Learning Designs Incorporating Animated Pedagogical Agents: Their Potential for Improving Academic Writing Competence, Writing Self-Efficacy, and Reducing Writing Anxiety

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DECLARATION

I declare that this thesis is my account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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ABSTRACT

Academic writing can be extremely challenging, especially for new university students. This is compounded by the mass-migration of courses to online delivery, which further increases the complexity of acquiring writing skills.

Animated pedagogical agents (APAs) have shown promise in addressing these problems, because they simulate authentic face-to-face social interactions thereby potentially increasing student engagement, motivation, and favourable emotions conducive to learning.

This study's first aim was to examine the impact of learning designs employing APAs on novice learners' academic writing, writing anxiety, and writing self-efficacy. Its second aim was to examine the influence of various delivery options (didactic delivery or scaffolded questioning) with support messages (emotional, motivational or neither) on writing competence, writing anxiety and writing self-efficacy.

These aims were achieved in a mixed-method study that included six experimental conditions tested using two multimedia academic writing lessons provided to 106 participants who were new to Australian tertiary studies. Quantitative data were collected immediately before and after the lessons (Phase 1), while qualitative data were obtained by interviews with a subset of participants after Lesson 2 (Phase 2). The impact of the independent variable combinations on the dependent variables were examined quantitatively (General Linear Modelling, t-tests) and qualitatively (thematic analysis).

The results demonstrate that completing two academic writing lessons with APAs can increase writing competence and self-efficacy, and reduce writing anxiety. However, no significant differences were found between the support and delivery groups. Despite the lack of significant inter-group differences, more participants from the emotional group reported that their negative emotions were reduced because of the lesson. Also, all the participants in the motivational group reported perceptions of writing improvement as a result of attending the lessons.

The overall positive result suggests promising possibilities for writing support delivered online to counter student under preparedness for academic writing.

"The journey of a thousand miles begins with one step"

Lao Tzu, Chinese philosopher

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Meaning
APA	Animated pedagogical agent
API	Agent Persona Instrument
Did	Didactic delivery
EAP	English for academic purposes
Emo	Emotional messages
FEASP	Fear, Envy, Anger, Sympathy, Pleasure approach
ICC	Interclass coefficient
ITS	Intelligent tutoring system
LMS	Learning management system
Mot	Motivational messages
QA	Scaffolded questioning delivery
SEWS	Self-Efficacy for Writing Scale
SSSES	Skills Specific Self Efficacy Scale (1 and 2)
WAT	Writing Apprehension Test

CHAPTER ONE: INTRODUCTION

"It is not knowledge, but the act of learning,
not possession but the act of getting there,
which grants the greatest enjoyment."

Carl Gauss 1777–1855, German mathematician and physicist

1.1 Chapter Overview

This chapter commences with a description of the background to the study in Section 1.2. The research problems to be addressed are outlined in Section 1.3, while these problems are reframed as research aims and questions in Section 1.4. Section 1.5 underscores the importance of this research, and Section 1.6 outlines the research approach. This chapter concludes with a description of the organisation of the thesis structure in Section 1.7.

1.2 Background of the Study

In a number of Anglophone countries, universities are lamenting the issue of student under preparedness for academic writing. For example, the United Kingdom (Calvo, Celini, Morales, Martínez, & Núñez-Cacho Utrilla, 2020; Leese, 2010), the United States of America (Andrade, Evans, & Hartshorn, 2014; Antonetti, 2017; Dunston & Wilkins, 2015; Kellogg & Whiteford, 2009; Perin & Holschuh, 2019; Perin, Lauterbach, Raufman, & Kalamkarian, 2017; Wahleithner, 2020) and Australia (Bradley, Noonan, Nugent, & Scales, 2008; Kift & Moody, 2009; McKay et al., 2018; Murray, 2012). In Australia, this phenomenon has been attributed to the massification of higher education through rapid internationalisation and the agenda to widen participation (Australian Government, 2016; Bradley et al., 2008; Briguglio & Watson, 2014).

Learning to write for academic purposes can be challenging for new university students for several reasons. First is the tendency for some students to oversimplify the requirements of academic writing genres based on their limited prior exposure to academic writing, thereby overlooking important detail (Reiff & Bawarshi, 2011). Next is their penchant to underestimate the importance of coordinating and organising the various individual writing sub-processes that are goal directed and iterative (Flower & Hayes, 1980). Additionally, it is fair to assume that many new university students do not yet possess adequate task schemata, topic knowledge, audience awareness, and genre knowledge. These complexities present significant obstacles for such students achieving writing transfer, defined by Moore (2017, p. 2) as a "writer's ability to repurpose or transform prior knowledge about writing for a new audience, purpose, and context". Undoubtedly, this problem is compounded for English as an additional language (EAL) students who may also not demonstrate the requisite linguistic and cultural knowledge (Hayes, 1996).

It is therefore no surprise that academic writing can cause anxiety in students, a subject that has been researched extensively since the 1970s (Armendaris, 2009; Cheng, 2002; Daly & Miller, 1975b; Faris, Golen, & Lynch, 1999; Martinez, Kock, & Cass, 2011; Olanezhad, 2015; Olivier & Olivier, 2016; Palmquist & Young, 1992; Petzel & Wenzel, 1993; Sanders-Reio, Alexander, Reio, & Newman, 2014; Stewart, Seifert, & Rolheiser, 2015). Indeed, in recognition of the role of affect and motivation in writing, Hayes (1996), an eminent cognitive psychologist in writing research, revised the earlier Hayes-Flower (1980) cognitive model of text production to incorporate *motivation* and *affect* into his writing processes framework. Thus, it is a foregone conclusion that

academic writing instruction should include design elements that not only address the cognitive, but also the affective and motivational elements (Bruning & Horn, 2000).

While the requirement for academic writing instruction to incorporate motivational, affective and sociocultural elements can easily be met by the instructor during face-to-face delivery, this is difficult to achieve online. Indeed, the mass migration of courses towards online delivery has necessitated that universities deliver instruction and support online primarily through asynchronous discussions (Ertmer, Sadaf, & Ertmer, 2011), screencasts (Stagg, Kimmins, & Pavlovski, 2013) and synchronous webinars (Gegenfurtner & Ebner, 2019), often delivered through learning management systems (LMSs). Synchronous webinars have been found more effective in promoting learning than asynchronous discussions and even face-to-face instruction in a recent meta-analysis and systematic review of randomised controlled trials involving 15 separate data sources (Gegenfurtner & Ebner, 2019). However, with respect to learner satisfaction, face to face instruction surpassed webinars which in turn outperformed asynchronous discussions in the meta-analysis (Ebner & Gegenfurtner, 2019). This finding is congruent with Bollinger and Halupa's (2018) observation that while online delivery has improved through more advanced communication technologies, it is still lacking in the situated experience that can only be achieved through face to face delivery.

Problems associated with the lack of situated experience are more acute with respect to asynchronous discussions as this communication channel lacks immediacy in feedback, and uses only one mode of communication (Q. Wang & Woo, 2007), the very strengths of face to face communication. Thus, asynchronous discussions are devoid of "presence…the extent to which a medium is perceived as sociable, warm, sensitive,

personal or intimate when it is used to interact with others" (Lombard & Ditton, 1997, p. 2). Additionally, in this online text based medium, novice learners are required to exercise self-directedness in their own learning which can be difficult because of the excessive cognitive load it places on working memory (Kirschner, Sweller, & Clark, 2006). It is therefore no surprise that with respect to instruction delivered online, a higher proportion of students fail or drop out when compared to face to face delivery (Bawa, 2016; Sapp & Simon, 2005).

In order to overcome this lack of situated experience online, researchers continue to investigate technological innovations for enhancing the motivational, affective and sociocultural elements that are often lacking in virtual spaces. Each of these elements can potentially be conveyed through a human proxy, or animated pedagogic agent (APA) which is defined by Craig, Gholson, and Driscoll (2002) as a computerised persona that guides the learner through multimedia learning environments by focusing attention and providing instructions. This audio and visual presence of the anthropomorphic persona is thought to be the means by which the learner's social interaction schema is activated (Domagk, 2010). Consequently, beyond merely delivering content, APAs can be designed to simulate authentic face to face social interactions (Y. Kim & Baylor, 2006), which increases the plausibility of eliciting desirable emotions to facilitate learning.

APAs that display emotions, or affective pedagogical agents, have been found to increase learner engagement (Y. Kim, Baylor, & Shen, 2008; Mayer & Estrella, 2014), motivation (Maldonado et al., 2005; Okonkwo & Vassileva, 2001), and retention (Mayer & Estrella, 2014), and to increase positive feelings and reduce negative ones (Um, Plass, Hayward, & Homer, 2012; Um, Song, & Plass, 2007).

Aside from enhancing emotions that facilitate learning, APAs can be endowed with the ability to motivate learners, which will undoubtedly further advance the field of academic writing. In a number of studies, APAs have been shown to be effective in increasing learner motivation (Baylor & Kim, 2005; Dinçer & Doğanay, 2017; Ebbers, 2007; X. Huang & Mayer, 2016; Im, 2012; Y. Kim, 2007; Y. Kim et al., 2008; Shiban et al., 2015). Accordingly, it is plausible that employing APAs to deliver motivational messages in a learning design may favourably affect writing anxiety, writing self-efficacy and writing ability.

Finally, a design consideration in APA learning environments that has not yet been systematically explored is the effectiveness of scaffolded questioning as a format of delivery in academic writing instruction. It has been shown that the act of questioning when initiated by learners can serve to engage reflective thinking (I. Choi, Land, & Turgeon, 2005; Scardamalia & Bereiter, 1991). However, it has long been observed that novice learners simply do not initiate questions on difficult material, as the learner first needs to recognise gaps in knowledge so as to know what to ask (Garner & Alexander, 1989; Miyake & Norman, 1979). This presents what is referred to as *the metacognitive knowledge dilemma* (Land, 2000) where low prior domain and metacognitive knowledge prevents the learner from asking the right questions.

Given these difficulties, it would be useful to investigate the effects of scaffolded question-answer dialogues between an instructor APA and fellow learner/peer APA on learning. Scaffolding in the traditional sense is defined as "the process by which a teacher or more knowledgeable peer assists a learner, altering the learning task so the learner can solve problems or accomplish tasks that would otherwise be out of reach" (Reiser, 2004, p. 274). As such, the formulation of naïve questions to be directed at an

instructor APA by a learner APA may be a useful scaffolding mechanism to highlight the necessary shifts that learners need to make to their schemata. Some examples of effective question types that may be formulated for delivery by an APA are those that elicit past knowledge, test learner comprehension, provide subtle hints and those that elicit deeper reasoning. Similarly, questions for delivery by a *peer* APA may be those that encourage learners to contrast ideas, apply concepts, and to elaborate on causal relationships (Roscoe & Chi, 2007). These examples serve to illustrate that the *type* of questions asked are important considerations for learning to occur. For the purposes of this study, questioning refers to the act of posing questions as initiated by a peer APA with the objective of underscoring common misconceptions about writing.

In summary, the complexities inherent in learning to write for academic purposes can be difficult to navigate, particularly for novice learners working in the online space. Such virtual spaces will undoubtedly benefit from the social enrichment that APAs can provide as they guide novice learners across the various emotional, motivational, cognitive and epistemological obstacles of writing for academic purposes.

1.3 Problem to be Addressed

Incoming university students are expected to possess a functional level of academic writing skills in order to participate successfully in tertiary education. However, this is often not a reality and instead, many students experience writing anxiety and faltering motivational levels (Martinez et al., 2011; Olivier & Olivier, 2016; Stewart et al., 2015). Despite the potential for these factors to derail the success of incoming university students, research into writing anxiety and motivation has not attracted sufficient research interest, particularly with students for whom studying online is a necessity.

While asynchronous discussions, the mainstay of online learning, are beneficial to learners due to the flexibility it affords students, students simply do not experience an identical lived experience as they would being in the same location with the instructor (Bolliger & Halupa, 2018). This is unfortunate as teaching is a fundamentally social process and requires the experience of *being there*, or *social presence* (Lombard & Ditton, 1997; Sinatra et al., 2021; Witmer & Singer, 1998). Social presence has also been defined as the degree to which learners feel that they are "interacting with real people" when online (Sung & Mayer, 2012; Yen & Tu, 2011).

Furthermore, incoming students who are relative novices at learning often do not tend to initiate questions about the learning material because they tend to be ignorant of any knowledge gaps compared to their more experienced counterparts (Glenberg, Wilkinson, & Epstein, 1982; Miyake & Norman, 1979; Pressley, Ghatala, Woloshyn, & Pirie, 1990). This is explained by the *Dunning Kruger effect* (Dunning, 2011), that is the tendency for novices in any domain to overestimate ability due to metacognitive skill deficits (Dunning, 2011; Kruger & Dunning, 1999).

Although research has been carried out on the impact of APAs on learning motivation, emotion and learning transfer, no single study exists that examines the effectiveness of APAs in improving novice learners' academic writing competency by witnessing question and answer dialogues between an instructor and naive student APA, while enhancing learner writing self-efficacy and reducing writing anxiety through the respective use of emotional and motivational support messages in a relatively short intervention. These knowledge gaps are addressed in this thesis.

1.4 Research Aims and Questions

To address the knowledge gaps described in Section 1.3, this study's first aim was to examine the impact of learning designs employing APAs on novice learners' academic writing, writing anxiety and writing self-efficacy. Its second aim was to examine the influence of various delivery options (didactic delivery or scaffolded questioning) with support messages (emotional, motivational or neither) on writing competence, self-efficacy and anxiety.

This study aims to address the following research questions:

1. To what extent can learning designs incorporating APAs be used to increase writing competence and writing self-efficacy, while reducing writing anxiety?
2. What effect do emotional support messages, motivational support messages and scaffolded questioning have on writing competence, writing self-efficacy and writing anxiety?

1.5 Importance of this Research

From a conceptual perspective, the outcomes of this project will inform the field of academic writing in general. In particular, the project will provide much needed information on design variables influencing academic writing competence, self-efficacy and anxiety in online learning contexts incorporating APAs, for which information has been found to be scant.

From an applied perspective, the results of this study will inform the design of learning environments using APAs to improve learning outcomes, elicit and sustain writing self-efficacy, and reduce writing anxiety when interacting within academic writing online environments. Furthermore, this study will address methodological inadequacies of

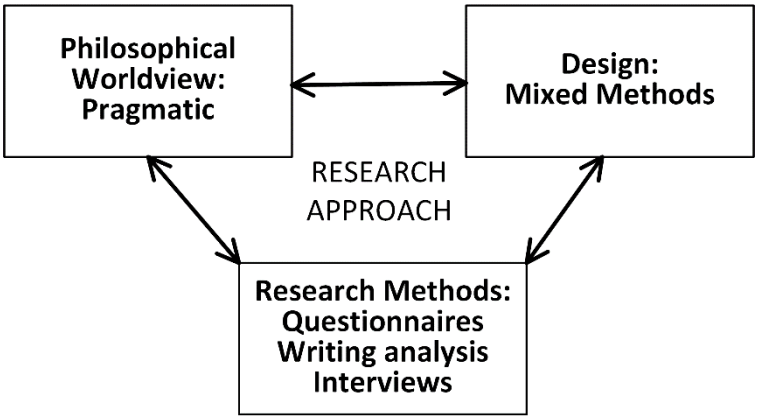
prior studies, by applying psychological theories (pertaining to self-efficacy and anxiety) to the learning design of a number of specific academic writing topics.

1.6 Research Approach

The term 'research approach' is defined by Creswell (2014, p. 3) as "plans and procedures for research that spans the steps from broad assumptions to detailed methods of data collection, analysis and interpretation". This broad research approach involves the intersection of three areas, each cascading into the subsequent one, namely the philosophical worldview, research design and research methods (Creswell, 2014).

Consequently, Creswell's (2014) framework as applied to this research is guided by the pragmatic worldview which feeds into the employment of the mixed methods approach. This mixed methods approach involves data collection from questionnaires, writing analysis and interviews with a subset of the participants. The interrelationship between the three elements of the research approach for this study is shown in Figure 1.1 and discussed further in Chapter 4.

Figure 1.1 Research approach for this study



Adapted from Creswell (2014)

The participants in the study were students who were relative newcomers to tertiary study, and were therefore eager to develop their academic writing skills. This target population was restricted to novice students from Perth tertiary institutions or colleges with aspirations for developing their academic writing skills.

The mixed method research approach used in this research is an embedded design, with data collection progressing along two phases. In the first phase of this study, a randomised block design was used where participants within each university or college (blocks) were randomly allocated to one of six experimental conditions to complete two online writing lessons with APAs, occurring within two weeks of each other. The scope of the lesson content was focussed primarily on structural elements of English for General Academic Purposes and referencing.

From both lessons in this phase, questionnaire data were collected and analysed. In addition, participants were required to write a short essay before the first lesson (the pretest writing task) and then again after the second lesson (the posttest writing task). These pretest and posttest writing samples were analysed against each other for evidence of improvement on a number of writing competency criteria. The second phase of the study involved interviewing the participants and using this to complement the data collected in the first phase.

The quantitative data from the first phase was analysed using General Linear Modelling (GLM) in IBM SPSS Statistics for Windows, Version 25.0, and the writing tasks were analysed by two independent assessors using a scoring rubric designed by the researcher. Finally the qualitative data were analysed using NVivo 12.0 for Windows software.

1.7 Organisation of this Thesis

This thesis comprises eight chapters. Chapter 1 has introduced the background to the study, the research problem to be addressed, the research aims and questions, the rationale for this research, and the research approach.

Chapter 2 provides a review of the corpus of literature upon which this study is based. It commences with a brief context on writing for academic English and goes on to discuss the three interrelated phenomena of writing transfer, threshold concepts and genre knowledge. This is followed by a review of the literature underpinning issues and concepts involved with operationalising writing competence, writing anxiety, and writing self-efficacy. Next, literature relating to the independent variables in the study is reviewed, specifically scaffolded questioning, motivational support and affective phenomena as they relate to cognition, and emotional support. This chapter concludes with a review of APA literature, followed by a visualisation of the literature reviewed in this study in the form of a literature map.

Chapter 3 states the research aims and corresponding research questions. It concludes with the research hypotheses and their justifications.

Chapter 4 provides a description of the methodology used in this study. It commences with a statement of the theoretical and methodological underpinnings of the study, research design, lesson structure and design of the lesson environment. This is followed by the APA design decisions made in this study at global, medium and detail levels. It moves on to discuss the operationalisations of the independent and dependent variables in this study. Next, the ethical considerations are outlined, followed by a description of the participants, materials, and data collection procedures

employed in both phases of the study. This chapter concludes with an overview of the qualitative approaches used.

Chapter 5 explicates the quantitative results of this research. This chapter commences with the reporting of participant demographics, followed by an explanation of the methods to evaluate reliability of the measurement scales in this study, and those to evaluate reliability of content analysis coding. Following on from this, the distribution of participants across the six conditions are described. Finally, the findings on each of the research questions are discussed in turn.

Chapter 6 provides an analysis of the qualitative results. This includes the overall participant background for this aspect of the study, a word frequency query, and an analysis of the main themes emanating from the data as a corpus. Next, the effect of delivery and support interventions as perceived by the participants are analysed.

In Chapter 7, a discussion of the findings of the research is provided, along with a set of principles and guidelines for designing learning environments that deploy APAs in the teaching of academic genre to novice students.

Finally, in Chapter 8, a summary of findings is provided followed by a discussion of the limitations of the study and possible means of overcoming them. This chapter details the study delimitations and their implications. Finally, the implications for practice and future research are provided.

CHAPTER TWO: LITERATURE REVIEW

"A theory is a good theory if it is an elegant model,
if it describes a wide class of observations,
and if it predicts the results of new observations.
Beyond that it makes no sense to ask if it corresponds to reality,
because we do not know what reality is independent of a theory."

Stephen Hawking 1942 –2018, English theoretical physicist

2.1 Chapter Overview

The purpose of this chapter is to review theoretical underpinnings of the disparate and interrelated areas upon which this research is based. Given that this research is situated within the domain of writing for academic English generally, and writing transfer more specifically, it begins by providing a brief background about writing for academic English in Section 2.2. Next, important literature on the interrelated concepts of writing transfer, threshold concepts and genre knowledge is reviewed in Section 2.3. These sections provide the backdrop for understanding the complexities of acquiring writing competence, one of the three key variables in this study as elaborated on in Section 2.4. Following on from this, Sections 2.5 and 2.6 respectively provide a review of the literature on the remaining key variables in this study, namely writing anxiety and writing self-efficacy

The final sections in this chapter provide the theoretical basis for the APA design decisions made in this study. Section 2.7 provides an overview of the literature on scaffolded questioning; Section 2.8 reviews the literature on motivational support; and Section 2.9 provides an evaluation of the body of work on affective phenomena, cognition, and emotional support. Finally, the literature on the benefits and affordances APAs provide, their design taxonomy, the application of affective

phenomena and motivational support as they apply to APAs in multimedia learning environments is synthesised and analysed in Section 2.10. This chapter concludes with a summary of the review and literature map in Section 2.11.

2.2 Writing for Academic English: A Brief Background

As was forecast in the introduction to this chapter, this section provides a brief background about writing for academic English, the domain within which this research is situated. In a review of the literature on writing for academic English, Tribble (2009) synthesised three major trends in contemporary English for academic purposes (EAP) writing instruction.

The first strand in the EAP writing tradition is the social/genre approach. Originating from the United Kingdom (UK), this approach stemmed from the dissemination of the English language to other educational cultures, and the massive influx of second language students entering UK higher education. In Australia, approaches to genre were situated within the field of systemic functional linguistics (which broadly concerns the relationship between language and how it functions in social situations). Systemic functional linguistics was the brainchild of distinguished UK scholar Michael Halliday, who subsequently founded the University of Sydney's department of linguistics in 1975, and became a catalyst for Australian linguistic theory and education (Hyon, 1996). The genre approach has drawn on seminal literature on register analysis (Halliday, McIntosh, & Strevents, 1964), and subsequent work on genre (Halliday & Hasan, 1985). Other foundational authors subscribing to this tradition include the works of Hyland (2004) on disciplinary discourses, and Swales (1990) on genre analysis.

The second strand in EAP writing instruction, the intellectual/rhetorical approach (composition studies), had its genesis in the United States in the 1960s and 1970s. This approach was adopted to address the widening participation in higher education, where students previously precluded from participating in higher education were required to have their literacy issues addressed. The influence of this approach has endured, as evidenced by modern textbooks and pedagogy that emphasise imitation of formal factual text organisation (Johns, 1990). Composition studies have strong underpinnings in the process approach to writing instruction as propounded by Flower and Hayes (1977).

The third tradition is referred to as *Writing in the Disciplines* in the United States and as *Academic Literacies* in the United Kingdom**.** Tribble (2009) attributes the close connection between both approaches to the rapidity with which significant transformations in the higher education sector in the US and the UK—and the associated changes to the student profile—have required equally swift responses. This tradition endorses the view that problems with student writing are the result of discrepant expectations between academic staff and students pertaining to what is involved in student writing (Lea & Street, 1998, 2006). Lea and Street (1998) acknowledge the impact on learners' personal identities when they are required to switch their academic literacy practices from one setting to the next. In particular, these requirements to conform to certain disciplinary writing requirements may be at odds with a student's identity, which in turn may cause a student to resist conforming to these writing conventions (Ivanic, 1998).

Of the three approaches, the social/genre approach (particularly the systemic functional linguistic pedagogy) is the one with the strongest emphasis on genre

acquisition (Johns, 2008) and the most replete with instructional frameworks (Hyon, 1996). Within the social/genre approach, systemic functional linguistic pedagogy—based on the premise that enabling students to first control and produce a few decontextualized 'key genres'—can enable students to generate more contextualised genres of a specific discipline (Johns, 2008). Hence, in concrete terms, there are strong expectations that teaching key genres will yield writing transfer at least with respect to genre acquisitions.

