	< .001
Q30	.35	101	< .001	.73	101	< .001

Note. *df* denotes degrees of freedom. Q denotes question number.

Table J3
Results of Kolmogorov-Smirnov and Shapiro-Wilk Tests for Normality for SRLEDS at Timepoint 3

	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	***df***	***p***	**Statistic**	***df***	***p***
Q1	.41	103	< .001	.64	103	< .001
Q2	.27	103	< .001	.82	103	< .001
Q3	.33	103	< .001	.76	103	< .001
Q4	.30	103	< .001	.84	103	< .001
Q5	.30	103	< .001	.81	103	< .001
Q6	.24	103	< .001	.86	103	< .001
Q7	.29	103	< .001	.85	103	< .001
Q8	.35	103	< .001	.76	103	< .001
Q9	.34	103	< .001	.76	103	< .001
Q10	.25	103	< .001	.87	103	< .001
Q11	.37	103	< .001	.75	103	< .001
Q12	.30	103	< .001	.78	103	< .001
Q13	.37	103	< .001	.73	103	< .001
Q14	.29	103	< .001	.83	103	< .001
Q15	.29	103	< .001	.84	103	< .001
Q16	.34	103	< .001	.78	103	< .001
Q17	.26	103	< .001	.83	103	< .001
Q18	.24	103	< .001	.84	103	< .001
Q19	.32	103	< .001	.80	103	< .001
Q20	.28	103	< .001	.82	103	< .001
Q21	.31	103	< .001	.83	103	< .001
Q22	.34	103	< .001	.78	103	< .001
Q23	.30	103	< .001	.82	103	< .001
Q24	.36	103	< .001	.72	103	< .001
Q25	.39	103	< .001	.71	103	< .001
Q26	.28	103	< .001	.86	103	< .001
Q27	.28	103	< .001	.84	103	< .001
Q28	.30	103	< .001	.84	103	< .001
Q29	.32	103	< .001	.77	103	< .001
Q30	.34	103	< .001	.77	103	< .001

Note. *df* denotes degrees of freedom. Q denotes question number.

Appendix K – Calculations of Weighted Coefficients for the MSLQ-Motivation

Table K1
Calculations of the Weighted Coefficients for the MSLQ-Motivation

	Factor 1	SFL1	SFL1/ ΣSFL1+SFL2	Factor 2	SFL2	SFL2/ ΣSFL1+SFL2
Q1	.46	.21	.02	.34	.11	.01
Q2	.55	.30	.03	.37	.14	.02
Q3		.00	.00		.00	.00
Q4	.52	.27	.03		.00	.00
Q5		.00	.00	.63	.40	.05
Q6		.00	.00	.64	.41	.05
Q7	.43	.18	.02		.00	.00
Q8	.33	.11	.01		.00	.00
Q9	.56	.31	.04		.00	.00
Q10	.54	.30	.03		.00	.00
Q11	.54	.30	.03		.00	.00
Q12	.49	.24	.03		.00	.00
Q13	.46	.21	.02		.00	.00
Q14	.31	.10	.01		.00	.00
Q15		.00	.00	.69	.48	.06
Q16		.00	.00	.31	.10	.01
Q17	.31	.09	.01	.55	.30	.03
Q18	.47	.22	.03	.40	.16	.02
Q19	.47	.22	.03	-.45	.20	.02
Q20		.00	.00	.62	.38	.04
Q21	.42	.18	.02	.54	.29	.03
Q22	.44	.19	.02		.00	.00
Q23	.61	.37	.04		.00	.00
Q26	.36	.13	.02		.00	.00
Q27	.59	.35	.04		.00	.00
Q28	.37	.14	.02	-.36	.13	.02
Q29	.34	.12	.01	.44	.19	.02
Q30	.56	.32	.04		.00	.00
Q31		.00	.00	.69	.47	.05
Σ		4.86			3.76	
			ΣSFL1+SFL2			**8.61**
			Check (Σ weighted factors = 1?)			**1.00**

Note. Σ denotes sum of. SFL denotes square of factor loading. Q denotes question number.