2.3 Writing Transfer, Threshold Concepts and Genre Knowledge

Before proceeding to examine the construct of writing competence, a key abstract phenomenon of interest being measured in this study, it is necessary to first review relevant literature on the three interrelated concepts of writing transfer, threshold concepts and genre knowledge.

The principles of writing transfer are governed by those of learning transfer which comprises "two sets of processes: initial learning, followed by reusing or applying what was learned" (Chi & VanLehn, 2012, p. 177). Perkins and Salomon (1992) observe that learning transfer is assumed to occur within the boundaries of a specific context, but also explore its impact beyond its contextual boundary confines. They describe transfer as a valanced concept, meaning that learning in one context can either improve performance in another (resulting in positive transfer) or degrade performance (resulting in negative transfer). Another dichotomous facet of transfer propounded by these authors is the concepts of 'near transfer' (the transfer of learning between similar contexts) and 'far transfer' (the transfer between contexts that seem vastly different).

There are two distinct mechanisms by which transfer occurs. As Perkins and Salomon (1992) explain, when the context the learner currently faces is similar to those encountered previously, 'low road' transfer with its routinised responses is triggered. Conversely, when the learner experiences a context perceived to be sufficiently different to previous situations, 'high road' transfer is mobilised. This latter mechanism requires purposeful mental effort and the deployment of higher order cognitive processes such as mindful abstraction from the learning context in an effort to discern patterns, needs, and principles that might apply (Perkins & Salomon, 1992).

2.3.1 Writing Transfer

Having outlined the principles of the transfer of learning more generally, this section of the chapter discusses transfer as it relates to writing. Moore (2017, p. 2) defines writing transfer as a "writer's ability to repurpose or transform prior knowledge about writing for a new audience, purpose, and context". Moore (2017) distils five core principles about writing transfer based on findings from 45 writing researchers from 28 institutions in five countries. This work was conducted between 2011 and 2013 and involved the participation of those in the Elon University's Critical Transitions: Writing and the Question of Transfer research seminar. The aim of this endeavour was to foster discussions about "recognizing, identifying enabling practices for, and developing working principles about writing transfer" (Moore, 2017, p. 1) . These principles as stated by Moore (2017, pp. 4-8) are:

> Principle 1: Successful writing transfer requires transforming or repurposing prior knowledge (even if only slightly) for a new context to adequately meet the expectations of new audiences and fulfill new purposes for writing.
>
> Principle 2: Writing transfer is a complex phenomenon and understanding that complexity is central to facilitating students' successful consequential transitions, whether among university writing tasks or between academic and workplace or civic contexts.

> Principle 3: Students' dispositions (e.g., habits of mind) and identities inform the success of their unique writing transfer experiences.
>
> Principle 4: University programs (first-year writing programs, writing across the curriculum programs, majors, etc.) can "teach for transfer."
>
> Principle 5: Recognizing and assessing writing transfer require using a mix of qualitative and quantitative methods looking at both critical transition points and longitudinal patterns of learning.

In short, writing is teachable and success depends on repurposing knowledge for various audiences, contexts and purposes; understanding its complexity; and recognising the individualistic nature of its acquisition. As a result, multimethod approaches are needed to discern writing transfer at critical junctures spanning the longer term (Moore, 2017).

Salomon and Globerson (1987) distil four intrinsic categories of factors that can thwart the process of learning a new skill, namely cognitive, motivational, personality and mindfulness. Cognitive factors are those that relate to difficulties in retrieving and producing, incorrect heuristics being applied and the misapplication of metacognitive strategies. Motivational factors may include mismatched expectations, learned helplessness, self-efficacy deficiencies or failure being misattributed inappropriately.

Personality factors include a variety of elements such as preferences for perceptual gestalt like cues, or inclinations towards data or theory. Finally, mindfulness, which is defined as "…the volitional, metacognitively guided employment of non-automatic, usually effort demanding processes" (Salomon & Globerson, 1987, p. 625), influences all three. As Salomon and Globerson (1987) argue, without approaching tasks mindfully during the learning and transfer processes, learner performance is

compromised irrespective of the knowledge gained. In other words, approaching a new task without mindfulness compromises all three preceding factors.

In an early comprehensive literature review on writing transfer, Mikulecky, Albers, and Peers (1994) concluded that the transfer of mindful strategies such as "summarizing, problem solving, studying, writing for multiple audiences, and editing" (p. 1) did not appear to be as routinised when contrasted with reading. This is unsurprising especially in light of the emergence of ideas that further explain the difficulties in achieving writing transfer, including the phenomenon of threshold concepts (Meyer & Land, 2003) as discussed in the next section.

2.3.2 Threshold Concepts

The idea of threshold concepts was first conceptualised by Meyer and Land (2003), with threshold concepts being seen as "a portal, opening up a new and previously inaccessible way of thinking about something" (Meyer & Land, 2003, p. 1). Thus, with their potential to transform learners' epistemologies, threshold concepts are much more than mere 'concepts', and can be troublesome for novice learners in any domain (Meyer & Land, 2003). The term 'troublesome' is defined by Meyer and Land (2003) as "knowledge that is conceptually difficult, counter-intuitive or 'alien'" (p. 1). Consequently, it is no wonder that the difficulties faced by learners travelling through these metaphoric learning portals can cause them to experience a state of 'liminality' as characterised by Meyer and Land (2003) as imitation or wanting for authenticity. Accordingly, the theory of threshold concepts provides a useful framework to understand the difficulties associated with achieving writing transfer.

Adler-Kassner, Clark, Robertson, Taczak, and Yancey (2017) have discussed five threshold concepts as they relate to writing studies which may be summarised as:

1. Writing is an activity and a subject of study.
2. Writing is always context-bound, with each context being unique.
3. Reflection is a critical aspect of a writer's development.
4. Awareness of different genres contributes to successful transfer.
5. Current writing experiences are shaped by a constellation of the learner's knowledge, attitudes, beliefs, and experiences.

2.3.3 Genre Knowledge

The consequence of the work of Adler-Kassner et al. (2017) on threshold concepts as discussed in the previous section supports the argument that genre and genre knowledge play a critical role in achieving writing transfer (Bawarshi & Reiff, 2010; Beaufort, 2007; Johns, 2011; Swales, 1990; Wenqi, 2019). Based on the seminal research of John Swales in the UK into the structuring of introduction sections of research articles, the use of the term 'genre' first came into prominence in the 1980s in the field of L2 writing, before it was applied to English for Specific Purposes (Paltridge, 2014). Subsequently, Swales (1990) provided a seminal definition for the teaching of genre based on his analysis of the move structures of text, where a move is defined as "a discoursal or rhetorical unit that performs a coherent communicative function in a written or spoken discourse" (Swales, 2004):

> …a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognised by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choice of content and style (p. 58).

This definition helped clear the confusion arising from the myriad of ways genre had been defined prior to this (Wingate & Tribble, 2012).

In the field of genre studies, this concept is underpinned by five claims. First, a genre's development of language and forms arise from shared rhetorical aims and contexts of a group of users. Second, the dissemination of ideas of this group of users produces common aims and social structures. Third, the acquisition of genre by new users reinforces existing aims and structures, and fourth, its existence strengthens institutional and cultural norms and ideologies. Finally, its alteration results in changes to common aims, structures, and norms (Devitt, 2009).

While this definition of genre may be taken to imply that students should develop competency in communicative practices within the specific genre of discipline, or English for Specific Academic Purposes, there are arguments for a more generic genre pedagogy. This stance as embraced by advocates of English for Generic Academic Purposes is based on the arguments that a common set of language features and skills are required across disparate disciplines, and the ease with which novice learners acquire such generic writing (J. Flowerdew, 2016).

Abundant evidence attests to the efficacy of using genre based frameworks to scaffold writing knowledge in generic academic settings (Bawarshi & Reiff, 2010; J. Flowerdew, 2015; L. Flowerdew, 2000; Hyland, 2004; Hyon, 1996; Johns, 1995, 2011; Swales, 1990). Indeed, the success of genre-based frameworks in teaching writing structures may be attributed to the field of cognitive psychology more generally, and schema theory particularly (Bartlett, 1932). Bartlett (1932), a cognitive psychologist, first defined schemata as "..organised models of ourselves that modify the impressions

produced by incoming sensory impulses…" (p. 200). This theory helps to explain how global knowledge from a given domain gives coherence to what would otherwise appear as a series of unconnected facts (Mandler, 1984). This knowledge of schemata has been applied in the teaching of writing (Beaufort, 2007; Johns, 1986).

Despite these arguments for teaching generic writing skills in a somewhat reductionist manner, opposition for teaching genre in this way has been deemed by some to be ineffectual due to the apparently tacit nature in which these multifaceted skills are acquired (Elton, 2010; Freedman, 1993). This line of argument is based on the work of Polayni (2009, p. 4) who stated: “we can know more than we can tell” to argue for the futility of conveying procedural knowledge declaratively. Nevertheless, the introduction of generic writing skills using frameworks is still arguably an efficient means of conveying these skills.

2.4 Operationalising Writing Competence

In light of the previous discussions about the factors associated with acquiring writing skills, namely the mechanisms by which writing transfer occurs, the acknowledgement of writing transfer as a threshold concept, and the importance of genre knowledge playing a critical role in achieving writing transfer, it is clear that operationalising writing competence is difficult (Sparks, Song, Brantley, & Liu, 2014). Whereas a few decades ago, the absence of paradigms in the field of writing had made writing competence difficult to operationalise (Mosenthal, 1983), the current challenge appears to be the variety of paradigms with divergent emphases. A logical way of operationalising writing competence was adopted by Knoch (2011) who taxonomised the concepts upon which writing may be evaluated based on theories and models of

writing assessment. It comprises eight categories namely accuracy, fluency, complexity, mechanics, cohesion, coherence, reader/writer interaction, and content.

A comprehensive definition of writing competence is adapted from the Council of Europe (2009): The ability to answer a task question relevantly in sufficient detail and length and in the appropriate register, include a wide range of contextually appropriate vocabulary without making grammatical errors, organise ideas logically with unity of theme and express ideas coherently through a range of appropriately connected sentence types, and to spell and punctuate writing without any errors.

Interestingly, the emphasis on aspects of writing competence development varies between instructor and student with respect to difficulties in EAP settings. In a Canadian study involving an EAP needs analysis of 432 EAL university students and their instructors (L.-S. Huang, 2010), the students were found to emphasise problems with the micro features of their writing such as grammar, accuracy and writing mechanics. In sharp contrast, the instructors recorded a much greater concern for the students' academic literacy features such as cohesion, coherence, topic development and their use of sources. Similar results were obtained in a Hong Kong study of 620 students and 88 instructors across five universities. In this study, the students again fixated on the micro features of their writing as contrasted with the instructors who were much more concerned with the academic literacy features in the students' writing (Lockwood, 2013).

As such, the decision of which writing competence elements to include in this study were made based on those deemed of most concern by instructors, specifically cohesion, coherence, topic development and the use of source material; and writing in

an academic style. Cohesion is defined as “meaning relations in text” (Halliday & Hasan, 1976, p. 4) while coherence refers to “the underlying relations that hold between assertions (or propositions), and how they contribute to the overall discourse theme (or macro-structure)” (Grabe, 1985, p. 110). Aspects of content (in particular topic development) and referencing are described by Grabe and Zhang (2013) as reading, interpreting and integrating complementary information through the act of summarising, synthesising, and responding critically to text input. Referencing is of particular importance for academic writing competence because although it is taught in some schools, it has often not been taught explicitly enough in secondary education (Stagg et al., 2013). This often results in plagiarism, an issue that is particularly problematic with second-language writers (Pecorari & Petric, 2014).

2.5 Writing Anxiety

The literature on writing anxiety, a key construct in this study, is discussed in this section. Writing anxiety is a term used synonymously with writing apprehension. It is conceptualised primarily as an emotion with psychological elements such as fear and dread; and physiological aspects such as sweating, digestive disturbances and trembling; which are triggered by the process of writing in an academic context (Petzel & Wenzel, 1993). These symptoms can present a significant obstacle for certain individuals given the complexities of writing for academic purposes (Salomon & Globerson, 1987).

Writing anxiety is predicted by the Yerkes-Dodson Law, where the performance of difficult tasks are impaired by high anxiety levels (Yerkes & Dodson, 1908). This finding was replicated approximately fifty years later by Broadhurst (1957). Both empirical

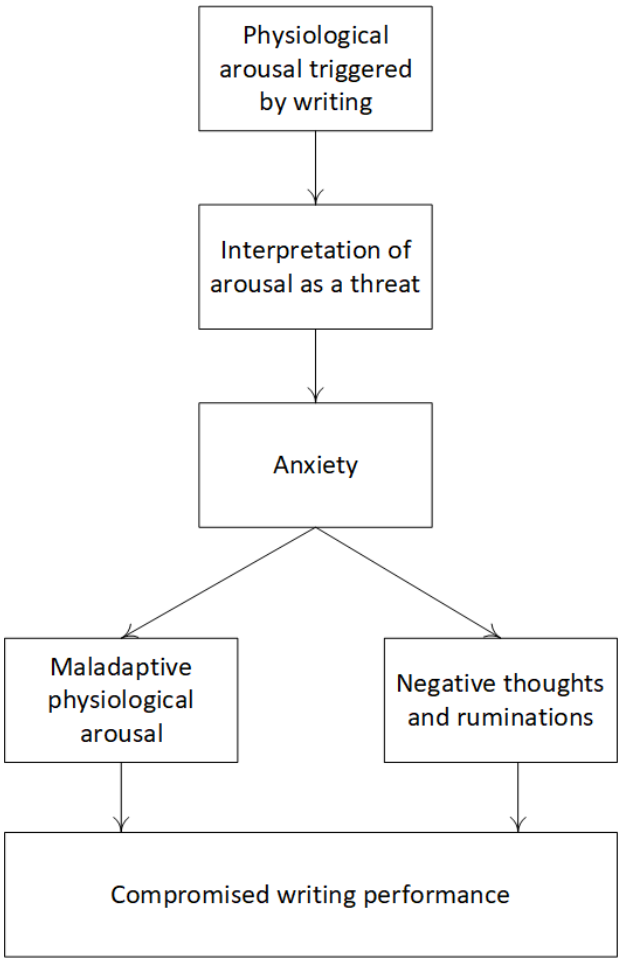
works have produced results that map to a curvilinear shape which only applies to difficult tasks (involving divided attention, demands on working memory, high complexity). With such complex tasks, low anxiety (arousal) decreases performance, but as anxiety increases, performance likewise increases, but only up to a point beyond which increasing arousal results in a progressive decline in performance. Additionally, this law finds a different relationship for simple tasks, where the relationship between arousal and performance increases and then plateaus (Diamond, Campbell, Park, Halonen, & Zoladz, 2007). Diamond et al. (2007) singled out the work of Broadhurst as being the only research that accurately represented the Yerkes Dodson Law in the 1950s. In contrast, many other researchers in the field of cognitive psychology at the time had erroneously misrepresented the curvilinear shape of the Yerkes Dodson Law as being universal to both simple and difficult tasks alike.

Writing anxiety, and its close cousin test anxiety, share common physiological and cognitive attributes with mathematics anxiety (Maloney, Sattizahn, & Beilock, 2014). As Maloney et al. (2014) explain, anxiety disrupts performance in two ways: First, it diverts neural activity away from cognitively demanding tasks in order to regulate physiological changes caused by the arousal. Second, it displaces cognitive resources used to perform the work through negative thought patterns and ruminations. This is illustrated in Figure 2.1. Hence, it is apparent that writing anxiety has been found to impede writing performance (Faigley, Daly, & Witte, 1981).

Additionally, writing anxiety is positively correlated with the belief that writing is an inherent attribute rather than something that can be developed through practice. A seminal study by Daly and Miller (1975c) involving 247 postsecondary students enrolled in an introductory writing course found that writing anxiety is related to the

belief that writing ability is associated with natural endowment or giftedness. Specifically, this study found that learners with higher beliefs in the idea that writing was a 'gift' registered higher levels on writing apprehension. However, these learners had lower levels in self-assessments of writing ability, confidence levels in becoming proficient in writing activities and genres, and self-assessments of prior experience with writing teachers (Palmquist & Young, 1992).

Figure 2.1 Physiological arousal interpreted as a threat rather than a challenge



Adapted from Maloney et al. (2014, p. 405)

2.6 Writing Self-efficacy

Writing self-efficacy is another key construct in this study. As a general concept, self-efficacy comprises two elements, namely outcome expectations, the conviction that specific outcomes will result from certain behaviours; and efficacy expectations, the belief that one can perform the behaviours necessary to produce the outcome (Eccles & Wigfield, 2002). Bandura (1997) theorised four salient sources of information that are appraised for an individual to derive self-efficacy beliefs. They are enactive mastery experience (learning through overt behaviour), vicarious experience (learning by observing others), verbal persuasion, physiological, and affective states as ordered from most to least influential.

Writing self-efficacy beliefs have consistently been shown to correlate with writing performance (Pajares, 2003; Pajares & Johnson, 1996). However, this applies specifically to *skills efficacy*, that is self-efficacy for generic writing skills associated with any writing task, for example spelling, punctuation, and paragraph construction (Troia, Shankland, & Wolbers, 2012). This can be contrasted with writing task efficacy, which is the use of just one writing task as a criterion measure in studies of writing self-efficacy (Troia et al., 2012). In this study therefore, writing self-efficacy refers to skills efficacy.

Writing self-efficacy has also been broadly conceptualised to consider a larger body of prior research encompassing the psychological and linguistic features of the writing process. This has resulted in a *multifactor* embodiment of this construct to include three domains, namely generating ideas (ideation), expressing those ideas using written language related tools (conventions), and managing writing decisions and

behaviours (self-regulation) (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013).

Writing competence, writing self-efficacy and writing anxiety have been shown to influence one another. For example, in his review of the literature on self-efficacy beliefs, motivation and writing achievement, Pajares (2003) noted the relationship between writing self-efficacy and writing competence. However, the correlations between both variables have not been high due to the use of holistic as opposed to analytic scoring of the essays, as the latter is much more revealing in its ability to detect fine-grained changes to writing competence (Bacha, 2001). Pajares (2003) further stated that when writing self-efficacy beliefs are controlled, the influence of apprehension is nullified, and hence consistent with Bandura's hypothesis that anxiety is mediated by self-efficacy beliefs. In other words, anxious feelings are the result of a student's confidence in approaching a task (Pajares, 2003). Additionally, in his review of 16 studies examining writing self-efficacy among young adolescents, Klassen (2002) found that a large number of studies showed a negative relationship between writing anxiety and self-efficacy.

Having discussed the key constructs upon which the dependent variables in this study are based, the next sections in this chapter discuss the literature informing the APA design decisions made in this study, specifically pertaining to the use of scaffolded questioning, motivational support, and affective phenomena, cognition and emotional support.

2.7 Scaffolded Questioning

It has long been observed that novice learners in any domain often do not initiate questions, as they lack awareness of gaps in their knowledge compared with more experienced learners (Glenberg et al., 1982; Miyake & Norman, 1979; Pressley et al., 1990). This phenomenon was subsequently explored by Kruger and Dunning (1999) through a series of four studies in three domains (English grammar, logical reasoning and humour) emphasising either knowledge, wisdom or savvy. Irrespective of testing domain, people at the bottom quartile of each were found to grossly overestimate their abilities and test performances. Kruger and Dunning (1999) attributed this to metacognitive skill deficits. Dubbed the *Dunning Kruger effect* (Dunning, 2011), this phenomenon was paradoxical because as participants improved their skills, and correspondingly increased their metacognitive abilities, their awareness of their own limitations increased (Kruger & Dunning, 1999).

This observation is congruent with that of the conscious competence learning model proposed by the US Gordon Training International organisation (Janus, n.d.). Under this model, the learner progresses through a number of stages as part of the learning process: Stage 1–unconscious incompetence, Stage 2–conscious incompetence, Stage 3–conscious competence, and Stage 4–unconscious competence (Janus, n.d.). Accordingly, most novice learners are believed to be at Stage 1 and as such, are in a position where they are unaware of areas in need of development. This *metacognitive knowledge dilemma,* as referred to by Land (2000), prevents the learner from asking the right questions due to low prior domain and metacognitive knowledge. This is problematic, because it has been shown that the act of questioning when initiated by learners can serve to engage reflective thinking (I. Choi et al., 2005; Scardamalia &

Bereiter, 1991). Indeed, in a number of empirical studies, researchers found that when university students viewed video dialogues between teacher and student as contrasted to watching lecture style monologue videos, these students actually learned more (Chi, Kang, & Yaghmourian, 2017; Fox Tree, 1999; Muldner, Lam, & Chi, 2014).

This superior learning derived from witnessing dialogues, could be explained by the Active-Interactive-Constructive-Passive (ICAP) conceptual framework proposed by Chi (2009). Chi (2009), operationalises the 'interactive' mode by learners dialoguing substantively on the same topic (for example responding to scaffoldings, revising errors from feedback, co-constructing activities, arguing, defending, confronting or challenging) and it engages jointly creating cognitive processes. Next, the 'constructive' mode is operationalised by activities that produce outputs that transcend the information provided in the instruction (for example explaining or elaborating, justifying, connecting, mind mapping, reflecting, planning or generating hypotheses) and engages the creating cognitive processes (Chi, 2009). Following on from this, Chi (2009) operationalises the 'active' mode as the performance of activities by the learner in interacting with the instructional materials (for example gazing, underlining, gesturing, or paraphrasing) and engages attending cognitive processes. Finally, the 'passive' mode is characterised by the absence of any activity related to the instructional material aside from attending to it (Chi, 2009). Empirical work by Chi et al. (2017) validated the prediction that interactive activities are more effective than constructive activities, which are in turn more effective than active activities, which are superior to passive activities (I>C>A>P hypothesis).

Given that novice learners stand to benefit from witnessing dialogues, yet are inhibited from formulating their own questions, teachers can use questioning to scaffold

learning. Resier (2004, p. 274) defines the traditional view of *scaffolding* as "the process by which a teacher or more knowledgeable peer assists a learner, altering the learning task so the learner can solve problems or accomplish tasks that would otherwise be out of reach." This idea originates from Vygotsky's (1978) conception of the zone of proximal development (ZPD) which is the developmental gap between the level of learning that individuals can achieve on their own and one that can be accomplished through interaction and cooperation with others.

As distinct from the traditional views of scaffolding described above, Reiser (2004) explains how technological tools can be used to deliver scaffolding functions, naming two mechanisms that are used to scaffold complex tasks: structuring and problematising. Whereas structuring involves deconstructing complex tasks, problematizing concerns highlighting discrepancies between actual and expected task performances.

It may be argued that the use of questioning to scaffold learning is a form of problematising for novice learners and may help them recognise gaps in their knowledge to know what questions to ask. Some examples of effective question types are those that elicit past knowledge, test learner comprehension, provide subtle hints, elicit deeper reasoning; and those that encourage learners to contrast ideas, apply concepts, and elaborate on causal relationships (Roscoe & Chi, 2007). These examples serve to illustrate that the *type*s of questions asked are important considerations for learning to occur.

In their summary of the taxonomy of questions, Tofade, Elsner, and Haines (2013) reviewed Bloom's Taxonomy of educational objectives (1984) pertaining to questioning

strategies. They argued that question prompts eliciting responses in the knowledge, comprehension, and application domains (lower order questions) were less suited to eliciting deeper and critical thinking when compared with analysis, evaluation and synthesis (higher order) questions. Indeed, the use of question prompts have been found helpful in enhancing content learning of secondary students (Bulgren, Marquis, Deshler, Lenz, & Schumaker, 2013; Bulgren, Marquis, Lenz, Deshler, & Schumaker, 2011).