Appendix L – Calculations of Weighted Coefficients for the MSLQ-Cognitive

Table L1

Calculations of the Weighted Coefficients for the MSLQ-Cognitive

	Factor 1	SFL1	SFL1/ SUM-SFL1+2	Factor 2	SFL2	SFL2/ SUM-SFL1+2
Q32	.46	.22	.02	.41	.17	.01
Q33R		.00	.00	.67	.45	.04
Q34	.32	.10	.01	.30	.09	.01
Q35	.24	.06	.00	.58	.34	.03
Q36	.65	.42	.03		.00	.00
Q37R		.00	.00	.64	.41	.03
Q38	.43	.19	.01		.00	.00
Q39	.52	.27	.02		.00	.00
Q41	.33	.11	.01	.41	.17	.01
Q42	.46	.21	.02	.29	.08	.01
Q43	.20	.04	.00	.52	.27	.02
Q44	.38	.14	.01		.00	.00
Q46	.35	.12	.01	.23	.05	.00
Q47	.45	.21	.02	.24	.06	.00
Q48	.29	.08	.01	.49	.24	.02
Q49	.39	.15	.01	.27	.07	.01
Q50	.28	.08	.01		.00	.00
Q51	.58	.33	.03	.24	.06	.00
Q52R		.00	.00	.41	.16	.01
Q53	.46	.21	.02	.31	.10	.01
Q54	.41	.17	.01		.00	.00
Q55	.54	.29	.02	.27	.07	.01
Q56	.29	.08	.01	.29	.08	.01
Q57R		.00	.00	.30	.09	.01
Q58		.00	.00	.47	.22	.02
Q59	.48	.23	.02		.00	.00
Q60R		.00	.00	.53	.28	.02
Q61	.53	.28	.02		.00	.00
Q62	.49	.24	.02		.00	.00
Q63	.55	.30	.02	.37	.14	.01
Q64	.32	.10	.01	.40	.16	.01
Q65	.26	.07	.01	.38	.14	.01
Q66	.60	.36	.03	-.26	.07	.01
Q67	.35	.12	.01	.34	.12	.01
Q68		.00	.00	.52	.27	.02
Q69	.55	.30	.02	.30	.09	.01
Q70		.00	.00	.61	.37	.03
Q71	.46	.21	.02	-.25	.06	.00
Q72	.52	.27	.02	.24	.06	.00
Q73		.00	.00	.45	.20	.02
Q74	.24	.06	.00	.23	.05	.00
Q75	.27	.07	.01		.00	.00
Q76R		.00	.00	.54	.29	.02
Q77	.43	.18	.01	.53	.28	.02
Q78	.23	.05	.00	.54	.29	.02
Q79R		.00	.00	.36	.13	.01
Q80	.46	.21	.02		.00	.00
Σ		6.55			6.16	
			ΣSFL1+SFL2			**12.71**
			Check (Σ weighted factors = 1?)			**1**

Note. Σ denotes sum of. SFL denotes square of factor loading. R denotes reversed item. Q denotes question number.

Appendix M – Calculations of Weighted Coefficients for the SRLEDS

Table M1

Calculations of the Weighted Coefficients for the SRLEDS

	Factor 1	SFL1	SFL1/ ΣSFL1+SFL2	Factor 2	SFL2	SFL2/ ΣSFL1+SFL2
Q1		.00	.00	.48	.23	.04
Q3	.45	.20	.04		.00	.00
Q4	.52	.27	.05		.00	.00
Q6		.00	.00	.32	.10	.02
Q8	.44	.19	.04	.47	.22	.04
Q9		.00	.00	.68	.46	.09
Q10	.37	.14	.03		.00	.00
Q11	.33	.11	.02		.00	.00
Q12		.00	.00	.51	.26	.05
Q13		.00	.00	.30	.09	.02
Q15		.00	.00	.41	.17	.03
Q19	.51	.26	.05		.00	.00
Q20	.40	.16	.03		.00	.00
Q22		.00	.00	.39	.15	.03
Q24		.00	.00	.41	.17	.03
Q25	.61	.37	.07		.00	.00
Q26	.57	.32	.06		.00	.00
Q27	.66	.44	.08		.00	.00
Q28	.56	.31	.06		.00	.00
Q29	.61	.37	.07		.00	.00
Q30	.33	.11	.02	.39	.15	.03
Σ		3.26			2.01	
			ΣSFL1+SFL2			**5.27**
			Check (Σ weighted factors = 1?)			**1.00**

Note. Σ denotes sum of. SFL denotes square of factor loading. Q denotes question number.

Appendix N – Detailed Tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Motivation Weighted Scores (6.3.1.1)

Table N1

Results of the Between-Subjects Effects for the MSLQ-Motivation Weighted Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Corrected Model	Course Approach	466.22	5	93.24	225.21	< .001	.78	1.00
	Affective Response	128.91	5	25.78	84.51	< .001	.57	1.00
Intercept	Course Approach	942.82	1	942.82	2277.15	< .001	.88	1.00
	Affective Response	260.19	1	260.19	852.89	< .001	.73	1.00
Timepoint	Course Approach	465.81	2	232.91	562.52	< .001	.78	1.00
	Affective Response	128.77	2	64.39	211.05	< .001	.57	1.00
Group	Course Approach	0.12	1	0.12	0.29	.591	.00	.08
	Affective Response	0.16	1	0.16	.053	.466	.00	.11
Timepoint * Group	Course Approach	0.31	2	0.15	0.37	.689	.00	.11
	Affective Response	0.09	2	0.04	0.15	.865	.00	.07
Error	Course Approach	131.25	317	0.41				
	Affective Response	96.71	317	0.31				
Total	Course Approach	1564.51	323					
	Affective Response	492.44	323					

Note. df denotes degrees of freedom.

Table N2
Univariate Statistics for the Effects of Timepoint for MSLQ-Motivation Weighted Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	*M*	Std. Error	95% Confidence Interval	
							Lower Bound	Upper Bound
Course Approach	2	562.52	< .001	1	0.0	.06	-0.12	0.12
				2	2.6	.06	2.44	2.68
				3	2.6	.06	2.45	2.69
Affective Response	2	211.05	< .001	1	0.0	.05	-0.11	0.11
				2	1.3	.05	1.22	1.43
				3	1.4	.05	1.27	1.48

Note. *df* denotes degrees of freedom, *M* denotes mean.