Additionally, research has shown that elaborative interrogation which uses *why* questions in order to help learners assimilate new knowledge by getting them to link this to previous knowledge is beneficial for learning facts (McDaniel & Donnelly, 1996; Woloshyn, 1992). Furthermore, King (1992, 1994) reported on a line of research using a guided student questioning strategy to scaffold students to ask thought provoking questions and to generate elaborate explanations which were found to improve comprehension. This strategy involved the use of *question stems*, or beginnings of open-ended questions. The effectiveness of utilising varied question stems to scaffold student comprehension was attributed to the myriad of ways that such scaffolds are able to elicit multiple and novel neural stimuli, which in turn increase the number of pathways between the short-term and long-term memory infrastructure for encoding (King, 1992). The list of generic question stems used in this line of research are listed in Table 2.1. Taken together, these examples illustrate that scaffolded questions can be powerful in fostering learning.

Table 2.1 Generic question stems

Question stems
What is a new example of…..?
How would you use … to …?
What would happen if…?
What are the strengths and weaknesses of …?
What do we already know about…?
How does … tie in with what we learned before?
Explain why …
Explain how …
How does … affect … ?
What is the meaning of … ?
Why is … important?
What is the difference between … and … ?
How are … and … similar?
What is the best … and why …?
What are some possible solutions for the problem of … ?
Compare … and … with regard to …
What do you think causes … ?
Do you agree or disagree with this statement …? Support your answer.

(King, 1992)

In recognition of the importance that questioning plays in learning and the difficulties faced by novice learners in framing meaningful questions, researchers have harnessed virtual means within multimedia environments to model effective questioning behaviours. These environments, termed vicarious learning environments, are defined as “those in which the learners see or hear content for which they are not the addressees and have no way of physically interacting with the source of the content they are attempting to master” (Craig, Sullins, Witherspoon, & Gholson, 2006, p. 566). This is achieved by embodying APAs into teacher and student personas, with the learner ‘eavesdropping’ on these dialogues. These dialogues specifically involve the student APA asking the teacher APA questions with the aim of increasing the learner's domain knowledge, while simultaneously improving the ability to ask questions. In one such study by Craig, Gholoson, Ventura, and Graesser (2000), learners observing a

dialogue between a questioning student APA (posing a series of 66 questions over eight topics), and a tutor APA–outperformed their counterparts overhearing a monologue (where the student only asked one question per subtopic, with the content embedded within the tutor APA's response). In this study, it was found that learners in the dialogue conditions "wrote significantly more in free recall and asked significantly more questions in a transfer task than those who overheard a monologue" (Craig et al., 2000, p. 242). This result was attributed to the power of vicarious learning.

2.8 Motivational Support

As previously mentioned in Section 2.6, self-efficacy is an important predictor of success in academic writing, and may be fostered through enactive mastery experiences, vicarious experiences, and verbal persuasion. Enactive mastery experiences, or situations where a person takes action to achieve a desired outcome, are deemed by Bandura (1997) as the most influential source of efficacy information because they provide the most legitimate feedback of success. However, an individual can also obtain information for self-efficacy appraisals vicariously through observing others' attainments, or through being persuaded verbally (Bandura, 1997).

2.8.1 Vicarious Experiences

The idea of vicarious experiences increasing self-efficacy is supported by a strong research base in psychology. In his seminal study on the topic, Meichenbaum (1971) investigated the effectiveness of models demonstrating *mastery* versus *coping* behaviours to reduce the participants' aversion to snakes. The 36 study participants were randomly allocated to one of four conditions, with each participant viewing a series of three videos. In the two mastery conditions, participants were shown three

video recordings of individuals modelling the effective handling of snakes (one video with the model verbalising her approach behaviour and interaction with the snake); while in the two coping conditions, participants viewed three video recordings of the individual progressing through fearful, coping and finally mastery behaviours (again one with verbalisations, and the other without). The coping group was found to significantly exceed its mastery counterparts in the reduction of avoidance behaviours, and fear arousal, with the self-verbalisations subgroup outperforming the non-verbalisations counterpart.

Schunk, Hanson, and Cox (1987) applied coping and mastery modelling to the education context, specifically to the teaching of fractions in children with low mathematics ability. Both experiments demonstrate that the children who observed the coping model when compared with those who observed the mastery model, developed higher self-efficacy for learning, performed better, achieved higher training performance, attained superior post self-efficacy and skill, and equated their competence to that of the model (Schunk et al., 1987).

2.8.2 Verbal Persuasion

Similarly, verbal persuasion has been found to increase self-efficacy. However, only a specific type of verbal persuasion is of interest in this study, namely using persuasive messages to support the view that intelligence is not static and can be increased. The view that intelligence is a fixed trait is referred to as an *entity theory,* and that it is a quality that can be modified is called an *incremental theory* (Dweck, 1999, 2006; Dweck & Leggett, 1988). The power of incremental theory messages to change behaviour has been observed in the way in which a goal is framed in a learning environment, the way it influences the learner's experiences of the learning task, and

the way meaning is assigned to learning opportunities (Elliott & Dweck, 1988). Specifically, goals that emphasise the value of *performance* were found to cause learners who perceived they had low ability to respond to feedback about mistakes with a constellation of learned helplessness attributes (perceiving they lacked ability, manifesting negative affect, and not persisting in overcoming those mistakes). Conversely, goals emphasising the value of *learning* resulted in learners seeking to increase their competence, opting for more challenging tasks, and not passing up opportunities to acquire new skills (Elliott & Dweck, 1988).

These goal orientations have been conceptualised in several ways to illustrate their dichotomous nature. These include *mastery* versus *performance* goal orientations (Ames, 1988, 1992); *task* versus *ego* goal orientations (Nicholls, 1984); and *learning* versus *performance* goal orientations (Dweck, 1986). The first orientation in each of these pairs (mastery/task/learning) focuses on knowledge, skill attainment, competence improvement and achievement. In contrast, the second orientation in each pair (performance/ego) emphasises ability demonstration, attainment of recognition, and outperforming others (Ames, 1992; Dweck, 1986; Nicholls, 1984). Overall, these authors have found the superiority of incremental theory over entity theory in yielding more positive learning outcomes. However, others have argued that this dichotomy may be too simplistic, and that the performance/ego orientations should be further differentiated into self-enhancing and self-defeating ego orientations (Seegers, Van Putten, & Vermeer, 2004). Table 2.2 summarises the characteristics of both major goal orientations.

Table 2.2 Characteristics of entity and incremental theorists

	Entity theorists	**Incremental theorists**
Goal orientations	Mastery Task Learning	Performance Ego
Goal focus (GF)	Documenting ability	Increasing ability
Effort orientation (EO)	Futility of effort is emphasised given low ability	Utility of effort is emphasised
Failure attributions (FA)	Low ability and helplessness	Low effort
Strategies displayed (SD)	Helpless strategies e.g. through withdrawal of effort or preservation of unsuccessful strategies	Adaptability oriented strategies e.g. through effort escalation or strategy change

Adapted from Blackwell and Trzniewski (2007)

In an important longitudinal experimental study that spanned two years (Blackwell et al., 2007), incremental ability belief messages were provided to high school students navigating mathematics education. The first study in the series predicted an increased trend in high school grades, in contrast to the control group that was not provided with these messages (Blackwell et al., 2007). This study found positive correlations between incremental theory and positive effort beliefs, learning goals, low helplessness attributions and positive strategies respectively.

In the second study in the series, incremental ability belief messages were used to convince participants in the experimental group that intelligence was malleable through persuasive messages embedded into an article “You Can Grow Your Intelligence”. This article emphasised brain neuroplasticity and the generation and strengthening of connections between nerve cells and discernible changes to brain physiology because of learning. After reading this article, participants were led in a discussion requiring them to recall successful learning encounters experienced through

practice. In contrast to the control group, the experimental group registered higher classroom motivation, with a trend of reversing decline in grades (Blackwell et al., 2007). Consequently, Blackwell et al. (2007) demonstrated the efficacy of verbal persuasion to influence a learner's cognition in order to increase motivation by using messages emphasising a growth mindset.

This positive association between mastery goals and students' performance on learning tasks has been found to translate to the realm of writing. In a salient study into the belief that writing is a natural endowment or gift possessed by some but not others, Palmquist and Young (1992) found that undergraduate students with the belief that writing ability is a natural endowment or gift registered higher levels of apprehension about their writing, possessed lower self-assessments of their writing ability, and had lower levels of confidence at the prospects at achieving proficiency in writing (Palmquist & Young, 1992).

2.9 Affective Phenomena, Cognition and Emotional Support

As previously mentioned in Section 2.5, writing anxiety is a key construct in this study. It has been conceptualised as an emotion and important predictor of success in academic writing. This section first clarifies the four categories of affective phenomena, then explains how affective phenomena can influence cognition, and finally discusses relevant literature on the emotional support mechanisms underpinning this study.

2.9.1 Affective Phenomena

Affective phenomena comprise four interrelated concepts: feelings, emotion, affect and mood (Ekkekakis, 2013). A *feeling* is described by Shouse (2005) as a sensation

that is unique to the person experiencing it, because it has been referenced against that person's previous subjective experiences and catalogued accordingly. Stated differently, feelings are triggered by cues that are usually subtle and obscure and require personal interpretation of the meaning of these cues (Frijda, 1988, p. 71).

Feelings, as experienced by a person, are displayed as emotions (Shouse, 2005). In particular, *emotions* are the tendency to enact expressive behaviour (termed action tendencies) in response to specific events (Frijda, 1988) and are characterised by brevity, intensity of shorter duration, and the cognisance of the person experiencing them (Ferguson, 1992). As such, this broadcast may be a direct expression of inward feelings but at other times, it could be feigned with the aim of fulfilling social expectations (Shouse, 2005). Emotions are capable of being passed on to people, a phenomenon termed emotional contagion (Hatfield, Cacioppo, & Rapson, 1993).

The next affective phenomenon, *affect,* is defined as "a pre-conceptual primitive process, a neurophysiological state, accessible to consciousness as a simple non-reflective feeling: feeling good or bad, feeling lethargic or energised" (Russell, 2009, p. 1264). Thus, affect is experienced as a precursor to and/or outside of consciousness, and these abstract properties make affect the most difficult to conceptualise (Shouse, 2005).

The final affective phenomenon, *mood*, is characterised by subtlety, continuity, intensity that is low and diffused with the ability to influence mindsets and to colour personal experiences positively or negatively (Ferguson, 1992). It has been observed that most psychological experiments on mood have tended to manipulate the positive or negative mood states (Fiedler, 2001; Forgas, 2008).

Taken together, any learning design that does not consider the impact of these affective phenomena on learner cognition will undoubtedly limit its effectiveness.

2.9.2 Affective Phenomena and Cognition

It was not until the 1980s that psychologists became aware of the influence of affective phenomena on cognition. This was due to the legacy of the Greek philosophers such as Plato, who believed that affective phenomena compromised rational thought (Forgas, 2008). However, over time, empirical support about the inseparability of affective phenomena and cognition began to emerge. An example of this is an important study by Bower (1981) who demonstrated that memory can be influenced by affective states experienced at the time of encoding. Other notable examples began to emerge over the same decade where researchers found that positive mood states favourably affected information processing style (Isen, Johnson, Mertz, & Robinson, 1985), and observed that learners appraise the potential positive or negative affect that a learning event can produce before deciding on whether to exert effort towards learning generally (Boekaerts, 1988), and literacy in particular (Csikszentmihalyi, 1990).

However, it was not until approximately the 2000s that learner emotions began to receive sufficient research attention in academic settings (Pekrun & Linnenbrink-Garcia, 2012). In multimedia instruction, there had been some acknowledgement of its importance, particularly with respect to anxiety (Frasson & Chalfoun, 2010; Graesser et al., 2008). Instead, the emphasis had been on human information processing and cognition (Pekrun & Linnenbrink-Garcia, 2012) as evidenced by the prominence in multimedia theories of the Cognitive Theory of Multimedia Learning (Mayer, 2005b)

and the Cognitive Load Theory (Paas, Renkl, & Sweller, 2003, 2004; Sweller, 2005; Sweller, Van Merrienboer, & Paas, 1998) in multimedia research.

In multimedia learning, and not unlike the Platonic scepticism of affective phenomena, learner emotions, whether positive or negative, had been considered 'seductive detail' (extraneous material added to the core instructional material to add interest, but which instead reduces learning) (Harp & Mayer, 1998). This is based on the premise that emotions induced by multimedia lessons can cause the learner to experience affective arousal, thereby distracting them from learning. However, this does not seem to be a strong argument because the seductive detail effect has not been proven in a number of subsequent studies of multimedia designs that have attempted to manipulate emotions and where comparable or better learning outcomes have been obtained with emotional designs (Mayer & Estrella, 2014; S. Park & Lim, 2007; Um et al., 2012).

Nevertheless, where such emotional (or for that matter, motivational) supports are provided in a multimedia lesson, but are perceived by the learner as unnecessary to their learning of the core material, these supports could be classified as seductive detail. Compounding this problem is the likelihood of such emotional and motivational supports extending the duration of the lesson time, which could magnify the seductive detail effect particularly for lessons where time limits are imposed. In fact, in a meta-analysis investigating the seductive detail effect (Rey, 2012), this effect was found to be associated with conditions where time limits were imposed, thereby degrading retention and transfer outcomes when compared to self-paced studies.

2.9.3 Emotional Support

Emotional support in multimedia instructional designs may be provided proactively or retrospectively. Proactive emotional supports are provided with the intent of reducing negatively valanced feelings, and concurrently increasing positively valanced ones to promote an optimal emotional ambience to facilitate learning. An example of this is the Fear, Envy, Anger, Sympathy, Pleasure (FEASP) approach (Astleitner, 2000, 2001). This approach uses instructional strategies intended to reduce negatively valanced feelings (fear, envy and anger) and correspondingly increase positively valanced ones (sympathy and pleasure) in educational settings.

According to this framework, feelings of *fear* arise from the subjective judgement of a situation as threatening or dangerous; *envy* surfaces with the desire to covet that which is possessed by others or to retain what is in one's possession; *anger* materialises when one's goal aspirations are thwarted or when compelled to perform an additional action; *sympathy* manifests when there is an orientation towards others needing support; and *pleasure* is elicited from learning mastery dedication (Astleitner, 2000).

In order to arrive at the five categories of the FEASP approach, Astleitner (2000) first decided on two major inclusion criteria. First, the chosen approach would only include emotions and feelings (thereby excluding moods as they are diffuse, weak, enduring, and difficult to attribute causation to). Second, it would only include feelings satisfying the following four sub-criteria: derivative of theory of emotions utilising a dimensional approach (e.g. Plutchik, 1984), short term in duration, vital to the social aspect of the instruction or institution, and without any overlaps with cognitive or motivational learning design approaches (Astleitner, 2000). The author then conducted a literature

review by applying a taxonomy recommended for classifying literature reviews for the behavioural and physical sciences (Cooper, 1988; Cooper & Hedges, 1994), thereby arriving at the following decisions for his review:

- Focus–primarily on practices or applications in instruction (over research outcomes, methods, or theories).
- Goal–integration and identification of central issues in the field of emotion and instruction (as opposed to integration or criticism).
- Coverage–representative (as opposed to exhaustive).
- Organisation–conceptual (instead of historical or methodological).
- Audience–instructional designers and practitioners (as opposed to scholars, policy makers or the public) (Astleitner, 2000).

Astleitner (2000) subsequently arrived at the five FEASP categories for implementation by instructional designers, each with five associated emotional strategies for producing emotionally sound instructions, as displayed in Appendix A. The FEASP approach has been validated empirically in two studies (Astleitner, 2000, 2001; Sztejnberg, Hurek, & Astleitner, 2006) and was also deemed appropriate for use in electronic learning environments (Astleitner & Leutner, 2000). However, despite its claims and appeal as an intuitive, theory informed, and systematic approach to designing emotional instruction, C. M. Kim and Pekrun (2014) noted that fourteen years after its publication, this approach had yet to be implemented in further empirical studies. This may be due to the pragmatism of operationalising the 20 FEASP sub-strategies (given the myriad of subcategories), and the fact that the intended primary audiences for this framework are instructional designers and practitioners (as opposed to researchers), who are possibly less likely to publish empirical results about the efficacy of this

approach than are researchers. Despite the dearth of research using this approach, Ültanır and Irkörücü (2017) encourage educational researchers to validate this framework through empirical studies.

In contrast to providing proactive emotional support to enhance positive feelings, retrospective emotional support is provided in response to negatively valanced feelings experienced by a learner. Accordingly, this type of emotional support is provided *after* such feelings are experienced. To this end, Carver, Scheier, and Weintraub (1989) developed a multidimensional inventory of coping to assess the various ways that individuals respond to stress. Using this inventory, they developed 13 conceptually different scales, and grouped them into three major categories:

- Problem focussed coping (active coping, planning, suppression of competing activities, restraint coping, seeking of instrumental social support).
- Emotion focussed coping (seeking emotional social support, positive reinterpretation, acceptance, denial, turning to religion); and
- Less useful coping responses (focus on and venting of emotions, behavioural disengagement, and mental disengagement).

Having discussed the context of writing for academic purposes and the underpinning theories informing dependent and independent variables in this study, the final section of this chapter reviews the literature on APAs incorporating theories discussed in the preceding sections.

2.10 Animated Pedagogical Agents

An APA is defined as a computerised persona that guides the learner through multimedia learning environments (Craig et al., 2002; Heidig & Clarebout, 2011) by

focusing attention and providing instructions (S. Choi & Clark, 2006). Arguably, visibility is an important prerequisite for a persona being classified as an APA, as embodiment endows it with social affordances (Baylor & Ryu, 2003; Mayer & DaPra, 2012; Rosenberg-Kima, Baylor, Plant, & Doerr, 2008). Levels of embodiment can range from the simplicity of static figures that only provide textual responses to considerably more authentic three-dimensional anthropomorphisations that mimic human speech and body language. APAs are devoid of artificial intelligence, but may work in tandem with intelligent tutoring systems (ITS) for customised lesson delivery (Schroeder, Adesope, & Gilbert, 2013). In order to be considered a true ITS, the software is required to present content and tasks to the learner by adapting to each learner's emergent level of knowledge within a particular task domain (VanLehn, 2006). Whereas in the past, the design and deployment of APAs into learning environments had been time and resource intensive, these limitations have largely been overcome by the evolution of APA software that is more user-friendly (Schroeder & Adesope, 2012).

2.10.1 APA Benefits and Affordances

APAs can be used effectively in multimedia learning environments because they augment the framework referred to as the Computers as Social Actors framework (Reeves & Nass, 1996), which is the tendency for people to interpret their interactions with computers or computer mediated personas as social interactions.

Also referred to as the media equation, empirical support for this hypothesis has come from an eye tracking study of an ITS with an embedded talking head APA (Louwerse, Graesser, McNamara, & Lu, 2009). In this study, the screen was partitioned into four: The APA on the left of the screen, a text box with a question on a horizontal window above the APA, a window with a graphic display of the components of the computer

system pertaining to the main question, and a text box below the APA for students to type their answers. This study found that the learners spent 56% of the time focussing on the APA's face, and particularly in the eye region compared with the other facial areas as found in previous research (Gullberg, 2003), even though the window in which the APA appeared only occupied 28% of display. This was a significant finding because it provides empirical evidence supporting the predominance of the human face (particularly the eye area) combined with vocalisations as the focus of visual attention. This finding therefore implies that learners in this study perceived the APA as a conversational partner in the sense of an authentic human face-to-face interaction (Louwerse et al., 2009).

The following benefits gained from incorporating APAs into a learning environment have been reported in various empirical studies:

- Improved retention (Clarebout & Elen, 2006; Dunsworth & Atkinson, 2007; Holmes, 2007; Moreno, Mayer, & Lester, 2000; Moreno, Mayer, Spires, & Lester, 2001).
- Increased transfer of learning (Ahmadi, Sahragard, & Babaie Shalmani, 2017; Holmes, 2007; Lusk & Atkinson, 2007).
- Enhanced recall (Lee et al., 2007).
- Changed attitudes (Plant, Baylor, Doerr, & Rosenberg-Kima, 2009).

From these findings, it may be surmised that embedding a lifelike personality into a computerised learning environment generates more favourable learning experiences, and therefore results in higher learner engagement, a phenomenon that has been referred to variously as the *persona effect* (Lester et al., 1997; Moreno et al., 2001), *personal-agent effect* (Moreno et al., 2000), and *the embodied agent effect* (Atkinson,

2002). Irrespective of terminology, the key notion is that this effect motivates learners to become more engaged with the learning task, which in turn drives them to exert more effort in their learning (Lester et al., 1997; Lusk & Atkinson, 2007). It is noteworthy that the persona effect has not only been observed in lessons with APAs possessing lifelike images, but even using those devoid of facial expression have had a beneficial effect on the learner's experience (Craig et al., 2002). Furthermore, the animation aspect makes APAs to be perceived by learners as 'instructor like' (Baylor & Ebbers, 2003). So powerful has this phenomenon been on learner perceptions of their learning experiences that Baylor and Ebbers (2003) developed and validated the Agent Persona Instrument (API) to assess agent persona according to perceptions of the extent that they facilitate learning, are credible, approach human-likeness and are engaging.

On account of this, it may be argued that through their interactions, these digital personas provide several affordances for the learners who engage with them. The idea of affordances was first elucidated by Gibson (1979) who conceptualised it as a property relevant to the organism it supports, and similar to Gestalt psychology, posits that the value or meaning of an object is perceived as any other attribute of the object. However, contrary to Gestalt psychology, the affordance of the object is immutable whether or not it is perceived by the organism (Gibson, 1979). Later, this definition was refined to mean a relationship between the object's properties, and the person's capabilities that establish the object's potential use (Norman, 1988, 2013).

The idea that APAs afford socialisation to learners is analogous to the notion that a baseball affords throwing, and an apple affords being eaten (Gibson, 1979). Accordingly, It is not surprising that the socialisation afforded by APAs benefits

learners in a myriad of ways that are continually being discovered, particularly in increasing enjoyment of a lesson and reducing perceptions of difficulty regardless of any similarities in performance between APA and non-APA groups. These outcomes have been noted in several empirical studies ranging from the deployment of APAs to provide feedback on algebraic problem solving (Moundridou & Virvou, 2002), the comprehension of technical content (pulley system operations) (Andre, Rist, & Muller, 1999), and the recall of nontechnical information (van Mulken, Andre, & Muller, 1998).

2.10.2 APA Design Taxonomy

Since their inception by Walker, Sproull, and Subramani (1994), APAs have been used to facilitate learning in a vast array of domains, including reading and writing (Allen, Jacovina, & McNamara, 2016; Johnson, McCarthy, Kopp, Perret, & McNamara, 2017), biology (Lester et al., 1997), engineering (S. Choi & Clark, 2006; Plant et al., 2009; Rosenberg-Kima et al., 2008) environmental science (Craig et al., 2002), mathematical problem solving (Atkinson, 2002; Lusk & Atkinson, 2007), English idiom (Ahmadi et al., 2017; Lee et al., 2007), summary writing (Li & Graesser, 2021) and neuroscience (F. Wang, Li, Mayer, & Liu, 2018).

The variety of disciplines where APAs have been deployed is matched only by the multiplicity of forms that they embody; for example, smiley faces (Okonkwo & Vassileva, 2001), animated insects (Lester et al., 1997; Moreno et al., 2000), birds (Atkinson, 2002; Lusk & Atkinson, 2007), rudimentary animated human forms (Baylor & Ryu, 2003; S. Choi & Clark, 2006; Craig et al., 2002), and more authentic animated human forms (Baylor & Kim, 2005; Baylor & Plant, 2005; Domagk, 2010; Li & Graesser, 2021; Mayer & DaPra, 2012; Ozogul, Johnson, Atkinson, & Reisslein, 2013; Plant et al., 2009; Rosenberg-Kima et al., 2008).