Table N3
Univariate Statistics for the Effects of Group for MSLQ-Motivation Weighted Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval	
							Lower Bound	Upper Bound
Course Approach	1	0.29	.591	A	1.7	.05	1.59	1.79
				B	1.7	.05	1.63	1.83
Affective Response	1	0.53	.466	A	0.9	.04	.79	.96
				B	0.9	.04	.83	1.01

Note. The *F* tests the effect of Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means. *df* denotes degrees of freedom, *M* denotes mean.

Table N4
Univariate Statistics for the Effects of Timepoint and Group for MSLQ-Motivation Weighted Scores

Dependent Variable	Timepoint	Group	*M*	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Course Approach	1	A	0.0	.09	-0.17	0.17
		B	0.0	.09	-0.18	0.18
	2	A	2.6	.09	2.39	2.73
		B	2.6	.09	2.38	2.73
	3	A	2.5	.08	2.34	2.67
		B	2.6	.09	2.46	2.81
Affective Response	1	A	0.0	.08	-0.15	0.15
		B	0.0	.08	-0.15	0.15
	2	A	1.3	.07	1.15	1.44
		B	1.4	.08	1.20	1.50
	3	A	1.3	.07	1.19	1.48
		B	1.4	.08	1.26	1.56

Note. *M* denotes mean.

Appendix O – Detailed tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Motivation Weighted Scores (6.3.1.3)

Table O1

Results of Mauchly's Test of Sphericity for the MSLQ-Motivation Weighted Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.74	14.48	2	.001	.80	.82	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.56	28.80	2	< .001	.69	.71	.50
Timepoint * Factor	.30	58.44	2	< .001	.59	.60	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.34	52.77	2	< .001	.60	.61	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the *p*-value is a dot. *df* denotes degrees of freedom.

Table O2

ANOVA Results for the MSLQ-Motivation Weighted Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Timepoint	517.01	1.59	324.63	689.61	< .001	.93	1.00
Error	37.49	79.63	0.47				
Group	0.28	1	0.28	0.58	.449	.01	.12
Error	23.89	50	0.48				
Factor	101.11	1	101.11	362.94	< .001	.88	1.00
Error	13.93	50	0.28				
Timepoint * Group	0.27	1.38	0.19	0.25	.693	.01	.08
Error	52.37	69.23	0.76				
Timepoint * Factor	48.95	1.18	41.52	88.40	< .001	.64	1.00
Error	27.69	58.94	0.47				
Group * Factor	0.01	1	0.01	0.03	.855	.00	.05
Error	18.86	50	0.38				
Timepoint * Group * Factor	0.04	1.21	0.03	0.06	.853	.00	.06
Error	35.42	60.26	0.59				

Note. Results for the within-subjects effects are given using Greenhouse-Geisser adjustment. *df* denotes degrees of freedom.

Appendix P – Detailed tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Cognitive Weighted Scores (6.3.2.1)

Table P1

Results of the Between-Subjects Effects for the MSLQ-Cognitive Weighted Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Corrected Model	Cognitive Control	370.81	5	74.16	177.37	< .001	.74	1.00
	Self-Management	351.09	5	70.22	192.96	< .001	.75	1.00
Intercept	Cognitive Control	748.96	1	748.96	1791.24	< .001	.85	1.00
	Self-Management	709.27	1	709.27	1949.10	< .001	.86	1.00
Timepoint	Cognitive Control	370.42	2	185.21	442.96	< .001	.74	1.00
	Self-Management	350.58	2	175.29	481.71	< .001	.75	1.00
Group	Cognitive Control	0.09	1	0.09	0.23	.636	.00	.08
	Self-Management	0.00	1	0.00	0.01	.931	.00	.05
Timepoint * Group	Cognitive Control	0.34	2	0.17	0.41	.664	.00	.12
	Self-Management	0.20	2	0.10	0.27	.765	.00	.09
Error	Cognitive Control	132.55	317					
	Self-Management	115.36	317					
Total	Cognitive Control	1271.87	323					
	Self-Management	1194.81	323					

Note. df denotes degrees of freedom.

Table P2

Univariate Statistics for the Effects of Timepoint for MSLQ-Cognitive Weighted Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	*M*	Std. Error	95% Confidence Interval	
							Lower Bound	Upper Bound
Cognitive Control	2	442.96	< .001	1	0.0	.06	-0.12	0.12
				2	2.3	.06	2.13	2.38
				3	2.3	.06	2.20	2.44
Self-Management	2	481.71	< .001	1	0.0	.06	-0.12	0.12
				2	2.2	.06	2.09	2.32
				3	2.2	.06	2.13	2.36

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table P3

Univariate Statistics for the Effects of Group for MSLQ-Cognitive Weighted Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval	
							Lower Bound	Upper Bound
Cognitive Control	1	0.23	.636	A	1.5	.05	1.41	1.61
				B	1.5	.05	1.44	1.64
Self-Management	1	0.01	.931	A	1.5	.05	1.39	1.58
				B	1.5	.05	1.39	1.58

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table P4

Univariate Statistics for the Effects of Timepoint and Group for MSLQ-Cognitive Weighted Scores

Dependent Variable	**Timepoint**	**Group**	***M***	**Std. Error**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
Cognitive Control	1	A	0.0	.09	-0.17	0.17
		B	0.0	.09	-0.18	0.18
	2	A	2.3	.09	2.09	2.44
		B	2.2	.09	2.07	2.42
	3	A	2.3	.08	2.09	2.42
		B	2.4	.09	2.21	2.56
Self-Management	1	A	0.0	.08	-0.16	0.16
		B	0.0	.08	-0.17	0.17
	2	A	2.2	.08	2.08	2.40
		B	2.2	.08	2.01	2.34
	3	A	2.2	.08	2.06	2.37
		B	2.3	.08	2.11	2.43

Note. *M* denotes mean.