There has been a growing interest in, and recognition of, the influence of the appearance of APAs on learners (Baylor, 2009; Baylor & Plant, 2005; Baylor, Shen, & Xiaoxia, 2003; Domagk, 2010; Ozogul et al., 2013; Rosenberg-Kima et al., 2008; Van vugt, Bailenson, Hoorn, & Konijn, 2010). Moreno (2005, p. 508) defines an APA's external attributes as its "visual and auditory presence, which are social features that are hypothesized to affect learning by making the learning experience more interesting, believable, or natural", and their internal attributes as "those that determine the actions or instructional methods that the APA may carry out during its interaction with a student to facilitate or enable learning…" (Moreno, 2005, p. 508).

There have been a number of approaches proposed in which to classify the ways APAs may be designed, ranging from relatively simple dimensional approaches to much more elaborate taxonomies. Strafling, Fliescher, Polzer, Leutner, and Kramer (2010) illustrate three design dimensions upon which an APA can vary in appearance along three intersecting continuums. These authors identify three bipolar dimensions: anthropomorphism versus zoomorphism; level of approximation to authenticity versus cartoonification; and hyperrealism versus low resolution.

While this model is a useful schematic to visualise some APA design variables available for manipulation, it is far too simplistic. Indeed, operationalising APA design decisions require a more granular and systematic framework. To this end, Domagk (2010) conducted a systematic review and synthesis of APA design literature with the aim of designing a comprehensive taxonomy of APA design considerations. This culminated in the Pedagogical Agent's Level of Design model which delineates three levels of considerations that may be used to guide APA design. These are in turn organised into a series of cascading decisions: The superordinate *global* level, that characterises the

APA as either human or nonhuman; the subordinate *medium* level, which concerns decisions about the level of technical decisions and choice of character; and the sub-subordinate *detail* level, which concerns the finer external attributes of the APA. This model was subsequently elaborated on by the original author Heidig (nee Domagk) and Clarebout (2011).

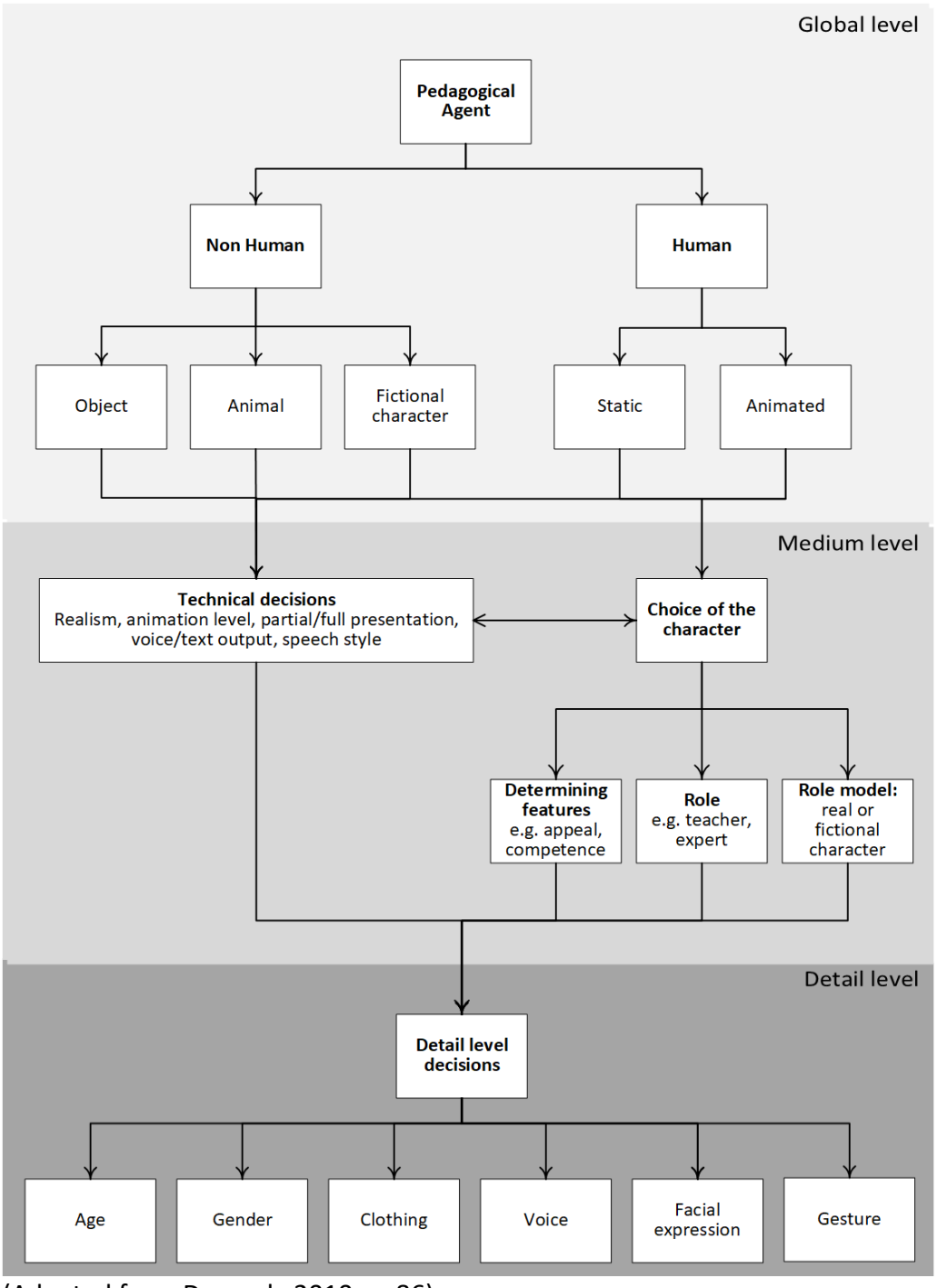
The Pedagogical Agent's Level of Design model (Domagk, 2010) has been adapted for use as an advanced organiser in this thesis to structure the discussion of the design aspects of the APAs deployed in this study, albeit with some minor amendments. Specifically, at the global level, the box with the text 'video of a real human' was removed because the use of an authentic human video is not strictly an APA by definition, as it is not a 'computerised persona'. Also, at the medium level, the term 'life-likeness' was subsumed into 'realism' because they are sufficiently synonymous. Finally, at the detail level, additional elements were added such as facial expression and gesture which are in accordance with Domagk's (2010) recommendation to expand these variables as guided by the requirements of the superordinate levels. The refined schema that guides the APA design considerations in this study is illustrated in Figure 2.2.

2.10.2.1 The Global Level

At the *global level*, decisions are made which involve character choices between human or nonhuman agents (Domagk, 2010). Related to this decision is the choice of whether to animate the agent or to use a static image. In prior studies comparing both animated and static agents, the former has been found to produce higher transfer scores (Lusk & Atkinson, 2007; Mayer & DaPra, 2012) and has been perceived as more engaging and instructor-like (Baylor & Ryu, 2003) when compared with the latter.

Interestingly, humanlike characters have also been found to possess more favourable personality attributes such as being more likeable, appropriate, and trustworthy compared with their more cartoon-like counterparts (Luo, McGoldrick, Beatty, & Keeling, 2006).

Figure 2.2 Pedagogical Agents Levels of Design Model



(Adapted from Domagk, 2010, p. 86)

2.10.2.2 The Medium Level

The subordinate medium level comprises two main considerations: technical decisions and the choice of the character (Domagk, 2010). Both are discussed in turn.

2.10.2.2.1 Technical Decisions

Technical decisions involve the "visual and auditory presence of the pedagogical agent" (Heidig & Clarebout, 2011, p. 49), and are made based on aspects of the agent such as its realism, animation level, whether to use voice or text, whether it is presented fully or only partially, and whether the speech style is formal or conversational (Heidig & Clarebout, 2011).

The argument for using realistic agents is attributed to the *embodiment effect* in multimedia learning as explained by Mayer and DaPra (2012). These authors describe it as the superior learning transfer achieved through being taught by an APA with authentic gestures, facial expressions, eye behaviour and kinesthetics, when contrasted with an APA devoid of these attributes. Convincing evidence for this effect is provided in Mayer and DaPra's (2012) elegant study involving students who viewed just two four minute lessons involving 11 successive slides and narrated by a fully embodied agent (with the full constellation of authentic gesturing, shifting postures, displaying appropriate facial expressions, directing attention by using eye gaze and lip syncing voice and speech) and contrasted with one delivered by a low embodied agent (that merely stood motionless, maintained a steady eye gaze, was devoid of facial expressions, and lip synced). Mayer and DaPra (2012) found that the students in the fully embodied agent group outperformed those in the low embodied agent group on learning transfer. These authors hypothesise that the *embodiment effect* occurs through the priming of the learner's social stance, which in turn activates more

effortful cognitive processing during learning lessons delivered by fully embodied APAs.

Despite the promising affordances of designing for realism, this needs to be tempered with three considerations. First, Norman (1997), an engineering design psychologist, cautions against deploying seemingly realistic agents as they could establish unrealistic performance expectations. Second is the situation where the agent's design is too realistic, thereby causing a form of psychological dissonance (Burgoon et al., 2016). This has been dubbed the 'uncanny valley effect' (Aljaroodi, Adam, Chiong, & Teubner, 2019), and is a phenomenon where efforts to counterfeit human like attributes in digital characters to promote learning through the embodiment effect, instead elicits negative visceral reactions such as revulsion and eeriness. Third, at least in some instances, stylised agents with augmented features have been found more effective at conveying emotions compared with their more realistic counterparts (Adamo, Dib, & Villani, 2019). Consequently, in order to address the three aforesaid issues, it would be prudent to follow Masterton's (1998, p. 211) recommendation to represent agents using 'a degree of anthropomorphism' as opposed to 'full personification'.

With respect to the presence or absence of auditory attributes of the APA, a fundamental decision needs to be made on whether it uses text (for example speech bubbles, or a text box) or verbalisations to communicate. Undoubtedly, the problem with using text as a means of communication is that it could violate the redundancy principle where "people learn more deeply from graphics and narration than from graphics, narration and on-screen text" (Mayer, 2005a, p. 184). This would be particularly problematic for lessons that already have text as part of the content. Indeed, studies have shown that APAs providing verbal instruction over textual based

modalities produce superior effects on transfer (Atkinson, 2002; Dunsworth & Atkinson, 2007; Mayer, Dow, & Mayer, 2003; Moreno et al., 2000), and that students recall more and rate the agent more favourably (Moreno et al., 2000). Nevertheless, such decisions to minimise violations of the redundancy effect may have to be rendered subservient in the interest of accommodating accessibility considerations.

Finally, APA speech style, particularly personalisations, can influence learning outcomes and the lesson's social rating. In their study teaching students the principles of plant design, Moreno and Mayer (2004) used personalised APA messages (operationalised by the use of first person language) in one group, and non-personalised APA messages (using third person formal monologue) in the other. This simple personalisation through the use of 'I' and 'you' messages resulted in students in the personalised group performing significantly higher on the transfer test and rating the program as more friendly and less difficult than their non-personalised counterparts. Interestingly, the personalised group rated their *own* sense of physical presence as significantly higher as well (Moreno & Mayer, 2004).

2.10.2.2.2 Choice of Character

Social agency theory posits that anthropomorphic characteristics of an APA prime the learner to interact socially with the computers within which these personas reside (Domagk, 2010), and is the theoretical framework most frequently used in APA research (Martha & Santoso, 2019). This effect appears to be facilitated by facial attributes (Louwerse et al., 2009), the authenticity of the APA's vocalisations (Atkinson, Mayer, & Merrill, 2005) and even the level of politeness exhibited by the APA when providing feedback (N. Wang et al., 2008). Designing APAs for outward appeal is another interesting direction of study pursued by researchers, namely by manipulating

APAs' facial appearance, age and 'coolness' (operationalised by clothing and hairstyles) to examine their impact on the students' stereotypes towards engineering (Baylor & Plant, 2005; Plant et al., 2009; Rosenberg-Kima et al., 2008; Rosenberg-Kima, Plant, Doerr, & Baylor, 2010). In one study, the outward appearances of the APAs were shown to influence the stereotypes assigned to them by learners, which in turn impacted learning recall. Additionally, the congruity between agent appearance and learning context was shown to influence learning gain (Veletsianos, 2010).

Where more than one APA is deployed in a learning environment, three design variations have been documented in the literature. First is that of role splitting where several APAs enact a number of disparate roles to facilitate learning. With role splitting, the instructor/mentor APA is either replaced with, or accompanied by a motivator/affective APA (that only encourages), and an expert APA (that only provides information). This strict role delineation among multiple APAs is referred to as the *split-persona effect*, and has been found to significantly increase student motivation and learning (Baylor, 2009, 2011; Baylor & Ebbers, 2003; Baylor & Kim, 2005; Ebbers, 2007). Second is co-learning where the student's avatar co-learns with the APA. This has been shown to engender "significantly greater feelings of social support, trust and enhanced recall" (King, 1994; Lee et al., 2007) as compared with a less caring counterpart. Finally, APAs may be used to embody mastery or coping models (Ebbers, 2007), which are based on the forms of modelling originally used in therapeutic settings (Meichenbaum, 1971), as elaborated on in Section 2.8.1.

2.10.2.3 The Detail Level

Finally, once design decisions at the global and medium levels of the design taxonomy have been determined, those at the *detail design level* can be considered. These

include elements such as age, gender, clothing, voice, facial expression and gesture (Domagk, 2010). In this review, only voice, facial expression and gesture are elaborated on as they were deemed essential to the enhancement of the APA roles and therefore their credibility.

2.10.2.3.1 Voice

The decision of whether to utilise a computer-generated or an authentic human voice is an important one as the former can obstruct learning. Computer generated voices used in earlier experiments were produced using text-to-speech (TTS) engines. For example, Atkinson et al. (2005) used a Microsoft TTS based on a middle aged female speaking in North American English. However, these early synthetic voices were found to impede learning (Atkinson, 2002; Dirkin, Mishra, & Altermatt, 2005). Further to this, across two separate experiments involving different participants, Atkinson et al. (2005) obtained a 'voice effect', a phenomenon where learners in the human voice groups as compared with the machine voice groups displayed significant improvements in mathematical problem solving, near transfer and far transfer, and perceived the APA more favourably (in terms of attractiveness, dynamism and superiority). A similar result was found in Experiment 2 of a study designed to discover if a human voice group would produce higher scores than its machine counterpart in understanding the process of lightning formation (Mayer, Sobko, & Mautone, 2003). Again, the human voice group significantly outperformed the machine voice group in retention and transfer, with large effect sizes.

The voice effect was once again manifested in the second in a series of three experiments examining the embodiment effect (Mayer & DaPra, 2012). Here, Experiment 2 examined whether an APA speaking in a human voice as opposed to one

generated by a machine would produce the embodiment effect. The researchers found that the high embodiment group (operationalised by an APA that gestured, was facially expressive, had purposeful eye gaze and moved) significantly outscored its low embodiment counterpart (operationalised by one who did not perform these actions). However, this effect was only found when the APA spoke in a *human voice*, and not when it spoke in a machine voice (Mayer & DaPra, 2012).

The voice effect is becoming less pronounced with contemporary machine voices as machine voices have evolved to become almost indistinguishable from authentic human voices. This is being achieved through the continuous evolution of TTS systems that align prosodic elements with speech to produce more authentic utterances (Hirschberg, 1999). For example, in a study contrasting three conditions: low-quality TTS voice (analogous to earlier studies), high-quality TTS (Neospeech) voice and authentic human voice, researchers found that the authentic human voice engendered positive perceptions of the APA, but only slightly above that of the high-quality TTS voice (Chiou, Schroeder, & Craig, 2020). The high-quality voice was seen as more credible than its low-quality counterpart but did not appear to impact learning.

Prosodic elements, namely pitch, volume, length and timbre (Hirst & Di Cristo, 1998) have been manipulated in APA studies using both human and machine voices. In order to determine the effects of APA verbal expressiveness, Veletsianos (2009) found that the verbally expressive APA in his study equipped participants to recall more information, and was rated more favourably than its non-expressive counterpart. Both versions of the APA were identical to each other in all respects except for how verbal expressiveness was operationalised. Specifically, the expressive APA was operationalised by emphasising several speech elements, specifically the incorporation

of 13 additional pauses, the delivery of eight elements in a louder voice, and the superior enunciation of six words.

Another APA study examined voice prosody on a non-native speaking Korean population (Davis, Vincent, & Park, 2019). Here, researchers contrasted the effect of a human strong prosodic voice (HSPV) condition, a human weak prosodic voice (HWPV) condition and a high-quality TTS voice on participants' estimations of information retention, agent persona and cognitive load. The HSPV condition scored significantly higher only on one of the four API subscales (engagement). In contrast, the HWPV condition significantly exceeded the high-quality TTS voice on the credibility, human-likeness and engagement API subscales. In addition, the high-quality TTS voice was rated significantly less than HSPV condition on the engagement API subscale. Furthermore, retention and cognitive load did not appear to be influenced by voice at least in the short term (Davis et al., 2019). These authors observed that for non-native speakers, an authentic voice with less prosodic elements was favoured over its high prosodic counterpart.

2.10.2.3.2 Facial Expression

When discussing facial expression in the design of APAs, it would be remiss not to include the contributions of the seminal work of Ekman and Friesen (2003) on human facial expression. Decades of research on the topic culminated in theory building that informs current thought on the potential effects of 'static', 'slow', 'cosmetic' and 'fast' cues in influencing emotion judgments. 'Static cues', or permanent physical facial features comprise phenotypic ethnic characteristics; *slow cues* are those that emerge over time such as the pattern of wrinkles and pigmentation; *cosmetic cues* involve hair style and length, type and length of facial hair and *fast cues* are the facial expressions

that result from fleeting activations of facial muscles (Ekman, 1979). While static and slow cues moderate emotional expression, fast cues provide primary indicators about emotion, and are thus the most important in emotional expression (Burgoon, Buller, & Woodall, 1996). Accordingly, Frijda's (1986, p. 71) definition of emotions as "tendencies to establish, maintain, or disrupt a relationship with the environment" implies that displays of fast cues are instrumental in eliciting desired behaviours in the individuals beholding them.

However, not all emotions are of equal importance. Frijda (1986) distinguished primary emotions as those that are more elemental in form that are "manifested by unambiguously specific facial expressions as determined by high recognition accuracy" (Frijda, 1986, p. 72). Universality studies conducted by primary researchers Ekman and Izard confirmed the existence of six universal expressions, namely happiness, sadness, fear, surprise, anger, and disgust (Ekman & Friesen, 1971; Ekman et al., 1987; Ekman, Sorenson, & Friesen, 1969; Izard, 1971).

A study by Wiggers (1982) provides particularly useful data concerning cues that affect decoding of emotional displays. Specifically, he applied the Facial Action Coding Scheme, a system designed to classify human facial expressions (Ekman & Friesen, 1978), to identify cues related to each of the six universal expressions. As such, these findings provide distinctive empirical emblems that portray each unique emotion which may be utilised to design APA facial expressions.

Early studies have demonstrated that APA facial expressions can elicit attitudinal changes in people. In a study by Walker et al. (1994), two APA faces: one with a neutral expression, and the other with a stern expression operationalized by "pulling the inner

portion of the eyebrows in and down" (Walker et al., 1994, p. 88) were used to administer a survey by speaking to the participants using an artificial voice. A third group simply completed a text-based version of the survey. Participants exposed to the stern face expressed their dislike of the face, took a significantly longer time to complete the survey, and expressed more negative attitudes.

One explanation for the hostile face eliciting negative attitudes and poorer efficiency in task completion comes from the domain of cognitive psychology. According to the anger superiority effect (Hansen & Hansen, 1988) threatening faces tend to 'pop out' more readily over neutral or happy faces in a crowd than a happy face in a crowd of angry faces. This is hypothesised by these authors to be an adaptive mechanism of threat detection. This effect was shown in a series of three experiments conducted by Hansen and Hansen (1988), and is hypothesised to be the result of "automatic or pre-attentive processing" (p. 917) which occurs quickly and is less prone to distraction and to information overload (Hansen & Hansen, 1988). Thus, in the Walker et al. (1994) study, it is likely that the threatening facial expression caused the learners to fixate on it, which distracted them from the task. It is plausible that they perceived the negative expression as being directed at them, which engendered negative attitudes towards the APA.

Even facial expressions in a rudimentary smiley face APA have been found to be sufficient to influence motivation. In one qualitative study involving the teaching of C^+ programming (Okonkwo & Vassileva, 2001), two versions of the same application were implemented: one with a smiley face with its emotional functionality switched on, and the other with it switched off. In the emotional condition, the APAs displayed an array of six human emotions, namely showing happiness, sadness, pleasure, surprise, anger

and neutrality as appropriate. What this study lacked in quantitative research rigour, was compensated for with rich qualitative data. Specifically, although no significant differences in learning were registered quantitatively, participants in the emotionally expressive condition disclosed that they felt more motivated. There was a gender effect, with females feeling compelled to try harder to elicit a smile from the APA, as contrasted with the male participants who merely used it to track their progress in the lesson (Okonkwo & Vassileva, 2001).

In another study (Baylor & Kim, 2008, 2009), APAs were deployed to deliver one of two instructional modules: relaying *procedure* (how to use a web-based software program) or conveying *attitude* (four scenarios on digital music and copyright, electronic plagiarism, movie recording, and software copying). The study's aim was to explore the effect of nonverbal communication (facial expression and gestures) on attitudes towards the content being taught, perceptions of the APA, and on learning. Both conditions within each module had an identical script with a computer-generated voice to keep this variable constant. The facial expressions that were used were: happy, sad, surprised, serious, and neutral, and were designed to match the content being discussed (e.g. seriousness matching when talking about laws), and the APA delivery was accompanied by appropriate gestures. With respect to facial expression, this study found that facial expression positively affected learners' attitude toward the content, perception of the APA persona (and all its subcomponents: facilitating learning, credibility, being human-like and engaging), and learning, but only for the *attitudinal content*. Contrastingly and interestingly, learners' attitudes towards the *procedural content* was improved when no facial expression was present (Baylor & Kim, 2008, 2009). This result is unsurprising because merely producing facial

expressions that are incongruous with the actual communicative intent (procedural) would undoubtedly produce cognitive dissonance in the learner, possibly evoking unnecessary load on cognition (Sweller et al., 1998).

Taken together, these findings provide compelling evidence for the need for appropriate selection and choreography of APA facial expressions that match instructional type so as to generate desirable learner attitudes conducive to learning in multimedia educational settings.

2.10.2.3.3 Gestures

Gestures typically accompany speech, and are fully integrated with speech, although they can be produced independently under unusual circumstances. (Goldin-Meadow, 2003). The gestures that are of particular interest to the design of APAs are those that accompany speech. Evidence from a meta-analysis examining the effect sizes from 63 samples contrasting verbal messages delivered with and without gestures found that speech accompanied by gestures provided a "significant, moderate benefit to communication" (Hostetter, 2011, p. 297). These gestures illustrate what is being uttered, and have been variously termed illustrators (Ekman & Friesen, 1969), gesticulation (Kendon, 1994, 2011), and simply, gesture (McNeill, 1992). McNeill (1992) further classifies these into a typology of four main categories*: iconic gestures* that illustrate semantic concepts using one or both hands; *metaphoric gestures* that represent images of abstract concepts; *deictic gestures* that involve pointing at a particular thing or location, usually done with a finger; and beat *gestures* that are rhythmic in nature that synchronise with speech prosody, but that do not represent meaning. Gestures such as these are believed to embody cognition in domains such as mathematics (Alibali & Nathan, 2011).

The importance of such gestures in complementing verbal communication has been evidenced by brain imaging studies. In particular, neural activation in regions of the brain processing discourse comprehension and motion suggests that hand movements accompanying speech are effortfully processed by listeners as they interpret meaning (Dick, Goldin-Meadow, Hasson, Skipper, & Small, 2009; Hubbard, Wilson, Callan, & Dapretto, 2009).