Appendix Q – Detailed Tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Cognitive Weighted Scores (6.3.2.3)

Table Q1

Results of Mauchly's Test of Sphericity for the MSLQ-Cognitive Weighted Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.87	6.77	2	.034	.89	.92	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.57	27.49	2	< .001	.70	.71	.50
Timepoint * Factor	.14	97.17	2	< .001	.54	.54	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.17	88.24	2	< .001	.55	.55	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the *p*-value is a dot. *df* denotes degrees of freedom.

Table Q2

Results of Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills for the MSLQ-Cognitive Weighted Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Timepoint	693.48	1.77	391.47	921.54	< .001	.95	1.00
Error	37.63	88.57	0.42				
Group	.01	1	0.01	0.02	.895	.00	.05
Error	27.50	50	0.55				
Factor	.17	1	0.17	0.50	.482	.01	.11
Error	16.77	50	0.34				
Timepoint * Group	.25	1.40	0.18	0.21	.732	.00	.08
Error	61.42	69.96	0.88				
Timepoint * Factor	.27	1.07	0.25	0.44	.526	.01	.10
Error	30.69	53.70	0.57				
Group * Factor	.12	1	0.12	0.34	.561	.01	.09
Error	17.44	50	0.35				
Timepoint * Group * Factor	.01	1.09	0.01	0.01	.941	.00	.05
Error	35.01	54.50	0.64				

Note. Results for the within-subjects effects are given using Greenhouse-Geisser adjustment. *df* denotes degrees of freedom.

Appendix R – Detailed Tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, SRLEDS Weighted Scores (6.3.3.1)

Table R1

Results of the Between-Subjects Effects for the SRLEDS Weighted Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Corrected Model	Motivation and Control	193.16	5	38.63	127.17	< .001	.68	1.00
	Communication and Forethought	88.20	5	17.64	66.72	< .001	.53	1.00
Intercept	Motivation and Control	393.18	1	393.18	1294.29	< .001	.81	1.00
	Communication and Forethought	179.44	1	179.44	678.75	< .001	.70	1.00
Timepoint	Motivation and Control	192.91	2	96.46	317.52	< .001	.68	1.00
	Communication and Forethought	88.11	2	44.06	166.64	< .001	.53	1.00
Group	Motivation and Control	0.10	1	0.10	0.34	.559	.00	.09
	Communication and Forethought	0.02	1	0.02	0.06	.803	.00	.06
Timepoint * Group	Motivation and Control	0.08	2	0.04	0.14	.871	.00	.07
	Communication and Forethought	0.01	2	0.01	0.02	.979	.00	.05
Error	Motivation and Control	90.22	297					
	Communication and Forethought	78.52	297					
Total	Motivation and Control	693.15	303					
	Communication and Forethought	353.83	303					

Note. *df* denotes degrees of freedom.

Table R2

Univariate Statistics for the Effects of Timepoint for the SRLEDS Weighted Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	*M*	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Motivation and Control	2	317.52	< .001	1	0.0	.06	-0.11	0.11
				2	1.7	.05	1.60	1.81
				3	1.7	.05	1.61	1.83
Communication and Forethought	2	166.64	< .001	1	0.0	.05	-0.10	0.10
				2	1.1	.05	1.04	1.24
				3	1.2	.05	1.07	1.27

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table R3

Univariate Statistics for the Effects of Group for the SRLEDS Weighted Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Motivation and Control	1	0.34	.559	A	1.1	.04	1.04	1.21
				B	1.2	.05	1.07	1.25
Communication and Forethought	1	0.06	.803	A	0.8	.04	0.68	0.84
				B	0.8	.04	0.69	0.86

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table R4

Univariate Statistics for the Effects of Timepoint and Group for the SRLEDS Weighted Scores

Dependent Variable	Timepoint	Group	*M*	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Motivation and Control	1	A	0.0	.08	-0.15	0.15
		B	0.0	.08	-0.16	0.16
	2	A	1.7	.08	1.51	1.81
		B	1.7	.08	1.59	1.90
	3	A	1.7	.07	1.56	1.85
		B	1.7	.08	1.58	1.89
Communication and Forethought	1	A	0.0	.07	-0.14	0.14
		B	0.0	.07	-0.15	0.15
	2	A	1.1	.07	0.99	1.27
		B	1.2	.07	1.00	1.29
	3	A	1.2	.07	1.02	1.29
		B	1.2	.07	1.04	1.34

Note. *M* denotes mean.

Appendix S – Detailed Tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, SRLEDS Weighted Scores (6.3.3.3)

Table S1

Results of Mauchly's Test of Sphericity for the SRLEDS Weighted Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.29	55.71	2	< .001	.58	.59	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.26	60.55	2	< .001	.57	.58	.50
Timepoint * Factor	.05	135.55	2	< .001	.51	.51	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.08	111.24	2	< .001	.52	.52	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the significance value is a dot. *df* denotes degrees of freedom.

Table S2

Results of Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills for the SRLEDS Weighted Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Timepoint	258.28	1.17	220.83	460.27	< .001	.91	1.00
Error	25.81	53.80	0.48				
Group	0.08	1	0.08	0.24	.629	.01	.08
Error	15.47	46	0.34				
Factor	18.31	1	18.31	70.41	< .001	.60	1.00
Error	11.96	46	0.26				
Timepoint * Group	0.04	1.15	0.03	0.05	.862	.00	.06
Error	34.87	52.89	0.66				
Timepoint * Factor	11.24	1.03	10.97	24.16	< .001	.34	1.00
Error	21.41	47.16	0.45				
Group * Factor	0.05	1	0.05	0.19	.666	.00	.07
Error	12.76	46	0.28				
Timepoint * Group * Factor	0.06	1.04	0.06	0.11	.756	.00	.06
Error	25.86	48.03	0.54				

Note. Results for the within-subjects effects are given using Greenhouse-Geisser adjustment. *df* denotes degrees of freedom.

Appendix T – Detailed Tables for Mixed ANOVA to Examine the Extent to Which Students' Mean Test Performance Changed Over Time, Weighted Scores (6.4.1.1)

Table T1

Results of Mixed ANOVA Calculated to Examine the Extent to Which Students' Test Performance Changed Over Time

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	1317481.71	1	1317481.71	11959.36	< .001	.97	1.00
Timepoint	1380.51	2	690.26	6.27	.002	.04	.89
Group	33.79	1	33.79	0.31	.580	.00	.09
Timepoint * Group	5.14	2	2.57	0.02	.977	.00	.05
Error	34591.24	314	110.16				

Note. *df* denotes degrees of freedom.

Appendix U – Correlation Matrices for Pearson's *r* Correlation Coefficient to Examine the Relationship Between Students' Self-Regulated Learning Skills and Test Performance (6.4.2.1)

MSLQ-Motivation

Table U1

Pearson's r Correlation Coefficient Results for Both Course Approach Items and Affective Response Items, and Students' Test Performance Across Timepoint

	Factor	***N***	**Pearson's *r***	***p* (two-tailed)**
Timepoint 1	Course Approach	105	-.09	.350
	Affective Response		.04	.658
Timepoint 2	Course Approach	107	.25	.009
	Affective Response		.07	.501
Timepoint 3	Course Approach	111	.22	.018
	Affective Response		-.12	.212

Note. *N* denotes number.

MSLQ-Cognitive

Table U2

Pearson's r Correlation Coefficient Results for Both Cognitive Control Items and Self-Management Items, and Students' Test Performance Across Timepoint

	Factor	***N***	**Pearson's *r***	***p* (two-tailed)**
Timepoint 1	Cognitive Control	105	.09	.364
	Self-Management		-.02	.847
Timepoint 2	Cognitive Control	107	-.12	.217
	Self-Management		-.15	.137
Timepoint 3	Cognitive Control	111	.08	.428
	Self-Management		.16	.091

Note. *N* denotes number.

Appendix V – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 1 (6.4.2.2)

Table V1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	394821.85	1	394821.85	6211.33	< .001	.99	1.00
Motivation and Control	0.77	1	0.77	0.01	.912	.00	.05
Communication and Forethought	8.13	1	8.13	0.13	.721	.00	.06
Group	47.74	1	47.74	0.75	.388	.01	.14
Error	5911.53	93	63.56				

Note. *df* denotes degrees of freedom.

Appendix W – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 2 (6.4.2.3)

Table W1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	2113.97	1	2113.97	17.56	< .001	.15	.99
Motivation and Control	158.62	1	158.62	1.32	.254	.01	.21
Communication and Forethought	305.31	1	305.31	2.54	.115	.03	.35
Group	49.56	1	49.56	0.41	.523	.00	.10
Error	11678.59	97	120.40				

Note. *df* denotes degrees of freedom.

Appendix X – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 3 (6.4.2.4)

Table X1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	2458.26	1	2458.26	17.49	< .001	.15	.99
Motivation and Control	0.01	1	0.01	0.00	.993	.00	.05
Communication and Forethought	233.57	1	233.57	1.66	.200	.02	.25
Group	24.62	1	24.62	0.18	.676	.00	.07
Error	13916.65	99	140.57				

Note. *df* denotes degrees of freedom.

Appendix Y – Detailed Tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Motivation Average Scores (7.3.1.1)

Table Y1

Results of the Between-Subjects Effects for the MSLQ-Motivation Average Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Corrected Model	Course Approach	6.06	5	1.21	1.97	.082	.03	.66
	Affective Response	3.59	5	0.72	1.54	.176	.02	.54
Intercept	Course Approach	7602.74	1	7602.74	12390.74	< .001	.98	1.00
	Affective Response	7539.03	1	7539.03	16222.82	< .001	.98	1.00
Timepoint	Course Approach	0.87	2	0.44	0.71	.492	.00	.17
	Affective Response	0.03	2	0.02	0.04	.963	.00	.06
Group	Course Approach	1.34	1	1.34	2.18	.141	.01	.31
	Affective Response	2.31	1	2.31	4.97	.027	.02	.60
Timepoint * Group	Course Approach	3.91	2	1.95	3.18	.043	.02	.61
	Affective Response	1.16	2	0.58	1.24	.290	.01	.27
Error	Course Approach	194.51	317					
	Affective Response	147.32	317					
Total	Course Approach	7814.34	323					
	Affective Response	7694.24	323					

Note. *df* denotes degrees of freedom.