It is therefore promising that gestures designed into the repertoire of APA behaviours can increase learning related outcomes. In particular, studies have shown that APAs using deictic gesture appear to engender more positive learner attitudes towards the content being learnt than their non-gesturing counterparts (Baylor & Kim, 2008; Buisine & Martin, 2007). This was illustrated in a study that tested the effects of speech-gesture coordination in APAs in a multimedia presentation providing instructions on using remote controls, photocopiers and video software (Buisine & Martin, 2007). The three conditions were the *control condition,* where the APA explained how to use each button, but did not accompany this with any illustrators; the *redundancy condition,* where the APA explained how to use each button and accompanied each with iconic and dietic gestures; and the *complementarity condition,* where half the explanations from the last scenarios were removed, thereby reducing communication redundancies.

It was found that speech–gesture cooperation influenced cued written recall significantly specifically in the redundancy condition (compared with the control and complementarity conditions). It was also found that speech–gesture cooperation had no effect on graphic recall, but with respect to the subjective ratings of the quality of explanation, it produced a significant result, with redundancy providing a higher

evaluation than complementarity and control conditions. Speech–gesture cooperation also influenced the likeability ratings of APAs: redundancy made APAs more likeable than the APAs in the complementarity and control condition. Finally, redundant APAs were perceived as more expressive than their complementary and control counterparts (Buisine & Martin, 2007). Together, these results show that gestures are an important APA design inclusion.

Having examined the APA design aspects working from the APA design taxonomy (Domagk, 2010), it is worth noting that Heidig (nee Domagk) and Clarebout (2011) subsequently developed a more comprehensive taxonomy of APA deployment, the Pedagogical Agent's Conditions of Use. In addition to design, this taxonomy identifies three other parameters for APA deployment, namely the learning context and knowledge domain, learner characteristics, and functions performed by the APA.

It is noteworthy that earlier APA literature has tended to emphasise the visual embodied qualities of APAs (Baylor, 2009, 2011; Plant et al., 2009; Rosenberg-Kima et al., 2008; Van vugt, Bailenson, Hoorn, & Konijn, 2010), in preference to the pedagogical and motivational impacts that they bring, and more importantly, the reasons for their impact (Domagk, 2010). As such, studies have tended to answer descriptive questions, those preceded by *what,* which far outnumber those that answer the more analytical questions, those preceded by *how* and *why*. Consequently, this research attempts to delve into the analytical questions which the remaining sub-sections of this review contextualise: the affective and motivational interventions delivered through APAs, and their effects.

2.10.3 Affective Pedagogical Agents

There is a growing interest in the application of *affective pedagogical agents* in multimedia learning. *Affective pedagogical agents* are defined as lifelike computerised characters that primarily provide learners with support of an affective nature so as to facilitate the achievement of educational objectives (Shen, 2009). It is important to note that some studies claiming to have used only affective interventions, have instead used both motivational and affective interventions, for example Arroyo et al. (2010), and Woolf et al. (2010).

Affective pedagogical agents afford several benefits to learning due to the enhancement of learning engagement, motivation, positive affect, and learning transfer. An example where engagement was enhanced through the deployment of affective pedagogical agents was a study by Y. Kim et al. (2008). In the first of two experiments, the levels of emotional expression of the APAs were varied (positive, negative or neutral) amongst 142 male and female university students. Those working with the positive or neutral APA rated it as significantly more engaging, and facilitating to their learning than the negative APA. However, APA emotional expression did not affect self-efficacy.

Affective pedagogical agents have also been found to enhance motivation. In the second experiment by Y. Kim et al. (2008) involving 56 pre service teachers, the effects of APA empathetic responses (responsive versus nonresponsive) and gender (male versus female) on social judgements, interest, self-efficacy and recall were investigated. In the empathetic responses condition, the APA provided instantaneous verbal responses to the learners' affect when the learner clicked an emoticon representing his/her emotional state. No such responses were provided in the

nonresponsive condition. Learners working with the responsive APA showed more self-efficacy than those working with the nonresponsive APA. Additionally, in a qualitative study using a rudimentary smiley faced emotive agent with emotional functionality switched on (Okonkwo & Vassileva, 2001), described in greater detail in Section 2.10.2.3.2, participants expressed how motivated they felt working on the lesson. (Okonkwo & Vassileva, 2001).

In another study investigating the effect of APA emotional expression on Japanese learners navigating a multimedia lesson on English idiom (Maldonado et al., 2005), learners operated their avatars with APAs that were embodied virtual co-learners under one of three conditions: no co-learner, emotionless co-learner or emotionally responsive co-learner. In the no co-learner condition, learners progressed through the lesson without an APA present; in the emotionless co-learner condition, the APA was present but devoid of emotion; and in the emotionally responsive co-learner condition, the APA provided compliments and showed concern for the student's avatar when mistakes were made or questions were skipped, accompanying these with appropriate facial expressions. The outcome of this study shows that emotionally expressive APAs can elicit higher motivation levels when contrasted with an expressionless counterpart. Interestingly, the emotional expressiveness of the APA also led learners to attribute positive perceptions of the co-learner with respect to possessing higher cooperativeness, warmth and thoughtfulness when contrasted to the emotionless counterpart, which attracted negative attributions such as being less trustworthy and less intelligent (Maldonado et al., 2005).

Affective pedagogical agents have also been deployed as graphic elements within actual lesson content with the aim of reducing negative feelings and increasing positive

ones. Norman (2013) has termed this ‘visceral designs’ or the principles of design aesthetics that influence user feelings. In a series of studies (Um et al., 2012; Um et al., 2007), researchers examined whether positive emotions experienced by college students studying a multimedia lesson about the immune system (prior to and during the lesson) were able to improve learning and satisfaction. The 'good' condition was designed to engage the learner by using vivid colours and anthropomorphisation of lesson elements, while the neutral design had elements that were devoid of these enhanced features. In addition to using these visceral design principles, the authors applied Seibert and Ellis's (1991) validated ‘self-referencing mood induction procedure’ immediately before the lesson. Using this procedure, participants were asked to read 25 statements designed to stimulate either good or neutral emotions. It was found that emotions elicited from the 'good' condition significantly affected transfer test results, mental effort investment and satisfaction (Um et al., 2012).

Subsequently, Mayer and Estrella (2014) conducted a series of two experiments to ascertain the effects of visceral design in a lesson explaining how a virus causes a common cold. In the original/control version of the lesson, the slides contained graphic elements in greyscale, while the emotional redesign of these elements employed anthropomorphisation (by representing the host cell and virus with round faces and emotionally expressive eyes) and visceral design principles (rendering the host cell and virus in different vibrant colours) to study their effects on enhancing retention, learning transfer and effort. In both experiments, the experimental group performed significantly better on retention. However, with respect to effort expended during learning, only the experimental group in the first experiment expended a significantly higher level of effort during learning compared with the control group. There was also

no significant result for transfer in either experiment, but the differences were in the predicted directions (Mayer & Estrella, 2014).

In summary, affective pedagogical agents in multimedia learning environments appear to have potential in improving learner engagement, motivation, and positive affect (Mayer & Estrella, 2014; Um et al., 2012; Um et al., 2007). Moreover, learners appear to recognise and be motivated by emotive intent conveyed even by an APA with a rudimentary smiley face (Okonkwo & Vassileva, 2001). Interestingly, learners working with an emotive agent attribute positive character traits to the agent (Maldonado et al., 2005). Beyond eliciting positively valanced emotions, affective pedagogical agents could also be incorporated into learning environments to decrease negatively valanced ones such as anxiety.

2.10.4 Affective Pedagogical Agents and Anxiety Alleviation

The literature on the use of affective pedagogical agents to alleviate anxiety is in its infancy, and has focussed primarily on mathematics anxiety (X. Huang & Mayer, 2016; Im, 2012; Shen, 2009; Wei, 2010) and to a lesser extent, listening comprehension (Ko, 2010).

Shen (2009) examined the impact of APAs employed as affective pedagogical agents to reduce negative emotions associated with mathematics anxiety, learning and motivation. Shen (2009) used different APAs to deliver emotional support messages and motivational messages (in separate conditions) to 109 General Educational Development students; that is, those without high school diplomas, who are likely to have only elementary mathematics competencies. These participants were also ascertained to have mathematical anxiety. The emotional support messages were

derived from the COPE model propounded by Carver et al. (1989) which is a multidimensional inventory of 13 emotional coping strategies as outlined in Section 2.9.3. Specifically, Shen applied four of the 13 types of emotional coping strategies in the study, which resulted in learners working with these *emotional* APAs outperforming their counterparts who had worked with APAs devoid of such support. Additionally, mathematics anxiety decreased as a result of this intervention (Shen, 2009).

Subsequently, in another study building on the work of Shen, Im (2012) investigated the effectiveness of emotional support messages and 'cognitive motivational messages' to assist General Educational Development students learning how to solve mathematical problems. In this context, 'cognitive motivational messages' was a phrase devised by the researchers to describe growth mindset messages (Dweck, 1999) uttered by APAs to help reduce students' cognitive dimension of mathematics anxiety while taking the lesson (Im, 2012). Hence, there were two independent variables in this study: the provision of emotional support messages based on the COPE inventory (Carver et al., 1989) as delivered by an affective pedagogical agent, and the provision of cognitive motivational messages containing growth mindset messages (Blackwell et al., 2007; Dweck, 1999; Dweck & Leggett, 1988) as explained in Section 2.8. This study found that emotional support reduced mathematics anxiety, improved self-efficacy and mathematical problem solving (Im, 2012, p. 71).

Similarly, X. Huang and Mayer (2016) investigated the benefits of introducing an affective agent to a multimedia statistics lesson on learner performance (problem solving during and after the lesson) as well as on anxiety levels, self-efficacy, cognitive load and perceived effort. This study utilised a two-step approach to address

mathematics anxiety. First, a female affective agent provided an anxiety coping message before the practice problem, and second was a journaling approach which was based on earlier studies using this method to successfully alleviate mathematics anxiety (D. Park, Ramirez, & Beilock, 2014; Sgoutas-Emch & Johnson, 1998). Huang and Mayer's study (2016) demonstrated the effectiveness of the affective agent at increasing learner accuracy at solving practice and retention problems and exerting more effort at learning the lesson within the experimental group when compared to the control group. However, the anxiety reduction interventions did not have an effect on anxiety levels and self-efficacy (X. Huang & Mayer, 2016).

2.10.5 APAs and Motivational Support: Vicarious Experience and Verbal Persuasion

As reviewed in Section 2.6 and 2.8 respectively, self-efficacy is an important predictor of success in academic writing, and learners can obtain self-efficacy through vicarious experiences of others and through being persuaded verbally (Bandura, 1997). Both principles have been applied to studies deploying APAs to provide motivational support, with promising results. These are discussed in the following paragraphs.

With respect to vicarious experiences, Ebbers (2007) examined the impact of APAs using mastery and coping styles (Meichenbaum, 1971; Schunk et al., 1987) discussed in Section 2.8.1. Ebbers (2007) examined style type (mastery versus coping) and social interaction type (direct versus vicarious) on learning performance, motivation (self-efficacy), attitude towards the APA (likeability and attitude), affect, learner social comparison and learning performance. In this study, the self-efficacy of the participants in the coping APA group exceeded that of the mastery counterpart over time. Coping models have been found in a number of studies to be particularly beneficial in enhancing learner motivation, self-efficacy and attitude (Baylor, 2009).

Creating and manipulating the roles and personalities of multiple agents have therefore made it possible to increase student motivation in learning environments. This capitalises on the phenomenon termed the split-persona effect discussed earlier in Section 2.10.2.2.2.

Verbal persuasion as it relates to the above study involved operationalising incremental theory through the APA based on the premise that intelligence is not a fixed trait and that it can be enhanced to improve learner self-efficacy (Dweck, 1999; Dweck & Leggett, 1988). As discussed earlier in Section 2.8.2, incremental theory has been applied to APA studies with success. Specifically, Dweck and Blackwell at Stanford University created a computer programme called Brainology (Mindset Works Inc., 2008) where users are led through activities by two APAs that build on the idea of the malleability of intelligence. In investigating the impact of the Brainology program on secondary students, Donohoe, Topping, and Hannah (2012) describe that Brainology uses two APAs: A peer and a scientist who impart incremental ability messages. Although this study did not specifically examine the impact of incremental ability messages on self-efficacy, nevertheless short-term changes in users' mindsets were recorded, but these were not sustained at follow up.

In another study (Im, 2012), a group of participants were exposed to APAs that were used to deliver motivational messages developed to increase incremental ability beliefs, operationalised by Im (2012, p. 42) as “statements which emphasise the students’ abilities are malleable and can be grown through effort and exercise”. It is worth noting that in this study, Im made a deliberate decision not to adopt the Attention, Relevance, Confidence, Satisfaction model of motivational design (Keller, 1987a, 1987b, 2008a, 2008b, 2010) because the earlier study upon which this work

was based (Shen, 2009) did not yield a significant result from the use of this design. Instead, applying incremental ability messages (Dweck, 1999; Dweck & Leggett, 1988) resulted in significant improvements to mathematics anxiety, self-efficacy, and mathematical problem solving (in combination) in participants exposed to such messages when compared with their counterparts who did not receive such messages (Im, 2012). Therefore, using Im's work, it is possible to argue that employing APAs to deliver motivational messages to increase incremental ability beliefs in a learning design may favourably affect writing anxiety, writing self-efficacy and writing ability.

2.11 Summary of the Literature Review and Map

This chapter reviewed relevant literature providing the theoretical basis for this research. The ten sections within this review are organised thematically into four major areas. The review commenced with the context of writing for academic English including major concepts to do with writing transfer, threshold concepts, and genre knowledge (Sections 2.2 to 2.3); before progressing to the underpinning theories informing dependent variables comprising sections on operationalising writing competence, writing anxiety and writing self-efficacy (Sections 2.4 to 2.6).

The chapter then reviewed the underpinning theories informing the independent variables namely scaffolded questioning, motivational support and affective phenomena (Sections 2.7 to 2.9); and concluded with a review of the literature on APAs incorporating theories in the preceding sections as they apply specifically to APA pedagogical design.

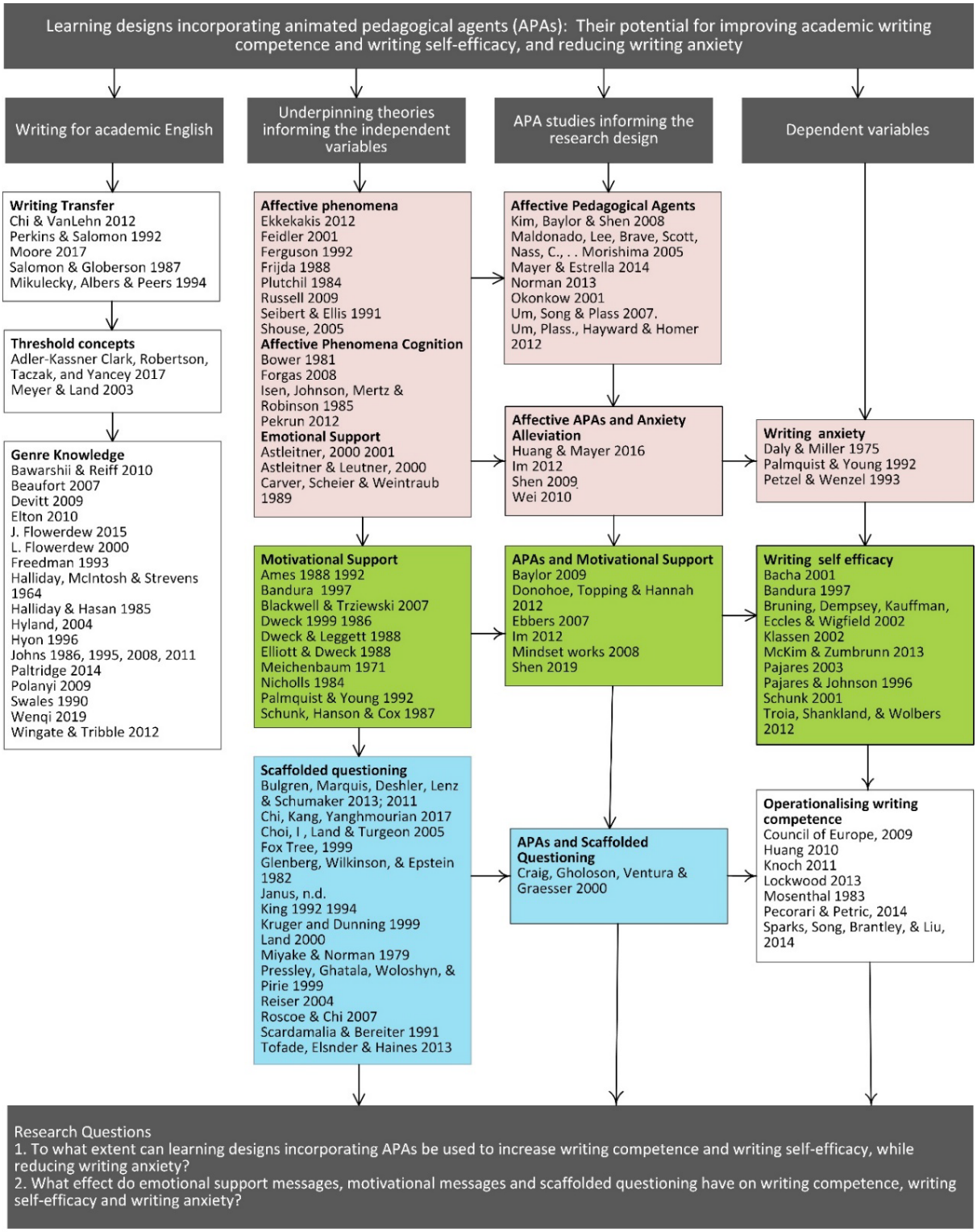
In order to explain the disparate themes from which the literature being reviewed originates, and for ease of accessibility, interpretation and analysis, Gatto (2015)

advocates for research data to be visualised. Echoing this sentiment, Creswell (2009) recommends the use of a literature map with the focus on visualising existing research about a particular topic. As such, this research follows Creswell's (2009) guidelines for constructing a literature map. As shown in Figure 2.3, the title of the literature review is positioned in the box at the top of the map and organised into four broad categories, namely 'Writing for academic English', 'Underpinning theories informing the independent variables', 'APA studies informing the research design', and 'Dependent variables'. The body of APA literature not directly pertinent to the research question was omitted from this literature map to minimise clutter which can potentially detract from comprehension, and due to space constraints.

The review as represented graphically shows complexity of the context within which writing for academic English and its associated concepts of writing transfer, threshold concepts and schema theory are discussed. It shows the underpinning psychological theories that inform APA studies which in turn inform this research study. These feed into the main research questions located in the box at the bottom of the page.

In order to improve coherence of the map, the three major themes in the literature were colour coded to visualise the associations between the elements within this body of literature. For example, moving from left to right on the literature map, the pink boxes denote the body of knowledge on affective phenomena which informs that of affective pedagogical agents, which are related to the literature on writing anxiety. Similarly, the green boxes signal the body of knowledge on motivational support which underpins that of APAs and motivational support, which are in turn related to the literature on writing self-efficacy. Finally, the blue boxes indicate literature on scaffolded questioning, which informs that of APAs and scaffolded questioning.

Figure 2.3 Literature map of this research project



Within each box, the subtopic labels with authors' names and the years of publications are displayed. Creswell (2009) also explains that it is acceptable for some topics in the map to have more literature compared with others as this is dependent of availability

of the literature, and the researcher's decision as to the depth at which the literature is to be explored.

Having reviewed the literature, the next chapter discusses the research aims, questions and hypotheses.

CHAPTER THREE: RESEARCH AIMS, QUESTIONS AND HYPOTHESES

"The great tragedy of science
is the slaying of a beautiful hypothesis by an ugly fact."
Thomas Henry Huxley 1825–1895, English biologist

3.1 Chapter Overview

Having reviewed the literature that underpins this research in the previous chapter, this chapter details the research aims in Section 3.2 and provides the research questions to be answered in Section 3.3. Section 3.4 presents the hypotheses tested in the study and provides a justification for each of them. This chapter concludes with a summary of the research aims, questions and hypotheses in Section 3.5.

3.2 Research Aims

As was discussed in Section 1.3, there has been a widening gap between the academic writing skills that incoming university students are expected to possess in order to participate successfully in tertiary studies, and the skills they actually possess (Calvo et al., 2020; Dunston & Wilkins, 2015; McKay et al., 2018; Murray, 2012; Pecorari & Petric, 2014; Perin & Holschuh, 2019; Perin et al., 2017). This problem is exacerbated by the mass migration of courses and associated writing supports to online delivery platforms which can further alienate students from their studies due to the lack of sociocultural cues, or social presence that online delivery platforms often fall short on (Bolliger & Halupa, 2018; Ebner & Gegenfurtner, 2019).

Against this backdrop, APAs are being deployed effectively in multimedia environments with success (Aljaroodi et al., 2019; Castro-Alonso, Wong, Adesope, & Paas, 2021; Schroeder & Craig, 2021). Although their deployment is no means

mainstream, in the online spaces where they are introduced, they have been able to engender learner engagement due to the social affordances they possess. Their deployment in various learning environments have shown promise in enhancing learning transfer (Ahmadi et al., 2017; Holmes, 2007; Lusk & Atkinson, 2007) and enhanced recall (Lee et al., 2007). When embedded into computerised learning environments, they are able to engage learners through a phenomenon called the persona effect (Lester et al., 1997; Moreno et al., 2001).

Studies investigating the effectiveness of APAs on learning performance have tended to proliferate around STEM disciplines such as biology and computing in particular, with a recent meta-analysis (Castro-Alonso et al., 2021) reporting medium to large positive effect sizes in biology, and small to medium positive effect sizes in computing. In contrast, the sole non-STEM discipline where a medium positive effect size of APAs on learning performance was in the discipline of English. Nevertheless, the literature is relatively silent on the use of APA interventions that help develop writing skills, and the associated phenomena of writing anxiety, writing self-efficacy, and the use of scaffolded questioning to facilitate writing transfer.

Given academic writing is such a crucial skill for incoming university students to acquire, without which participation in the academic community is impeded, there is a critical need to investigate the effectiveness of human analogues such as APAs in delivering writing instruction. To not take advantage of the affordances that APAs offer would be to overlook a great opportunity. As such, the first aim of this study was to examine the impact of learning designs employing APAs on learners' writing competence, writing self-efficacy and writing anxiety.

Its second aim was to investigate the effect of manipulating these learning designs by varying their delivery options (didactic delivery or scaffolded questioning) along with support interventions (with emotional support messages, motivational support messages, or no such messages) to study their effects on writing competence, writing self-efficacy and writing anxiety.

3.3 Research Questions

The above-mentioned problem of there being a dearth of information about the effectiveness of online writing support using APAs to deliver instruction to increase writing competence and self-efficacy while reducing writing anxiety may be addressed by the first research question:

> RQ 1: To what extent can learning designs incorporating APAs be used to increase writing competence and writing self-efficacy, while reducing writing anxiety?

Additionally, in domains deploying APAs in areas other than writing, the use of emotional support messages have improved mathematics anxiety (X. Huang & Mayer, 2016; Im, 2012; Shen, 2009), while motivational messages have increase student self-efficacy (Baylor, 2009; Im, 2012). In yet other studies, scaffolded questioning has shown promise in promoting learning transfer. This study therefore aims to obtain data which will help to assess the effects of emotional support messages, motivational support messages and scaffolded questioning on writing competence, writing self-efficacy and writing anxiety. Thus the second question addressed by this research is:

> RQ 2: What effect do emotional support messages, motivational messages and scaffolded questioning have respectively on writing competence, writing self-efficacy and writing anxiety?