Table Y2

Univariate Statistics for the Effects of Timepoint for the MSLQ-Motivation Average Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	*M*	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Course Approach	2	0.71	.492	1	4.8	.08	4.67	4.97
				2	4.8	.08	4.67	4.97
				3	4.9	.07	4.78	5.08
Affective Response	2	0.04	.963	1	4.9	.07	4.72	4.98
				2	4.8	.07	4.69	4.95
				3	4.8	.06	4.71	4.96

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table Y3

Univariate Statistics for the Effects of Group for the MSLQ-Motivation Average Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Course	1	2.18	.141	A	4.8	.06	4.67	4.91
Approach				B	4.9	.06	4.80	5.05
Affective	1	4.97	.027	A	4.8	.05	4.65	4.86
Response				B	4.9	.05	4.81	5.03

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table Y4

Univariate Statistics for the Effects of Timepoint and Group for the MSLQ-Motivation Average Scores

Dependent Variable	Timepoint	Group	*M*	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Course Approach	1	A	4.8	.11	4.60	5.02
		B	4.8	.11	4.61	5.04
	2	A	4.9	.10	4.65	5.06
		B	4.8	.11	4.57	5.00
	3	A	4.7	.10	4.51	4.92
		B	5.2	.11	4.94	5.36
Affective Response	1	A	4.8	.09	4.65	5.02
		B	4.9	.10	4.68	5.05
	2	A	4.8	.09	4.57	4.93
		B	4.9	.10	4.71	5.09
	3	A	4.7	.09	4.50	4.85
		B	5.0	.09	4.81	5.18

Note. *M* denotes mean.

Appendix Z – Detailed Tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Motivation Average Scores (7.3.1.3)

Table Z1

Results of Mauchly's Test of Sphericity for the MSLQ-Motivation Average Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.94	3.11	2	.212	.94	.98	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.97	1.54	2	.463	.97	1.00	.50
Timepoint * Factor	.89	5.78	2	.056	.90	.93	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.94	2.84	2	.242	.95	.98	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the *p*-value is a dot. *df* denotes degrees of freedom.

Table Z2

Results of Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills for the MSLQ-Motivation Average Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Timepoint	0.71	2	0.36	0.41	.668	.01	.11
Error	87.63	100	0.88				
Group	4.02	1	4.02	4.46	.040	.08	.54
Error	45.10	50	0.90				
Factor	0.08	1	0.08	0.53	.472	.01	.11
Error	7.53	50	0.15				
Timepoint * Group	3.35	2	1.68	1.48	.232	.03	.31
Error	113.16	100	1.13				
Timepoint * Factor	0.39	2	0.19	1.03	.360	.02	.23
Error	18.78	100	0.19				
Group * Factor	0.12	1	0.12	0.64	.428	.01	.12
Error	9.31	50	0.19				
Timepoint * Group * Factor	0.57	2	0.29	1.91	.154	.04	.39
Error	15.07	100	0.15				

Note. *df* denotes degrees of freedom.

Appendix AA – Detailed Tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Cognitive Average Scores (7.3.2.1)

Table AA1

Results of the Between-Subjects Effects for the MSLQ-Cognitive Average Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Corrected Model	Cognitive Control	13.95	5	2.79	4.72	< .001	.07	.98
	Self-Management	4.39	5	0.88	1.71	.133	.03	.59
Intercept	Cognitive Control	6515.72	1	6515.72	11027.88	< .001	.97	1.00
	Self-Management	6892.89	1	6892.89	13395.53	< .001	.98	1.00
Timepoint	Cognitive Control	10.40	2	5.20	8.80	< .001	.05	.97
	Self-Management	2.34	2	1.17	2.27	.105	.01	.46
Group	Cognitive Control	1.34	1	1.34	2.18	.141	.01	.31
	Self-Management	2.31	1	2.31	4.97	.027	.00	.60
Timepoint * Group	Cognitive Control	3.91	2	1.95	3.18	.043	.01	.61
	Self-Management	1.16	2	0.58	1.24	.290	.01	.27
Error	Cognitive Control	187.30	317					
	Self-Management	163.12	317					
Total	Cognitive Control	6734.92	323					
	Self-Management	7074.04	323					

Note. *df* denotes degrees of freedom.