3.4 Hypotheses

To help answer the two research questions, several hypotheses were developed based on previous research. RQ1 considers the potential of online writing instruction using APAs to increase writing competence and self-efficacy while reducing writing anxiety, and is addressed by H1 and its associated sub-hypotheses H1a, H1b and H1c, which are discussed below.

Embedding lifelike personalities into virtual learning environments can potentially augment the social dimension of learning as doing so builds on the tendency for people to regard their interactions with computers as social interactions (Reeves & Nass, 1996). This is because APAs tend to invoke person-perception heuristics within learners thereby encouraging them to invest considerably more effort at understanding the meaning being conveyed by these social models, as though conversing with a real person (Govindasamy, Muniandy, & Jamaluddin, 2010). Such social interactions within APA learning environments have been shown to result in higher learner engagement (Govindasamy et al., 2010; Moreno et al., 2001; Pareto, Haake, Lindström, Sjödén, & Gulz, 2012; Schroeder & Traxler, 2017). This heightened learner engagement that arises as a result of interacting with APAs is referred to as the *persona effect* (Lester et al., 1997; Moreno et al., 2001).

Learner engagement implies that the learner's attention is attuned to the learning stimuli being perceived. It is therefore no wonder that the deployment of APAs has been found to increase learning transfer (Atkinson, 2002; Holmes, 2007; Lusk & Atkinson, 2007; Moreno et al., 2000). In this vein, a meta-analytic review of 43 studies involving 3088 participants demonstrated that incorporating an APA into a learning

environment produced a significant effect on learning, albeit a small one (Schroeder et al., 2013). Together, these studies provide evidence as to the potential efficacy of using APAs to engage learners when deployed in multimedia environments, and suggest a valuable role for APAs in the delivery of academic writing instruction. Consequently, the following hypothesis was proposed:

> *H1a: Completing learning designs incorporating APAs will improve writing competence.*

The appearance of an APA in a learning environment can be highly motivating (self-efficacious) for learners. Strafling et al. (2010) investigated the impact of APAs on preparing students to understand specific learning strategies prior to the presentation of the material. They did so by deploying two different APAs (a cartoonified rabbit APA and a realistic human APA) in a multimedia lesson and a voice only non-agent control. Despite the lack of effect on learning outcomes, the appearance of the cartoonified rabbit APA motivated learners to engage with this particular lesson over the others (Strafling et al., 2010). Additionally, in one APA study used as an exam preparation aid, the students assigned to a specific APA group outperformed the group with non-agent controls with respect to motivation and exam performance (Shiban et al., 2015). In yet another study teaching Microsoft Excel program literacy, the APA groups registered superior motivation, academic and cognitive load outcomes when contrasted with the non-agent control (Dinçer & Doğanay, 2017). It was therefore hypothesised that:

> *H1b: Completing learning designs incorporating APAs will increase writing self-efficacy.*

A number of studies have shown that the mere presence of APAs helps to reduce anxiety in learners (Gulz, 2005; Liew, Tan, & Jayothisa, 2013). Furthermore, another study investigating the efficacy of APAs to help alleviate student mathematics anxiety

found that the students' anxiety had decreased over the course of the week-long experiment irrespective of whether the APAs provided anxiety reducing messages or not (Y. Kim, Thayne, & Wei, 2017). Consequently, it was hypothesised that:

H1c: Completing learning designs incorporating APAs will reduce writing anxiety.

Therefore, taken together, it was hypothesised that:

H1: Completing learning designs incorporating APAs will improve writing competence, increase writing self-efficacy and reduce writing anxiety.

To answer the second research question, three additional hypotheses were proposed. When trying to learn new skills, novice learners can be confounded by their inability to recognise their gaps in knowledge, so they may not initiate questions to help in acquiring new knowledge. In particular, they tend not to initiate questions on difficult material (Glenberg et al., 1982; Miyake & Norman, 1979; Pressley et al., 1990), although questioning appears to play an important role in learning (Bulgren et al., 2013; Bulgren et al., 2011; King, 1992, 1994; McDaniel & Donnelly, 1996; Woloshyn, 1992). This is attributed to metacognitive skills deficits (Kruger & Dunning, 1999). In multimedia environments, learners attending to question and answer dialogues between APAs embodied as experts, and novices overhearing these dialogues were found to have better recall in a transfer task, in contrast to learners who overheard a monologue (Craig et al., 2000). Thus, the following hypothesis was proposed:

H2: Scaffolded questioning will improve writing competence.

As reviewed in Section 2.10.5, promising research evidence supports the effectiveness of APAs in increasing the self-efficacy of participants who work with them, when these APAs are designed to deliver messages that emphasise that intelligence is a quality that can be modified as opposed to being a fixed trait (incremental versus entity

theory) (Dweck, 1999; Dweck & Leggett, 1988). Messages that emphasise incremental ability beliefs, mastery goals, and task orientations delivered through APAs to participants in one study were found to significantly reduce mathematics anxiety, increase self-efficacy, and mathematical problem solving in combination when compared with the control group participants who did not receive such messages (Im, 2012). Consequently, it follows that the use of APAs to deliver motivational messages in online academic writing instruction will lead to an increase in learner self-efficacy and a reduction in writing anxiety. This led to the third hypothesis:

> *H3: Motivational messages will improve writing self-efficacy and reduce writing anxiety.*

With its corresponding hypotheses:

> *H3a: Motivational messages will improve writing self-efficacy.*
>
> *H3b: Motivational messages will reduce writing anxiety.*

As reviewed in Section 2.10.3, there is a body of evidence that supports the effectiveness of affective pedagogical agents (APAs that also provide learners with affective support) in motivating participants who work with them (Maldonado et al., 2005; Okonkwo & Vassileva, 2001), and in helping to sustain interest, recall and self-efficacy (Y. Kim et al., 2008). Furthermore, an intervention with affective pedagogical agents delivering anxiety alleviating messages based on the work of Carver et al. (1989) was found successful in reducing negative emotions associated with mathematics anxiety in one study (Shen, 2009), and mathematics anxiety, self-efficacy, and mathematical problem solving in another (Im, 2012).

This led to the fourth hypothesis:

> *H4: Emotional messages will reduce writing anxiety.*

3.5 Summary of the Research Aims, Questions and Hypotheses

This chapter has provided a statement of the research aims of this study. Its first aim was to examine the impact of learning designs employing APAs on learners' writing competence, writing self-efficacy and writing anxiety, and its second was to investigate the effect of manipulating these learning designs by varying their delivery options (didactic delivery or scaffolded questioning) along with support interventions (with emotional support messages, motivational support messages, or no such messages) to study their effects on writing competence, writing self-efficacy and writing anxiety.

The study's two corresponding research questions were provided, namely RQ 1: To what extent can learning designs incorporating APAs be used to increase writing competence and writing self-efficacy, while reducing writing anxiety? and RQ 2: What effect do emotional support messages, motivational messages and scaffolded questioning have respectively on writing competence, writing self-efficacy and writing anxiety? Finally, the study's four main hypotheses and corresponding sub-hypotheses along with their justifications were provided.

CHAPTER FOUR: METHODOLOGY

"When you stop learning, stop listening, stop looking and asking questions, always new questions, then it is time to die."

Lillian Smith 1897–1966, American writer

4.1 Chapter Overview

The methodology for this study is described in this chapter. The theoretical and methodological underpinnings of this study are explained in Section 4.2. This is followed by sections detailing the various design considerations for the project. Specifically, Section 4.3 describes the research design; Section 4.4, the design of the lesson structure; Section 4.5, the design of the lesson environment; and Section 4.6, the design of the APAs.

The independent variables (scaffolded questioning, emotional support and motivational support) are defined and operationalised in Section 4.7, and the means by which the dependent variables (writing competence, writing self-efficacy and writing anxiety) were measured is outlined in Section 4.8. This is followed by an explanation of the ethical considerations for the study in Section 4.9.

Section 4.10 details the participant information, while Section 4.11 describes the data collection procedures. An overview of the approaches used to analyse the qualitative data is provided in Section 4.12. This chapter concludes with a summary of the methodology in Section 4.13.

4.2 Theoretical and Methodological Underpinnings

Although philosophical underpinnings are not always made explicit in research design, these overarching philosophies still implicitly inform research methods. As such, it is important to explicate the relationship between philosophy and research design.

The relationship between philosophy and research design is illustrated in Creswell and Plano Clark's (2011, p. 42) framework that outlines the elements of worldviews and implications for practice. Accordingly, the *ontology* (branch of philosophy inquiring about the nature of reality) that informs this study is that of pragmatism, described by Patton (1990) as the selection of methodological appropriateness above methodological orthodoxy for each unique research situation where the researcher tests hypotheses and provides multiple perspectives. Pragmatism has been found by many mixed method authors to be the most complementary worldview as a foundation for mixed methods research (Creswell & Plano Clark, 2011).

Its *epistemology* (theory pertaining to relationship between the researcher and that being researched) is that of practicality where the data is collected using the necessary means to answer the research question. Finally, its *methodology* combines both quantitative and qualitative data. In other words, it recognises the importance of complementing nomothetic approaches—search for general laws applicable to a diverse population—with idiographic ones—concern for what is unique to the individual case (Hermans, 2006).

In brief, mixing methods was deemed advantageous for this study as it:

(a) elevates the research question to a position of primary importance,

(b) abandons the forced choice dichotomy between post positivism and constructivism, and

(c) provides a pragmatic research philosophy to guide the choice of methodology (Creswell & Plano Clark, 2011).

4.3 Research Design

The mixed method design adopted in the research is classified as an embedded design, with merged or connected data analysis (Creswell & Plano Clark, 2011, p. 219). The analysis steps in this design first involved analysing the primary dataset to answer the primary research questions; analysing the secondary data (from qualitative interviews) where it is embedded within the primary design by merging this data with the former; and finally, interpreting how both sets of data answer the research questions (Creswell & Plano Clark, 2011).

As such, the aim of the qualitative phase is to provide a more in-depth explanation of the initial quantitative results. This design is believed to be particularly useful to explain trends in the quantitative data, and the reasons for those trends; as well as to provide the researcher with the opportunity to probe into any questions raised from the quantitative results that cannot be answered with quantitative data (Creswell & Plano Clark, 2011).

This study was conducted in two phases. The first phase of the study involved the manipulation of independent variables under six separate experimental conditions, where participants interacted with online lessons that were purposefully designed for this study. This enabled the measurement of the effect of the interventions. These independent variables in this study are defined in Table 4.1.

Table 4.1 Definition of independent variables in this study

Independent variable	Definition
Scaffolded questioning delivery (QA)	Naïve questions directed at a teacher/expert APA by a learner APA, used in a lesson's delivery, to highlight the necessary shifts that the learners need to make to their schemata
Emotional messages (Emo)	Messages provided by the APA to help increase positive emotions and reduce negative emotions
Motivational messages (Mot)	Messages provided by the APA to help to increase the learner's incremental ability beliefs

These experimental conditions were:

(1) scaffolded questioning delivery with emotional support messages,

(2) scaffolded questioning delivery with motivational support messages,

(3) scaffolded questioning delivery without any support messages,

(4) didactic delivery with emotional support messages,

(5) didactic delivery with motivational support messages, and

(6) didactic delivery without any support messages.

The levels of the independent variables are illustrated in Figure 4.1 and the associated interventions are provided in Table 4.2.

Figure 4.1 Levels of independent variables in this study

		Delivery Scaffolded Questioning	
		Present	Absent
Support	Emotional	1 Scaffolded questioning delivery & emotional support **QA (Emo)**	4 Didactic delivery & emotional support **Did (Emo)**
	Motivational	2 Scaffolded questioning delivery & motivational support **QA (Mot)**	5 Didactic delivery & motivational support **Did (Mot)**
	No emotional or motivational	3 Scaffolded questioning delivery without support **QA**	6 Didactic delivery without support **Did**

Table 4.2 Independent variables and associated interventions

Condition	Description	Acronym	Interventions
1	Scaffolded questioning delivery with emotional support	QA (Emo)	Lessons delivered as a series of instructor-student question and answer dialogues with emotional messages
2	Scaffolded questioning delivery with motivational support	QA (Mot)	Lessons delivered as a series of instructor-student question and answer dialogues with motivational messages
3	Scaffolded questioning delivery without support	QA	Lessons delivered as a series of instructor-student question and answer dialogues without emotional or motivational messages
4	Didactic delivery with emotional support	Did (Emo)	Lessons delivered didactically by the instructor with emotional messages
5	Didactic delivery with motivational support	Did (Mot)	Lessons delivered didactically by the instructor with motivational messages
6	Didactic delivery without support	Did	Lessons delivered didactically by the instructor without emotional or motivational messages

The effects of these conditions on writing competence, writing self-efficacy, and writing anxiety were examined.

Participants in each condition were asked to attend two successive lessons, approximately one week apart, on the important aspects of academic writing in Phase 1 of the study. In Phase 1, Lesson 1, topics on academic writing were covered, while Phase 1, Lesson 2 encompassed topics on referencing.

Phase 2 involved follow up interviews with two participants from each condition, in which they answered a number of open-ended interview questions in order to probe further into the extent that the learning environment helped improve their academic writing confidence, whether it had an impact on any pre-existing negative emotions and their writing competence.

4.4 Lesson Structure

Both lessons in Phase 1 of the research in each of the six conditions were designed in parallel and shared some common elements. For example, each lesson was designed to accomplish the same learning outcomes and required the participants to watch a lesson involving classroom interactions between a writing instructor and student APAs. Also, each lesson comprised in-lesson quizzes with elaborate feedback. Elaborate feedback, as distinct from simple feedback, is feedback that surpasses confirming the correctness of an answer to include explanations for both correct and incorrect answers, and has been shown to have a much stronger effect on student outcomes in a meta-analysis of 40 research studies (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991) and in an APA study (Lin, Atkinson, Christopherson, Joseph, & Harrison, 2013).

Lesson 1 covered five key elements of academic writing, namely writing in an academic style, writing introductions, writing body paragraphs, linking ideas, and writing conclusions. Lesson 2 covered four key elements for referencing, namely incorporating ideas, quoting, paraphrasing, and following referencing conventions.

Each lesson was also chunked according to the individual lesson learning outcomes where content was delivered either through scaffolded questioning (Conditions 1, 2, and 3) or didactically (Conditions 4, 5, and 6). In the scaffolded questioning delivery conditions, participants observed these lessons in the form of question-and-answer dialogues between the student and writing instructor APAs; while the remaining three conditions were designed so that participants would observe these lessons in the form of one-way instructions flowing from the writing instructor APA to the student APA. In each condition, participants observed a total of 14 scenes involving question answer dialogues or 14 involving didactic delivery depending on the condition they were assigned to.

Within each segment, delivery was followed by an in-lesson quiz with elaborate feedback which was provided either with emotional support (Conditions 1 and 4), motivational support (Conditions 2 and 5) or no support (Conditions 3 and 6). Next, participants received a lesson segment summary with either emotional support (Conditions 1 and 4), motivational support (Conditions 2 and 5) or no support (Conditions 3 and 6). The structure of the learning materials is overviewed in Appendix B.

Each of the two emotional conditions (Conditions 1 and 4) had a total of 29 emotional messages embedded within each of them, while the two motivational conditions

(Conditions 2 and 5) similarly had a total of 29 motivational messages embedded within each.

4.5 The Design of the Lesson Environment

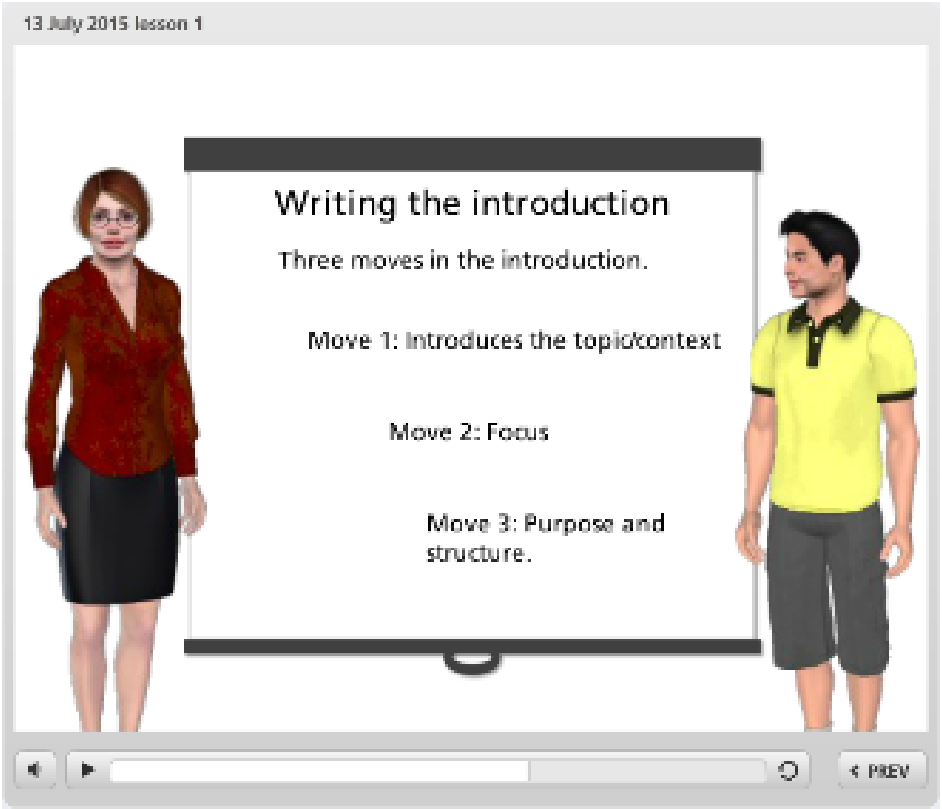
This study was designed based on four out of the five research grounded principles for designing experiments involving APAs as recommended by Clark and Choi (2005): "The Balanced Separation Principle" requires sufficient controls to be designed to enable changes to the APA intervention to be discerned; "The Variety of Outcomes Principle" necessitates a range of measurement instruments to be deployed to capture the range of outcomes that the APA is designed to affect; "The Robust Measurement Principle" recommends that measurement instruments satisfy reliability and construct validity criteria; and "The Cognitive Load Principle" necessitates APAs to be designed without superfluous stimuli so as not to overburden the learners' working memory. "The Cost-Effectiveness Principle", which recommends that data collection should reflect the comparative cost of producing APA treatments at the expense of non-APA treatments, was less relevant to this study design as it concerns authentic classroom interventions.

Both lessons within this study were created by the researcher using a course authoring software platform, Articulate Storyline (2014), within which the APAs would inhabit. In the key lesson delivery scenarios, the instructor and student APAs were placed on either side of the whiteboard where the interactive lesson content was displayed. This whiteboard was the canvas upon which the interactive elements of the lessons were choreographed to synchronise with the narrations uttered by the instructor APA. It is important to note that this lesson environment cannot be considered an authentic ITS given that it was not designed for adaptation to each student's emergent level of

development within the task domain, according to the strict definition of ITSs proposed by VanLehn (2006).

These lesson elements were animated in accordance with a number of established multimedia design principles, namely coherence, signalling, redundancy, spatial contiguity and temporal contiguity (Mayer, 2005a). In addition, design principles deemed important to achieve optimal visual impact in the lesson environment were adopted after considering complexity, colour, background, layout, arraying of information, typography, and graphics as synthesised in the work of Hilliard (2016). A sample screenshot of the lesson delivery is provided in Figure 4.2. Appendix C details the activities and time taken to create both lessons and the APAs.

Figure 4.2 Sample screenshot of the lesson delivery



4.6 The Design of the Animated Pedagogical Agents

The design of the APAs in this study was guided by the adapted version of the Pedagogical Agent's Level of Design model (Domagk, 2010), discussed and illustrated in Figure 2.2, with its series of cascading design decisions. These design decisions commenced at the superordinate *global level* (comprising decisions on whether to adopt non-human or human APAs), extended to the *medium level* (comprising technical decisions and character choices) and culminated in the *detail level* comprising decisions about the choice of each APA's age, gender, clothing, voice and the other finer details.

4.6.1 Global Level Design Decisions

At the global level, it was determined early on that the APAs would be embodied as animated human characters in preference to non-human objects or animals in order to replicate a classroom situation as closely as possible. Initially, the idea of using static pedagogical agents was entertained given that the Articulate Storyline (2014) course authoring platform provides a range of static pedagogical agents in their software suite. However, this option was ruled out because research has demonstrated that *animated* agents have been found to produce higher transfer scores compared with static agents (Lusk & Atkinson, 2007) and are perceived as more engaging (Baylor & Ryu, 2003) when compared with their static counterparts. Consequently, all four APAs in the lessons were designed to resemble humans using the Character Builder (2014) APA design software.

4.6.2 Medium Level Design Decisions

At the medium level, technical decisions were made on APA design attributes, namely realism, animation level, voice output and speech style. With respect to the element of realism, considerable time and attention were given to positioning and posing both the

instructor and inexperienced student APAs to replicate authentic instructor-student exchanges in a classroom situation during the lesson delivery. For example, during delivery, the writing instructor APA was positioned on the left-hand side of the screen, with the student APA on the opposite side, with their bodies turned slightly towards each other, but facing the study participants as if to address them when speaking. In order to maintain realism, APA movements were painstakingly choreographed so that even when an APA was the passive recipient of an interaction (for example, when the novice student APA was listening to the instructor APA) the novice student APA was automated to respond to the instructor APA by orientating itself towards the latter, nodding in agreement and also momentarily directing its gaze towards the participants, as if acknowledging the existence of an audience. Realism was also aided by the affordances provided by the Character Builder (2014) software which was equipped with a setting for augmenting the degree of lifelikeness in the APAs' fast cues (Ekman, 1979) See Section 2.10.2.3.2. for a discussion on fast cues. This Character Builder software setting was augmented so that the APAs would display natural human behaviours such as blinking and fidgeting to project realism in the intervals between performing their more deliberate actions.

With respect to decisions about speech style, natural human voices were preferred over machine generated ones. This decision was based on the phenomenon called the 'voice effect' where the human voice was found to be superior to machine voice in improving learning transfer (Atkinson et al., 2005; Mayer & DaPra, 2012) and engendering more favourable perceptions of the APA (Atkinson et al., 2005). In contrast, machine voices have been found to reduce the embodiment effect which could in turn negatively impact on learning transfer as has been found in several studies (Atkinson, 2002;

Atkinson et al., 2005; Mayer & DaPra, 2012). While modern machine voices have evolved to become almost indistinguishable from authentic human voices, participants in one study managed to discern the difference between them, and rated the authentic APA voice slightly more positively than the modern machine voice (Chiou et al., 2020). This confirmed the use of natural human voices over machine generated ones.

The decision to use natural human voices provided the researcher with two options: whether to record the APA voices using the Character Builder (2014) software voice recording feature or to import pre-recorded voices from dedicated voice recording and editing software. The latter option, specifically WavePad Sound Editor voice editing software was chosen for this task as it enabled more sophisticated processing of the voice clips such as the ability to edit out background noise, and adjust the voice captures for pitch, speed, volume and clarity. These edited sound clips were then uploaded to Character Builder (2014) and lip-synced to the respective APAs using the software's language-independent feature which had been tested with a myriad of languages in addition to English.

At the medium level, decisions were made about the choice of the various characters, including their determining features and roles. Each of the four APAs in the study were unique and were designed to perform a distinct pedagogical role within these lessons because the split-persona effect has been found to be beneficial to student motivation and learning (Baylor, 2009, 2011; Baylor & Kim, 2005). The four characters were:

- Professor Rutledge, a writing instructor;
- Chong, an inexperienced student;
- Dr Ramachandran, an educational psychologist; and
- Anna, an empathetic experienced student.

The various roles along with associated detail level design decisions made with respect to the APAs in this study are described in Sections 4.6.3.1 to 4.6.3.4, and these APAs are illustrated in Figure 4.3.

Figure 4.3 APAs used in the study

Professor Rutledge, Writing instructor

Chong, Inexperienced Student

Dr Ramachandran, Educational Psychologist (Emotional or Motivational Expert)

Anna, Experienced Student

4.6.3 Detail Level Design Decisions

This section first describes the various design decisions that were made about the APAs collectively at the detail level and then for each APA individually. The Character Builder (2014) software affords APAs to either be designed from the basic character template, or be modified from an imported image. Users are able to customise each APA's facial attributes including its static cues (gender, age, ethnic appearance, skin, hair and eye colours), slow cues (wrinkles and pigmentation), and cosmetic cues (hairstyles, attire and accessories) which comprise the array of human facial expression (Ekman, 1979).

An interesting affordance of this software is its ability to transform the facial features of each APA through several sliding scales that operationalise its static cues, for example ethnicity, masculinity/ femininity, and attractiveness. With respect to ethnicity, each APA's facial features can be altered to resemble one or more of the software's pre-

programmed ethnic groups (Oriental, African, Indian or European) by apportioning different percentages to each one. For example, one APA could be allocated a 90% European and 10% Indian appearance, while another could be assigned 25% to each of these four groups. Features can also be manipulated to appear more masculine (e.g. operationalised by a squarer jawline, shaving shadow) or feminine (e.g. operationalised by a softer jawline, larger eyes). Yet another sliding scale enables adjustments to be made for attractiveness, with higher levels of this attribute (larger eyes, symmetrical features) being on one end of the sliding scale, to lower levels of this attribute (beady eyes, and asymmetrical features) on the other. Through another sliding scale, the APA's slow cues could be varied, for example ageing it from the youthful dewiness of a 20-year-old to that of a withered 90-year-old.

4.6.3.1 Professor Rutledge, Writing Instructor

Professor Rutledge, the female writing instructor APA, was embodied to project an image of authority in the field of academic literacy. She was designed to appear middle aged and was assigned the female gender because this field has tended to attract a disproportionately higher number of females (Percy, 2011). Given that APAs perceived as attractive have a stronger influence over their learners (Rosenberg-Kima et al., 2010), this APA was adapted from a downloaded photograph of an individual generally considered beautiful. Her facial features were subsequently adjusted so that she would resemble each of the four ethnic groups equally to optimise appeal for the participants in the study. She was attired smartly in a shirt and formal skirt and developed to speak with a standard-accented low-pitched mature female voice to convey her expertise. The voice used was that of the primary researcher. Professor Rutledge was deployed in all six experimental conditions to:

- welcome the learners to the lessons,
- deliver the lesson content,
- announce each lesson's learning outcomes,
- introduce the in-lesson quizzes, and
- deliver feedback on these quizzes.

4.6.3.2 Chong, Inexperienced Student

Chong, the inexperienced male student APA, was personified to represent a novice student navigating the challenges of learning academic writing. This character was designed to resemble a youthful male. His facial features were adjusted to resemble those of an oriental looking person as programmed in the software to provide him with a distinctive identity to differentiate him from the other APAs in the lesson. He was dressed in a tee shirt and shorts and developed to speak with a standard-accented adolescent voice–that of the voice of the researcher's son. He was designed to appear with Professor Rutledge to ask naïve questions about academic writing in the lessons involving scaffolded questioning delivery (Conditions 1, 2 and 3); while in the lessons involving didactic delivery (Conditions 4, 5 and 6), he merely watched the lesson passively. Like Professor Rutledge, he appeared in all six experimental conditions with her during the lesson delivery.

4.6.3.3 Dr Ramachandran, Educational Psychologist

Dr Ramachandran, the male educational psychologist APA, was embodied to appear as an authority on motivation or emotion (depending on the condition). He was designed to appear middle aged and was assigned the male gender to convey a stereotypical fatherly and authoritative persona. In keeping with this persona, his image was adapted from a downloaded photograph of a popular contemporary television psychotherapist.

His facial features were then transformed to boost his Indian ethnicity by 75% in order to give him a distinctive identity. He was suitably attired in a formal suit and tie to project credibility.

He was developed to speak with an Indian-accented soothing deep male voice to convey his expertise in psychology. The voice of the researcher was used for this, but her voice pitch was digitally lowered using the voice editing software. Dr Ramachandran was programmed to only appear in the two emotional experimental conditions (Conditions 1 and 4) and the motivational ones (Conditions 2 and 5) and to play the role of either emotional or motivational expert. In the emotional conditions, he was deployed to enquire about how the learner feels after each sub lesson (six times throughout both lessons). In the motivational condition, he was utilised to perform two main roles: to narrate a five minute educational video on the malleability of the human brain (Maguire et al., 2003; Maguire, Woollett, & Spiers, 2006; MaxPlanckSociety, 2012), and to enquire whether the participants felt motivated to continue learning about writing (six times throughout both lessons). Negative responses to this would then trigger motivational messages to encourage the participant to continue. These were delivered by Anna, the experienced student APA.

4.6.3.4 Anna, Experienced Student

Anna, the experienced female student APA, was personified to represent an individual who had initially struggled with mastering writing for academic purposes, but who had successfully developed this skill over time. This character was created to resemble a youthful female. Her facial features were designed from the software's generic template, and were adjusted to resemble each of the four ethnic groups equally. She was dressed casually in a tee shirt and jeans and was developed to speak with a

standard-accented youthful female voice–that of the voice of the researcher's daughter. Anna was scheduled to appear only in the two emotional experimental conditions (Conditions 1 and 4) and the motivational ones (Conditions 2 and 5).

In the emotional conditions, Anna's main role was summoned only when the participant clicked 'yes' in response to a prompt that appeared at six critical junctures in the lesson to enquire about whether the participant was feeling anxious. When this happened, she was designed to:

- express her empathy and invite them to vent their emotions,
- invite them to seek support for instrumental reasons whereupon she recounted her strategies for overcoming similar challenges when she had faced them, and
- invite them to seek support with their feelings whereupon she disclosed her own anxieties when starting to learn how to write.

Similarly, in the motivational condition, Anna's main role was summoned only when the participant clicked 'yes' in response to a prompt that appeared at six critical junctures in the lesson to enquire about whether the participant was feeling motivated. When this happened, she was designed to:

- relate her strategies for improving her initially low motivation to write,
- provide encouragement to improve the skill and the resulting effect of doing so, and
- emphasise that the particular skill in this lesson segment is achievable with some practice.

4.7 Independent Variables

Of the three independent variables in this study, only scaffolded questioning was operationalised during lesson delivery (Conditions 1, 2 and 3), while the remaining two

were operationalised outside of lesson delivery by the relevant APAs supporting the participants with either emotional messages (Conditions 1 and 4) or motivational messages (Conditions 2 and 5). Each independent variable was provided at two levels (presence versus absence) which resulted in six different conditions. These independent variables are illustrated in Figure 4.1.

4.7.1 Scaffolded Questioning

Scaffolded questioning was operationalised by the inexperienced student APA directing questions that reflect a "naive perspective of an inquisitive novice on first exposure…", (Driscoll et al., 2003, p. 436). The questions were guided by many of the generic questions stems (King, 1992) discussed in Section 2.7. In response to these questions, the writing instructor APA, performing the role of an accomplished writer, was designed to elaborate on the answers to these questions in the order that they are raised. For example, on the topic of writing introductions, the inexperienced student APA was designed to first asks the question: "How is an essay structured?" to which the writing instructor was programmed to respond appropriately. The student APA then progressively asks each of the remaining questions on the topic, receiving a response to each question from the writing instructor APA. Examples of the naïve questions asked in this study are provided in Table 4.3.

Table 4.3 Scaffolded questions used in this study based on generic question stems

Question stems adapted from King (1992)	Examples from the scaffolded questioning dialogue
What is a new example of…..?	Do you have any other proof that learning helps to change my brain?
How would you use … to …?	So how can I improve cohesion in my writing?
What would happen if…?	If I use linking words, will my writing be more understandable?
What are the strengths and weaknesses of …?	So why would you use idea prominent sometimes, and author prominent at other times?
How does … tie in with what we learned before?	What about the end of the essay–is there a good way of doing it?
Explain why …	I heard that I have to use tentative language when writing. What does that mean, and why do I have to do this?
Explain how …	How do I do that (write in an academic style)? How do I write concisely? How long is a paragraph? How do I structure my paragraphs?
How does … affect … ?	[after watching a video on the malleability of intelligence] So what does this mean for me learning to write?
What is the meaning of … ?	What does it mean to write in an academic style? What is a paragraph?
Why is … important?	What about using the third person voice? Why am I not allowed to use I, we and you? Why can't I use slang? Why do I need to write in paragraphs?
What is the difference between … and … ?	I notice that there are two ways of referencing sources in text. Sometimes the author's name is outside the bracket at the front of the sentence, and other times it's in the bracket at the end of the sentence. What's the difference?
How are … and … similar?	Is cohesion the same thing as coherence?
What is the best … and why …?	I don't get it. Why do I have to say something in my own way when I can easily quote it?
Compare … and … with regard to …	Do I need to provide a page number when paraphrasing like I need to do when quoting?
Do you agree or disagree with this statement …? Support your answer.	I usually write paragraphs as long as a page. Is that ok?

Adapted from King (1992)

The second level (no scaffolded questioning) was operationalised by the writing instructor APA initiating delivery of identical content as in the scaffolded questioning conditions, but without being prompted to answer any questions. In other words, the writing instructor APA delivers the content didactically to the inexperienced student APA who passively listens to it.

4.7.2 Emotional Support

The second independent variable (emotional support) was operationalised by the provision of emotional support messages, but only for Conditions 1 and 4. This emotional content was delivered using a three-pronged approach across both lessons: at the start of both lessons, in summary messages occurring upon conclusion of six out of the eight lesson sub-topics, and through the delivery of feedback for each of the 21 quiz questions. The absence of emotional support was operationalised by omitting such emotional content at each of these lesson junctures. Appendix B overviews the structure of the learning material.

Emotional support was grounded conceptually in the provision of coping strategies developed by Carver et al. (1989) and operationalised using the FEASP approach designed by Astleitner (2000). The background for both approaches is discussed in Section 2.9.3. Thus, participants in the study were provided with emotional support by *proactively* cultivating an environment that supported learners emotionally and *retrospectively* providing coping strategies to alleviate anxious feelings when they occurred. These are discussed in Sections 4.7.2.1 and 4.7.2.2.

4.7.2.1 Proactive Emotional Support

Proactive emotional support involved the establishment of a learning environment conducive to supporting participants emotionally by reducing negatively valanced feelings, and concurrently increasing positively valanced feelings. Accordingly, the FEASP approach (Astleitner, 2000, 2001) was adopted as it had been validated empirically (Astleitner, 2001) and deemed suitable for delivery through instructional technologies (Astleitner & Leutner, 2000). This approach was chosen because it complemented Carver et al.'s (1989) COPE strategies and was straightforward to operationalise through the use of dialogue.

The FEASP approach was applied at two main points in the lesson. The first was at the beginning of both lessons, when participants were assured that if they felt nervous about writing, it was normal to do so, and not to worry. The second was in feedback responses to the 21 quiz questions within the lessons, where participants received emotional messages irrespective of whether they provided correct or incorrect responses. While the FEASP approach was the primary approach used to provide proactive emotional support, one of the coping strategies deployed the Carver et al. (1989) positive reinterpretation and growth (RG) messages mentioned in Section 2.9.3. Appendix D displays the emotional support messages for both correct and incorrect quiz responses primarily based on the FEASP strategy. In crafting these emotional support messages, words were purposefully chosen from an inventory of feelings (The Centre for Nonviolent Communication, n.d.) to elicit the desired feelings from the learner (Appendix E).

4.7.2.2 Retrospective Coping Strategies

Retrospective emotional support was provided should the participant experience negative emotions while doing the lesson, the primary one being anxiety. Coping strategies are the means by which learners experiencing anxiety may obtain support for their anxious feelings. Emotional support in this study was operationalised using three of the thirteen elements of Carver et al.'s coping theory (1989) described in Section 2.9.3. These three emotional coping strategies are seeking social support for emotional reasons (ES); seeking social support for instrumental reasons (IS); and venting of emotions (VE).

The operationalisation of emotional support based on these strategies was deemed appropriate for this study because previous studies using APAs to convey emotional messages based on Carver's (1989) strategies demonstrated a number of significant positive effects on students' mathematics anxiety, mathematical problem solving and self-efficacy (Im, 2012), and on mathematical problem solving and self-efficacy (Shen, 2009). Therefore, in the present study, retrospective coping strategies were enacted by APAs, to provide emotional support to the students.

Using the work of Carver (1989), emotional messages were provided upon conclusion of six out of the eight lesson sub-topics, when the educational psychologist APA appeared to ask participants whether they were feeling anxious. An affirmative participant response (by the action of clicking on the 'yes' button) resulted in the experienced student APA appearing and presenting the participants with a number of options. Participants could choose whether to seek social support for emotional reasons (ES) and/or seek social support for instrumental reasons (IS) by clicking on the appropriate buttons; or vent their emotions (VE) by typing into the text box. Clicking on the ES

and/or IS buttons resulted in the experienced student APA providing them with the appropriate message(s). Examples of retrospective emotional support based on the Carver et al.'s (1989) COPE inventory as used in this study are provided in Table 4.4

Table 4.4 Examples of emotional support based on Carver et al.'s (1989) COPE Inventory

COPE categories	Stage in the lesson	Operationalisation of concept for this study	Example from this study
Seeking support for emotional reasons (ES)	At the end of six lessons sub-topics	Talking to someone about feelings. Eliciting emotional support from others.	"Don't worry! I was also unsure about writing for academic purposes when I first started university. I know you are feeling anxious now, and I remember feeling that way. Like me, you WILL get through this!"
Seeking support for instrumental reasons (IS)	At the end of six lessons sub-topics	Asking others with similar experiences what they did. Eliciting advice from others about what to do Finding out more about the situation from others Talking to others who could do something concrete about the problem.	"Writing introductions may seem hard at first. I know that I found it challenging when I first started, but once I followed the three moves on how to write one, and as I practise it in my own writing, I find that I am starting to be really good at it. You will too if you do the same!"
Venting of emotions (VE)	At the end of six lessons sub-topics	Expressing emotions when upset	"Hi! I know how you are feeling as I have been through this before. Click on the blue buttons to see how I have dealt with this area of writing, and managed my feelings. Why not type how you are feeling into the text box. This may help you to relax."

4.7.3 Motivational Support

The third independent variable (motivational support) was operationalised by the provision of motivational support messages, but only for Conditions 2 and 5. This motivational content was delivered using a three-pronged approach across both lessons: upon commencement of both lessons, in summary messages occurring upon conclusion of six out of the eight lesson sub-topics, and through feedback responses for each of the 21 quiz questions. The absence of motivational support was operationalised by omitting such motivational content at each of these lesson junctures. Appendix B overviews the structure of the learning material.

The provision of motivational support in this study is underpinned by the work of Schunk et al. (1987), particularly on the success at applying coping (as opposed to mastery) modelling for improving self-efficacy and performance as reviewed in Section 2.8. Motivational support in this study is also based on research demonstrating the effectiveness of growth mindset thinking to persuade learners that intelligence is malleable and can result in improved self-efficacy (Blackwell et al., 2007; Dweck, 1999; Dweck & Leggett, 1988).

This previous research has informed the design of motivational APAs in a number of subsequent studies (Baylor, 2009; Donohoe, Topping, & Hannah, 2012; Ebbers, 2007; Mindset Works Inc., 2008) as reviewed in Section 2.10.5. Of particular relevance to the present study is a computer program called Brainology (Mindset Works Inc., 2008) that utilises a peer and scientist APA, with the latter providing the incremental ability messages. This study as reported in Donohoe et al. (2012) provides evidence for short-term changes in users' mindsets due to participants' exposure to messages conveying the malleability of intelligence. In another APA study, Im (2012) found that applying

incremental ability messages resulted in significant improvements in mathematics anxiety, self-efficacy, and mathematical problem solving of study participants exposed to incremental ability messages when compared with the control group. Thus, these studies collectively provide compelling evidence for the potential of incremental ability messages to bolster learner self-efficacy when learning academic writing.

Motivational messages were applied using the three-pronged approach discussed earlier in this section. At the beginning of the first lesson, the educational psychologist APA was designed to narrate a five-minute educational video produced by the researcher on the malleability of the human brain. This narration was based on a study of London taxi drivers that unequivocally demonstrated the strong positive correlation between brain grey matter volume and time spent navigating, thereby showing that learning stimulates brain development (Maguire et al., 2003; Maguire et al., 2006). The researcher adapted growth mindset messages from a number of sources (MaxPlanckSociety, 2012; Mindset Works Inc., 2008). Examples of growth mindset messages from the video used in this study as adapted from Brainology along with screen captures from the video are provided in Appendix F.

The second place that motivational messages were included was in feedback responses to the 21 quiz questions within the lessons. Participants received these motivational messages irrespective of whether they provided correct or incorrect responses. These messages were a form of verbal persuasion designed to convince learners that intelligence was not fixed (entity theory), but instead can be grown (incremental theory) (Dweck, 1999; Dweck & Leggett, 1988). With respect to incremental theories, Blackwell et al. (2007) discussed the four dimensions that were operationalised in this study. These are goal focus (GF)—goals with the aim of increasing as opposed to documenting

ability; effort orientation (EO)—utility as opposed to futility of effort in the face of challenges; failure attributions (FA)—attributions to failure are towards low effort as opposed to low ability; and strategies displayed (SD)—strategies that demonstrate adaptability as opposed to helplessness. These characteristics were implemented in the motivational support messages for both correct and incorrect quiz responses in the lessons. Appendix G displays these motivational support messages.

4.8 Dependent Variables and Their Measurement

The measurement of the dependent variables in this study first required their operationalisation, namely writing competence, writing self-efficacy and writing anxiety. In order to achieve this, additional measurable variables were created by subtracting the pre-intervention measurements from their respective post-intervention measurements. The only exception to this was the writing anxiety measurement where the post-intervention measurement was subtracted from its pre-intervention counterpart because this was hypothesised to move in the opposite direction in contrast to the rest of the dependent variables. Table 4.5 clarifies the relationship between the constructs, their dependent variables, the instruments used to measure them and their operational definitions.

Table 4.5 Constructs, dependent variables, instruments, and their operational definitions

Constructs	Dependent Variable	Instruments	Operational Definitions
Writing anxiety	Reductions in Writing Anxiety	Writing Apprehension Test (WAT)	Subtraction of final WAT score (after completing Lesson 2) from initial WAT score (before completing Lesson 1).
Writing self-efficacy	Improvements in Writing Self Efficacy	Self-Efficacy for Writing Scale (SEWS)	Subtraction of initial SEWS score (Before completing Lesson 1) from final SEWS score (after completing Lesson 2).
Writing self-efficacy	Improvements in Writing Self Efficacy (Generating Ideas)	Self-Efficacy for Writing Scale (SEWS)	Subtraction of initial SEWS score for generating ideas concept/ factor (before completing Lesson 1) from final SEWS score (after completing Lesson 2).
Writing self-efficacy	Improvements in Writing Self Efficacy (Following Writing Conventions)	Self-Efficacy for Writing Scale (SEWS)	Subtraction of initial SEWS score for following writing conventions concept/factor (before completing Lesson 1) from final SEWS score (after completing Lesson 2).
Writing self-efficacy	Improvements in Writing Self Efficacy (Self-regulating ideas)	Self-Efficacy for Writing Scale (SEWS)	Subtraction of initial SEWS score for self-regulating ideas concept/ factor (before completing Lesson 1) from final SEWS score (after completing Lesson 2).
Writing self-efficacy for specific skills	Improvements in Writing Skills Self-Efficacy Lesson 1	Skill Specific Self-efficacy Scale (SSSES) Lesson 1	Subtraction of initial SSSES scores (Before completing Lesson 1) from final SSSES scores (after completing Lesson 1).
Writing self-efficacy for specific skills	Improvements in Writing Skills Self-Efficacy Lesson 2	Skill Specific Self-efficacy Scale (SSSES) Lesson 2	Subtraction of initial SSSES scores (Before completing Lesson 2) from final SSSES scores (after completing Lesson 2).
Writing competence	Improvements in Writing Competence	Essay tasks Scoring rubrics	Subtraction of initial rubric score (Before completing Lesson 1) from final rubric score (after completing Lesson 2).

4.8.1 Writing Competence

In order to measure changes to the participants' writing competence as a result of participating in the study, it was necessary to first determine the elements of writing competence that would most likely be impacted by the delivery of the two lessons. Knoch, Rouhshad, and Storch (2014) provide some guidance to address this question by reviewing previous studies in second language writing that synthesise instances of writing development that have been responsive to instruction. Of particular interest to the present study were improvements resulting from short term instruction, namely in the use of informal expression (Shaw & Liu, 1998; Storch, 2009) and structural adequacy, that is writing introductions, conclusions and paragraphing (Felix & Lawson, 1994). In contrast, the rate at which grammatical errors occurred did not appear to respond to short term writing interventions (Felix & Lawson, 1994). As such, the former elements were incorporated into the lesson outcomes, which were writing in an academic style, writing a well organised introduction and conclusion, constructing effective body paragraphs, using techniques to link ideas cohesively within a piece of writing and citing other peoples' ideas accurately.

These learning outcomes were the basis upon which the lessons were designed, and assessments of whether improvements were made on these various lesson learning outcomes were obtained by examining improvements in participants' writing. This is in accordance with the principle of constructive alignment, which necessitates "…coherence between assessment, teaching strategies and intended learning outcomes in an educational programme" (McMahon & Thakore, 2006, p. 10). The learning outcomes for the lessons designed for the study are provided in Appendix H.

The writing tasks designed for this study used simple essay writing prompts instructing participants to write a short essay comprising an introduction, body and conclusion. Additionally, participants were provided with some ideas from two journal article abstracts, which they were asked to incorporate into their essays and to attempt to reference them if they were able to do so. These tasks were chosen because they provided participants with the opportunity to transfer their knowledge to an authentic writing task. The initial and final essay questions were deemed comparable in topic and level of sophistication and are displayed in Appendices I and J respectively.

In order to measure the writing competence construct, literature on assessing rating scales was consulted. In particular, Knoch's (2011) recommendations for designing rating scales for diagnostic assessment of writing were considered. These were: (a) that an analytic over a holistic scale should be used due to its ability to provide "more diagnostic information about a writer's ability" (Knoch, 2011, p. 83) in contrast to the latter, which would only yield one score thereby minimising its usefulness for diagnostic purposes; (b) that this scale should be assessor oriented as it is to be used primarily by assessors, thereby necessitating that adequate information is provided to enable a reliable allocation of scores; (c) that it should be underpinned by a taxonomy of all current existing models of language or writing development due to the absence of an overarching theory; (d) the intended use of the scale should inform the number of band levels with associated explicit descriptors; and (e) that reporting of the results of the diagnostic assessment should be in as much detail as possible. Table 4.6 lists the taxonomic features of existing models of language or writing development. The items of interest to this study that were incorporated into the writing rubric are bolded.

Table 4.6 Categorisation of taxonomy features into concepts

Category	Feature (Knoch, 2011)
Accuracy	Vocabulary Syntax Grammar Error types/frequency and gravity of errors Morphology Functional knowledge
Fluency	Text length Fluency, editing
Complexity	Vocabulary Syntax morphology Functional knowledge
Mechanics	Spelling, Punctuation Capitalisation Paragraphing, Layout
Cohesion	**Cohesion**
Coherence	**Coherence**
Reader/writer interaction	Functional knowledge Sociolinguistic knowledge Style Stance and posture Audience awareness
Content	**Topic development** **Relevance** **Support,** **Logic** **Quantity of content** **Task completion** **Use of source material**

In line with Knoch's (2011) identified features, the writing rubric was deliberately analytic, assessor orientated, underpinned by a current taxonomy of current existing models of language/writing development, and incorporated an appropriate number of scale levels with explicit descriptors. Specifically, it utilised five scale points based on the recommendations by Myford (2002). This is in keeping with research into the limits of human working memory, which had long been hypothesised to range from between five

and nine discrete items (Miller, 1956), but had subsequently been reduced to between three and five items (Cowan, 2001).