Table AA2

Univariate Statistics for the Effects of Timepoint for MSLQ-Cognitive Average Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	*M*	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Control	2	8.80	< .001	1	4.3	.08	4.11	4.40
				2	4.5	.07	4.39	4.69
				3	4.7	.07	4.55	4.83
Self-Management	2	2.27	.105	1	4.7	.07	4.60	4.88
				2	4.5	.07	4.40	4.68
				3	4.6	.07	4.46	4.73

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table AA3

Univariate Statistics for the Effects of Group for MSLQ-Cognitive Average Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Control	1	2.83	.093	A	4.4	.06	4.31	4.54
				B	4.6	.06	4.45	4.69
Self-Management	1	0.14	< .001	A	4.6	.06	4.52	4.74
				B	4.6	.06	4.51	4.73

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table AA4
Univariate Statistics for the Effects of Timepoint and Group for the MSLQ-Cognitive Average Scores

Dependent Variable	Timepoint	Group	*M*	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Cognitive Control	1	A	4.1	.10	3.94	4.35
		B	4.4	.11	4.16	4.58
	2	A	4.6	.10	4.37	4.78
		B	4.5	.11	4.29	4.72
	3	A	4.6	.10	4.35	4.75
		B	4.8	.11	4.62	5.04
Self-Management	1	A	4.7	.10	4.49	4.87
		B	4.8	.10	4.60	5.00
	2	A	4.7	.10	4.47	4.85
		B	4.4	.10	4.22	4.62
	3	A	4.6	.09	4.36	4.73
		B	4.6	.10	4.45	4.83

Note. *M* denotes mean.

Appendix BB – Detailed Tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, MSLQ-Cognitive Average Scores (7.3.2.3)

Table BB1

Results of Mauchly's Test of Sphericity for the MSLQ-Cognitive Average Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.91	4.76	2	.093	.92	.95	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.93	3.41	2	.182	.94	.97	.50
Timepoint * Factor	.93	3.68	2	.159	.93	.97	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.97	1.68	2	.432	.97	1.00	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the *p*-value is a dot. *df* denotes degrees of freedom.

Table BB2

Results of Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills for the MSLQ-Cognitive Average Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Timepoint	3.08	2	1.54	1.76	.177	.03	.36
Error	87.68	100	0.88				
Group	0.49	1	0.49	0.56	.456	.01	.11
Error	43.41	50	0.87				
Factor	2.91	1	2.91	13.39	.001	.21	.95
Error	10.88	50	0.22				
Timepoint * Group	2.51	2	1.26	1.17	.314	.02	.25
Error	107.31	100	1.07				
Timepoint * Factor	10.21	2	5.11	25.18	< .001	.33	1.00
Error	20.28	100	0.20				
Group * Factor	1.16	1	1.16	6.84	.012	.12	.73
Error	8.52	50	0.17				
Timepoint * Group * Factor	0.04	2	0.02	0.07	.932	.00	.06
Error	25.08	100	0.25				

Note. *df* denotes degrees of freedom.

Appendix CC – Detailed Tables for Mixed MANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, SRLEDS Average Scores (7.3.3.1)

Table CC1

Results of the Between-Subjects Effects for the SRLEDS Average Scores

Source	Dependent Variable	Sum of Squares	*df*	Mean Square	F	*p*	η_p^2	Observed Power
Corrected Model	Motivation and Control	1.52	5	0.30	2.08	.068	.03	.69
	Communication and Forethought	0.31	5	0.06	0.71	.614	.01	.26
Intercept	Motivation and Control	2226.15	1	2226.15	15257.30	< .001	.98	1.00
	Communication and Forethought	2574.81	1	2574.81	29716.68	< .001	.98	1.00
Timepoint	Motivation and Control	1.15	2	0.57	3.93	.021	.03	.70
	Communication and Forethought	0.21	2	0.10	1.21	.300	.01	.26
Group	Motivation and Control	0.41	1	0.41	2.80	.095	.01	.39
	Communication and Forethought	0.05	1	0.05	0.63	.429	.00	.12
Timepoint * Group	Motivation and Control	0.01	2	0.00	0.03	.970	.00	.05
	Communication and Forethought	0.05	2	0.03	0.32	.730	.00	.10
Error	Motivation and Control	43.04	297					
	Communication and Forethought	25.56	297					
Total	Motivation and Control	2311.26	303					
	Communication and Forethought	2650.86	303					

Note. *df* denotes degrees of freedom.

Table CC2
Univariate Statistics for the Effects of Timepoint for SRLEDS Average Scores

Dependent Variable	*df*	*F*	*p*	Timepoint	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Motivation and Control	2	3.93	.021	1	2.7	.04	2.58	2.74
				2	2.8	.04	2.69	2.85
				3	2.8	.04	2.73	2.88
Communication and Forethought	2	1.21	.300	1	2.9	.03	2.88	3.00
				2	2.9	.03	2.88	2.99
				3	3.0	.03	2.93	3.05

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table CC3
Univariate Statistics for the Effects of Group for SRLEDS Average Scores

Dependent Variable	*df*	*F*	*p*	Group	*M*	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Motivation and Control	1	2.80	.095	A	2.7	.03	2.65	2.77
				B	2.8	.03	2.72	2.85
Communication and Forethought	1	0.63	.429	A	2.9	.02	2.89	2.99
				B	3.0	.03	2.92	3.02

Note. *df* denotes degrees of freedom. *M* denotes mean.

Table CC4

Univariate Statistics for the Effects of Timepoint and Group for the SRLEDS Average Scores

Dependent Variable	Timepoint	Group	*M*	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Motivation and Control	1	A	2.6	.05	2.52	2.73
		B	2.7	.06	2.58	2.80
	2	A	2.7	.05	2.63	2.82
		B	2.8	.06	2.70	2.93
	3	A	2.8	.05	2.67	2.87
		B	2.8	.06	2.73	2.95
Communication and Forethought	1	A	2.9	.04	2.85	3.01
		B	2.9	.04	2.86	3.03
	2	A	2.9	.04	2.86	3.01
		B	2.9	.05	2.84	3.03
	3	A	3.0	.04	2.88	3.04
		B	3.0	.04	2.94	3.11

Note. *M* denotes mean.

Appendix DD – Detailed Tables for Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills, SRLEDS Average Scores (7.3.3.3)

Table DD1

Results of Mauchly's Test of Sphericity for the Mixed ANOVA for the SRLEDS Average Scores

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	*df*	*p*	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Timepoint	.91	3.54	2	.170	.92	.96	.50
Group	1.00	0.00	0	.	1.00	1.00	1.00
Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group	.96	1.39	2	.498	.97	1.00	.50
Timepoint * Factor	.94	2.39	2	.303	.94	.99	.50
Group * Factor	1.00	0.00	0	.	1.00	1.00	1.00
Timepoint * Group * Factor	.97	0.99	2	.609	.97	1.00	.50

Note. As at least three conditions are required for sphericity to be an issue, in the instances where this is not met the *p*-value is a dot. *df* denotes degrees of freedom.

Table DD2

Results of Mixed ANOVA to Examine the Extent to Which the Intervention Enhanced Students' Self-Regulated Learning Skills for the SRLEDS Average Scores

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η_p^2	Observed Power
Timepoint	0.62	2	0.31	2.02	.139	.05	.41
Error	12.05	78	0.15				
Group	0.41	1	0.41	1.93	.172	.05	.27
Error	8.25	39	0.21				
Factor	4.90	1	4.90	83.53	< .001	.68	1.00
Error	2.29	39	0.06				
Timepoint * Group	0.07	2	0.03	0.19	.828	.00	.08
Error	14.15	78	0.18				
Timepoint * Factor	0.31	2	0.16	3.55	.033	.08	.64
Error	3.45	78	0.04				
Group * Factor	0.05	1	0.05	0.71	.406	.02	.13
Error	2.76	39	0.07				
Timepoint * Group * Factor	0.06	2	0.03	0.50	.611	.01	.13
Error	4.36	78	0.06				

Note. *df* denotes degrees of freedom.

Appendix EE – Correlation Matrices for Pearson's *r* Correlation Coefficient to Examine the Relationship Between Students' Self-Regulated Learning Skills and Test Performance, Average Scores (7.4.1.1)

MSLQ-Motivation

Table EE1

Pearson's r Correlation Coefficient Results for Both Course Approach Items and Affective Response Items, and Students' Test Performance Across Timepoint

	Factor	*N*	Pearson's *r*	*p* (two-tailed)
Timepoint 1	Course Approach	105	.09	.350
	Affective Response		.18	.064
Timepoint 2	Course Approach	107	.11	.247
	Affective Response		.22	.025
Timepoint 3	Course Approach	111	.15	.107
	Affective Response		-.07	.444

Note. *N* denotes number.

MSLQ-Cognitive

Table EE2

Pearson's r Correlation Coefficient Results for Both Cognitive Control Items and Self-Management Items, and Students' Test Performance Across Timepoint

	Factor	*N*	Pearson's *r*	*p* (two-tailed)
Timepoint 1	Cognitive Control	105	.04	.654
	Self-Management		.10	.302
Timepoint 2	Cognitive Control	107	.04	.679
	Self-Management		-.07	.473
Timepoint 3	Cognitive Control	111	.08	.399
	Self-Management		.19*	.050

Note. *N* denotes number. * denotes significant at .05 level.

Appendix FF – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 1 (7.4.1.2)

Table FF1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	3754.10	1	3754.10	59.14	< .001	.39	1.00
Motivation and Control	83.96	1	83.96	1.32	.253	.01	.21
Communication and Forethought	69.23	1	69.23	1.09	.299	.01	.18
Group	27.54	1	27.54	0.43	.512	.00	.10
Error	5776.95	91	63.48				

Note. *df* denotes degrees of freedom.

Appendix GG – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 2 (7.4.1.3)

Table GG1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	966.97	1	966.97	8.48	.004	.08	.82
Motivation and Control	11.71	1	11.71	0.10	.749	.00	.06
Communication and Forethought	241.49	1	241.49	2.12	.149	.02	.30
Group	133.82	1	133.82	1.17	.281	.01	.19
Error	11174.41	98	114.02				

Note. *df* denotes degrees of freedom.

Appendix HH – Detailed Tables for ANCOVA to Examine the Extent to Which Students' Self-Regulated Learning Skills Predict Students' Mean Test Performance at Timepoint 3 (7.4.1.4)

Table HH1

Results of ANCOVA Calculated to Examine the Extent to Which Self-Regulated Learning Skills Predict Test Performance

Source	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2	Observed Power
Intercept	4668.22	1	4668.22	42.47	< .001	.30	1.00
Motivation and Control	29.23	1	29.23	0.27	.607	.00	.08
Communication and Forethought	0.81	1	0.81	0.01	.932	.00	.05
Group	136.79	1	136.79	1.24	.267	.01	.20
Error	10992.29	100	109.92				

Note. *df* denotes degrees of freedom.