It is worth noting that the specificity of the elements of writing competence as embodied in the lessons' learning outcomes and scope of the project necessitated that only pertinent taxonomic features were adopted in the design of the writing rubric. Consequently, the first five elements that were incorporated into the development of the writing rubric were to measure how well the participants wrote in an academic style, assembled a well organised introduction, constructed effective paragraphs, wrote with cohesion and coherence, and constructed a well organised conclusion. The next five measured how well the participant used sources, quoted and paraphrased, integrated ideas, used reporting verbs, and formatted a reference list. Each criterion was weighted equally and allocated five scale levels with explicit descriptors. Table 4.7 shows the writing assessment competence criteria as expressed in the Final Scoring Rubrics for Essay Writing Tasks.

Table 4.7 Finalised scoring rubric for measuring writing competence in the essay writing tasks

Criteria and What to look for	1	2	3	4	5
1.Academic style Examine the essay for the use of: • contractions, • slang, • first person language • wordy (not concise) language Remember to ignore basic grammatical and sentence structure mistakes	*The entire essay is not written in an academic style as evidenced by the presence of one or more of the following: contractions, slang, or first-person language. Writing is very wordy.	*With a few exceptions, this entire essay is not written in an academic style as evidenced by the absence of contractions, slang or first-person language. Writing is wordy.	*Most of the essay is written in an academic style as evidenced by the presence of one or more of the following: contractions, slang, or first-person language. Writing is somewhat wordy.	*With a few exceptions, this entire essay is written in an academic style as evidenced by the absence of contractions, slang or first-person language. Writing is concise.	*This entire essay is written in an academic style as evidenced by the absence of contractions, slang or first-person language. Writing is concise.
2. introduction Examine the introduction for evidence of **all** of the identifiable three moves, and their placement in the correct order: • introduction to the topic content • focus and purpose • Structure of the essay. For the top score, each element needs to be organised into the correct order and linked together seamlessly. *Note: For a score of 5, it is ok for moves 2 and 3 to be combined into one if the topic is very simple	There is no identifiable introduction.	There is a defined introduction, but it comprises only one of the three moves	There is a defined introduction, but it comprises only two of the three moves.	There is a defined introduction comprising the three moves. However, these may not be organised logically, linked together seamlessly nor do they identify the thesis statement	The introduction has **all** of the identifiable three moves: with each element organised logically, linked together seamlessly and that correctly identifies the thesis statement.
3. Body paragraphs Examine each of the **body paragraphs** for: • Development of one idea per paragraph, • a topic sentence followed by a few sentences that develop the main idea identified in the topic sentence, • evidence sentences that support the main idea (*note: If evidence sentence does not support the main idea, do not include this bullet in scoring the essay) • a final sentence that sums up the paragraph or leads into the next paragraph.	***Most** of the **body paragraph** do not conform to the requirements for constructing effective body paragraphs as evidenced by the **absence** of any of the dot points shown here.	***Most** of the **body paragraphs** meet the requirements for constructing effective body paragraphs as evidenced by the **presence** of just one **dot point** shown here.	***Most** of the **body paragraphs** meet the requirements for constructing effective body paragraphs as evidenced by the presence of **two dot point** shown here.	***Most** of the **body paragraphs** meet the requirements for constructing effective body paragraphs as evidenced by the presence of **three dot point** shown here.	***All** the body **paragraphs** meet the requirements for constructing effective body paragraphs as evidenced by the presence of **four dot point** shown here.
4. Coherence and cohesion Examine the essay for coherence and cohesiveness. • Evidence of coherence is the structuring of essay body paragraphs in accordance with the order identified in the thesis statement (in the introduction) • Evidence of cohesion is the use of a range of strategies including repetition of key nouns, linking and transition words.	The essay is highly incoherent, and never uses cohesive devices appropriately.	The essay lacks coherence, and occasionally uses cohesive devices appropriately.	The essay is coherent, and sometimes uses cohesive strategies appropriately.	The essay is coherent, and usually uses cohesive strategies appropriately.	The essay is coherent, and always uses cohesive strategies appropriately.
5. Conclusion Examine the conclusion for evidence of **all** of the identifiable three moves, and their placement in the correct order: • a restatement of the essay's main premise, • key arguments (a sentence for each key argument), • future statement For the top score, each element is organised into the correct order and linked together seamlessly.	There is no identifiable conclusion.	There is a defined conclusion, but it comprises only one of the three moves	There is a defined conclusion, but it comprises only two of the three moves.	There is a defined conclusion comprising **all** the three moves. However, these may not be organised logically and/or linked together seamlessly.	There is a defined conclusion comprising **all** the three moves with each element organised logically and linked together seamlessly.

6. Effective use of sources Examine the essay for evidence of the integration of source material to provide support for the arguments made. For the top score, the sources are integrated seamlessly into the essay.	No sources are used in this essay.	Sources are used in the essay, but smooth integration of this material to support the main argument/s rarely or never occurs.	Sources are used in the essay, but smooth integration of this material to support the main argument/s sometimes occurs.	Sources are used in the essay, but smooth integration of this material to support the main argument/s usually occurs.	Sources are used in the essay and smooth integration of this material to support the main argument/s always occurs.
7.Quoting and paraphrasing Examine the essay for evidence of formatting of a quote or paraphrase.	No quotes or paraphrases were used in this essay	Where a quote or paraphrase was added, it was not formatted at all.	Where a quote or paraphrase was added, an attempt was made to format it, although parts were missing or wrongly included e.g. Quotation marks, page numbers. *The paraphrase is identical in parts to the original text and/or does not reflect the true meaning of the original text	Where a quote or paraphrase was added, an attempt was made to format it, although parts were missing e.g. Quotation marks, page numbers (if quoting) *The paraphrase is identical in parts to the original text and/or does not reflect the true meaning of the original text	Where a quote or paraphrase was added, it was formatted accurately *The paraphrase is not at all close in form to the original text and accurately reflect the true meaning of the original text
8. Integrating ideas effectively Examine the essay for evidence of the distinction between the student's words and those of the cited author(s).	The reader cannot distinguish between the student's words and the cited author(s).	The reader can occasionally distinguish between the student's words and the cited author(s).	The reader can sometimes distinguish between the student's words and the cited author(s).	The reader can usually distinguish between the student's words and the cited author(s).	The reader can always distinguish between the student's words and the cited author(s).
9. Reporting verbs Examine the essay for the use of reporting verbs when referring to an author's view or position. E.g. Stein ***found*** in his research project that the women in the study were more hardworking than the men. Stein ***argued*** that heterogeneous teams are more productive than homogenous ones. Note: The phrase "**According to** x (2015, 1995)" is **not** a reporting verb. Ensure you do not treat it as one when scoring the paper.	No reporting verbs were used in this essay.	*A reporting verb was used once in this essay,	*Reporting verbs were used twice in this essay,	*Reporting verbs were used three times in this essay,	*Reporting verbs were used more than three times in this essay
10. Reference list Examine the reference list entry for correct use of APA referencing regarding a journal article.	No reference list was provided	Full referencing details were provided, but they were placed wrongly into the body of the essay.	A reference list was provided at the end of the essay, but it had some major errors/ omissions i.e. important details missing like author's initials, surnames, article name, journal name, page numbers	A reference list was provided at the end of the essay, and it was mostly correct except for a few minor errors /omissions i.e. punctuation, captialisations	A reference list was provided at the end of the essay, and it was 100% correct in detail and formatting

***** Denotes changes made to the rubric as a result of the feedback from the coders

Prior to using this writing rubric to code the participants' writing, indicators of a scale's validity, defined by Pallant (2016, p. 7) as "the degree to which it measures what it is supposed to measure" were examined. While there is no distinct indicator of a scale's validity, Pallant (2016) recommends collecting empirical evidence concerning its use. This was not possible in this case, given the fact that this rubric was designed specifically to measure only the constructs of interest in this study.

Reliability refers to the consistency of a measure, and whether the results can be reproduced under the same conditions. As such, initial indications of the rubric's reliability were achieved by conducting a pre-coding exercise with input from three individual coders (two who held doctoral qualifications in linguistics, and the other who was a qualified teacher of English as a second language). Six samples of participants' completed essays were provided for them to assign scores to each criterion on the writing rubric, and to provide feedback on any difficulties they encountered in interpreting the grade related descriptors within the rubric.

Salient variances between the coders were captured using a 'traffic light' colour coding scheme, where red signalled that two or more of the grades were discrepant from the rest of the grades for the item being graded, and orange represented that only one of the grades was discrepant. Using this scheme, it was possible to identify scoring descriptors that required editing for clarity to improve interrater reliability. Appendix K illustrates the interrater scoring information. In the interest of achieving improved interrater reliability for the writing rubric, scoring criteria with rows coloured red were reworded to achieve greater clarity.

The changes made to the rubric as a result of the feedback from the coders is summarised in the last columns in Appendix K and was incorporated into the finalised scoring rubric in Table 4.7. These changes made are denoted by asterisks and were the result of methodical investigation and ensuing refinement of instructions.

Improvements in writing competence was a dependent variable of interest and was calculated by subtracting each participant's initial rubric score (before completing Lesson 1) from their final rubric score (after completing Lesson 2). This variable was named *Improvements in Writing Competence*. Table 4.5 summarises this calculation along with the calculations of the other dependent variables in this study. Similarly, and at a more elemental level, it was also possible to determine improvements in writing competence for each of the ten discrete writing rubric elements by subtracting each participant's initial writing rubric score from their final score for each individual skill, for example writing in an academic style.

4.8.2 Writing Self-efficacy

Writing self-efficacy in this study is conceptualised in two ways. The first adopts a multifaceted view of this construct, while the second applies a task specific view by capturing the participants' perceptions of their confidence as it relates to specific writing tasks.

4.8.2.1 Writing Self-efficacy as a Multidimensional Construct

Writing self-efficacy has been conceptualised as a multidimensional construct (comprising multiple underlying concepts) in previous research. In this vein, Bruning et al. (2013) identified three concepts regarded as being salient to writing self-efficacy, namely generating ideas (ideation), expressing those ideas following writing convention

(conventions), and managing writing decisions and behaviours (self-regulation). These authors designed the Self-Efficacy for Writing Scale (SEWS; Bruning et al., 2013) to measure this construct and its associated concepts. This instrument was chosen as it has been used in a number of previous studies (Ekholm, Zumbrunn, & Conklin, 2015; Zumbrunn, Marrs, & Mewborn, 2016). These concepts are measured using 16 items: five for ideation, five for conventions, and six for writing self-regulation, as illustrated in Table 4.8.

Table 4.8 Self-Efficacy for Writing Scale construct and dimensions (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013)

Ideas about writing	
1	I can think of many ideas for my writing.
2	I can put my ideas into writing.
3	I can think of many words to describe my ideas.
4	I can think of a lot of original ideas.
5	I know exactly where to place my ideas in my writing.
Using writing conventions	
6	I can write in an academic style.
7	I can write a well-organized introduction.
8	I can construct effective body paragraphs.
9	I can use techniques to link ideas cohesively within a piece of writing.
10	I can write a well-organized conclusion.
Managing my writing	
11	I can focus on my writing for at least one hour.
12	I can avoid distractions while I write.
13	I can start writing assignments quickly.
14	I can control my frustration when I write.
15	I can think of my writing goals before I write.
16	I can keep writing even when it's difficult.

The SEWS, as administered in this study, adopts Bandura's (1982) recommendations for writing certainty scale development following the SEWS authors' recommendations. This scale was chosen as it had been endorsed by a number of researchers (Shell, Colvin,

& Bruining, 1989; Shell, Colvin, & Bruining, 1995). Specifically, it uses the '0' to '100' certainty scale where participants enter any number between '0' (no chance they can do a particular writing task) and '100' (completely certain that they can do this). See Appendix L for the SEWS as it was administered to the participants in this study.

The variables used to test H1b were at two levels: a global level and a skills level. With the former, a variable called *Improvements in Writing Self-Efficacy* was calculated for each participant by subtracting their initial SEWS score (before completing Lesson 1) from their final SEWS score (after completing Lesson 2). Given this was a multi-dimensional construct, this identical calculation was performed to compute each of the three underlying variables constituting this construct namely generating ideas (ideation), expressing those ideas following writing convention (conventions), and managing writing decisions and behaviours (self-regulation). See Table 4.5 for a summary of all additional variables calculated to test the hypotheses.

4.8.2.2 The Skills Specific View of Writing Self-efficacy

Whereas the SEWS captures writing self-efficacy as a multidimensional construct, potential relationships between the skills covered in Lessons 1 and 2 (as delineated in the lesson learning outcomes outlined in Appendix H) and the participants' self-efficacy for completing these skills were also phenomena of interest. As such, the skills specific view of self-efficacy conceptualises the writing self-efficacy construct as it relates to an individual's perceived self-efficacy for completing the specific writing skills covered in the lessons.

Accordingly, two scales were derived from the lesson learning outcomes for Lesson 1 and Lesson 2 to measure skills specific self-efficacy: the Skills Specific Self Efficacy Scale

Lesson 1 (SSSES1) and the Skills Specific Self Efficacy Scale Lesson 2 (SSSES2). The SSSES1 and SSSES2 instruments measure various factors representing the self-efficacy related to the skills taught in each lesson. These factors were derived from the lesson learning outcomes for the writing skills that were covered in the lesson, which were used to design the wording of the SSSES1 and SSSES 2 scales in the following way: "Rate your confidence in being able to successfully do the following tasks by recording a number from '0 'to '100'. The SSSES1 and SSSES2 items are displayed in Table 4.9 and Table 4.10 respectively.

Table 4.9 Skill Specific Self-efficacy Scale Lesson 1 items

Writing in an academic style	
1	I can write in a way that avoids using contractions (shortened form of words)
2	I can write using third person language
3	I can write using formal language
4	I can write in a concise way (without rambling)
Writing introductions	
5	I can identify the attributes of a good introduction
6	I can identify the three moves of an effective introduction
7	I can organize sentences in an introduction so it follows the three moves
8	I can construct an effective introduction
Writing body paragraphs	
9	I can construct a paragraph that develops only one idea
10	I can structure a basic paragraph
11	I can organize sentences in a paragraph so that it is logical
12	I can construct different types of paragraphs according to what is needed in an essay question
Linking ideas	
13	I can identify connectors (linking words) in a piece of writing
14	I can use connectors (linking words) in my writing to make it flow more logically
15	I can use repetition of key nouns in my writing so that the ideas flow more clearly
16	I can use pronouns consistently in my writing
Writing conclusions	
17	I can identify the attributes of a good conclusion
18	I can identify the three moves of an effective conclusion
19	I can organize sentences in a conclusion so it follows the three moves
20	I can construct an effective conclusion

Table 4.10 Skill Specific Self-efficacy Scale Lesson 2 items

Incorporating ideas	
1	I know when to cite other author's ideas in my own writing appropriately
2	I can use sources to support my own ideas
Quoting	
3	I can recognize when it is appropriate to quote when writing essays
4	I know when to use quotes in my own writing
5	I can use quotes effectively in my essays
6	I can format quotations
Paraphrasing	
7	I can recognise when I need to paraphrase when writing essays
8	I know when to use paraphrases instead of quotes in my essays
9	I can paraphrase effectively in my essays
10	I can format paraphrases
Conventions:	
11	I know when to use idea prominent and author prominent citations when referencing in text
12	I can identify appropriate reporting verbs to use when referencing others' ideas
13	I can format a journal article for a reference list

As described earlier, the measurement used a scale of 1 to 100 The full SSSES1 and SSSES2 questionnaires as used in this study are provided in Appendices M and N.

As mentioned earlier, the variables used to test H1b were at two levels: a global level and a specific skills level. With the latter, a variable called *Improvements in Writing Skills Self-Efficacy Lesson 1* was calculated for each participant by subtracting their initial SSSES 1 score from their final SSSES 1 score. In the same way, a variable called *Improvements in Writing Skills Self-Efficacy Lesson 2* was calculated for each participant by subtracting their initial SSSES 2 score (before completing Lesson 2) from their final SSSES 2 score (after completing Lesson 2). See Table 4.5 for a summary of all additional variables calculated to test the hypotheses.

4.8.3 Writing Anxiety

Writing anxiety in this study is conceptualised as an *emotion* which is elicited by the process of writing in an academic context, with psychological elements such as fear and dread; and physiological aspects such as sweating, digestive disturbances, and trembling (Petzel & Wenzel, 1993). In this study, the writing anxiety construct was measured using the Writing Apprehension Test (WAT; Daly & Miller, 1975a). In particular, the WAT was used to measure global changes to writing anxiety over the two lessons. This instrument was deemed suitable for the study because it has demonstrated considerable predictive validity (Richmond & Dickson-Markman, 1985) and is relatively simple to complete.

The WAT is a 26 item self-report questionnaire, where responses are made on a 5-point Likert scale with response anchors ranging from 1 to 5, with 5 (strongly agree), 4 (agree), 3 (neither agree nor disagree), 2 (disagree), and 1 (strongly disagree) being used to rate each item. Half the items, specifically items 2, 3, 6, 9, 10, 11, 12, 14, 15, 17, 19, 20 and 23 are reverse scored, and are marked (R) in Table 4.11 which displays the items within the WAT.

WAT total scores can range from 26 to 130, with *higher* scores indicating higher writing anxiety. The reliability coefficient for this instrument was .921 (Daly & Miller, 1975b). The instrument also has face and predictive validity (Daly & Miller, 1975b). The actual WAT instrument as administered to the participants is displayed in Appendix O.

Table 4.11 Items in the Writing Apprehension Scale (Daly & Miller, 1975b)

Item Number	Item (R reverse scored)
1	I avoid writing
2	I have no fear of my writing being evaluated (R)
3	I look forward to writing down my ideas (R)
4	I am afraid of writing essays when I know they will be evaluated
5	Taking a writing lesson is a very frightening experience
6	Handing in an essay makes me feel good (R)
7	My mind seems to go blank when I start to work on my essay writing
8	Expressing ideas through writing seems to be a waste of time
9	I would enjoy submitting my writing to magazines for evaluation and publication (R)
10	I like to write my ideas down (R)
11	I feel confident in my ability to clearly express my ideas in writing (R)
12	I like to have my friends read what I have written (R)
13	I am nervous about writing
14	People seem to enjoy what I write (R)
15	I enjoy writing (R)
16	I never seem to be able to clearly write down my ideas
17	Writing is a lot of fun (R)
18	I expect to do poorly in my writing classes even before I enter them
19	I like seeing my thoughts on paper (R)
20	Discussing my writing with others is an enjoyable experience (R)
21	I have a terrible time organising my ideas in a writing lesson
22	When I hand in a piece of writing, I know I am going to do poorly
23	It is easy for me to write good essays (R)
24	I don't think I write as well as most other people
25	I don't like my writing to be evaluated
26	I'm no good at writing

The WAT was administered before Lesson 1 to measure each participant's initial writing anxiety score. It was subsequently administered after Lesson 2 to obtain the participants' final writing anxiety scores.

In order to test H1c, a variable called *Reduction in Writing Anxiety* was calculated for each participant by subtracting their final WAT score (after completing Lesson 2) from

their initial WAT score (before completing Lesson 1). See Table 4.5 for a summary of constructs, dependent variables, instruments, and their operational definitions.

4.9 Ethical Considerations

Prior to approaching the various educational institutions, ethics approval was sought, as this research study involved gathering information from students enrolled at a number of Western Australian educational institutions. A human research ethics application was submitted to the Murdoch University Human Research Ethics Committee, and approval was granted (Approval 2014/068). See Appendix X for a copy of the ethics approval. Once the ethics approval was granted, permission was sought from each college principal (in the case of pre-university colleges), or program manager or course-coordinator (in the case of universities) to recruit participants for the study.

4.10 Participants

In Phase 1 of the study, a combination of purposive sampling and self-selection sampling techniques were used to recruit participants. Purposive sampling is a group of sampling techniques that require the researcher to exercise judgement for the selection of participants to be studied, while self-selection sampling is when potential participants volunteer to participate in the research (Sharma, 2017). Purposive sampling was applied in selecting the most appropriate institutions from which to recruit participants for this study. The Western Australian institutions that were approached included university pathway institutions (Perth Institute of Business and Technology, UniPrep, Ontrack, Murdoch Institute and Uniready), and universities (Edith Cowan, Murdoch and Curtin).

4.11 Data Collection

Prior to the commencement of data collection, each college principal, program manager or course-coordinator was approached for a meeting to discuss the study. They were contacted first by telephone, and a formal letter was emailed to them (Appendix P). Once the study was approved by the institution in question, recruitment commenced. This was done by the researcher attending appropriate lectures/ tutorials/ workshops to explain the rationale for the study and circulate signup sheets inviting the prospective participants to write their names, mobile phone numbers and email addresses. These signup sheets were collated and used to contact each potential participant by SMS to invite them to participate. Once confirmation of interest in participation was received, potential participants were notified via email about the details of the study (Appendix Q).

The potential participants were asked to attend both two-hour lessons in Phase 1 of the study, separated by an interval of between one and two weeks. The rationale for running more than one lesson is due to affordances of the spacing effect as initially documented by Ebbinghaus (1885). Specifically, the spacing effect is a phenomenon where presenting learning material in discrete lessons produces more favourable retention when contrasted to presenting the same material in one lesson (Ebbinghaus, 1885). This phenomenon has been verified by subsequent researchers (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006; Godwin-Jones, 2010; Greene, 1989; Melton, 1970; Miyamoto et al., 2015). Also, writing is a complex and multi-faceted skill to learn which takes time to assimilate. Both lessons in Phase 1 were held at a computer laboratory located within the institution where the participants were enrolled.

4.11.1 Phase 1 of the Study

Upon arrival at the computer laboratory where Lesson 1 of Phase 1 of the study was to be conducted, participants were welcomed and then asked to seat themselves in front of a computer terminal. They were provided with a flowchart detailing the lesson experimental procedure. The instructions in the flowchart summarised the requirements for the participants to (a) complete the pre-test surveys and writing task (up to 60 minutes), (b) log in to the internet using their university or college credentials, (c) check their email accounts to locate the email from CourseSites.com which contained their lesson user IDs and passwords to access the lesson, (d) click on the link within the email to log on to the CourseSites LMS, (e) type in their user name and password from their email, and (f) access their lesson. The instruction sheet also contained troubleshooting instructions for common issues such as pop-up blockers. Please refer to Appendix R for the lesson procedures provided to the participants in Lesson 1.

In accordance with the flowchart instructions, participants were provided with a pre-lesson questionnaire bundle and asked to complete the consent form for Phase 1 of the study (Appendix S). Participants were assured that their responses would be de-identified.

They then completed a questionnaire asking demographic questions (Appendix T). Next, they were asked to transpose their unique ID number from their consent forms into their demographic sheet to ensure that demographic details and names were decoupled to increase confidentiality.

Participants then completed the pre-lesson measures comprising the WAT (Appendix O), the SEWS (Appendix L), the SSSES for Lesson 1 (Appendix M) and finally undertook the

initial essay writing task (Appendix I). The requirement was for the essay to have a minimum of 300 words. While the participants were writing this essay, the researcher randomly assigned each participant into one of the six experimental conditions using a randomised block design where participants within each college or university (blocks), were then randomly assigned to the six treatment conditions : (1) Scaffolded questioning with emotional support messages; (2) Scaffolded questioning with motivational support messages; (3) Scaffolded questioning without motivational or emotional support messages (4) Didactic delivery with emotional support messages (5) Didactic delivery with motivational support messages, and (6) Didactic delivery without motivational or emotional support messages.

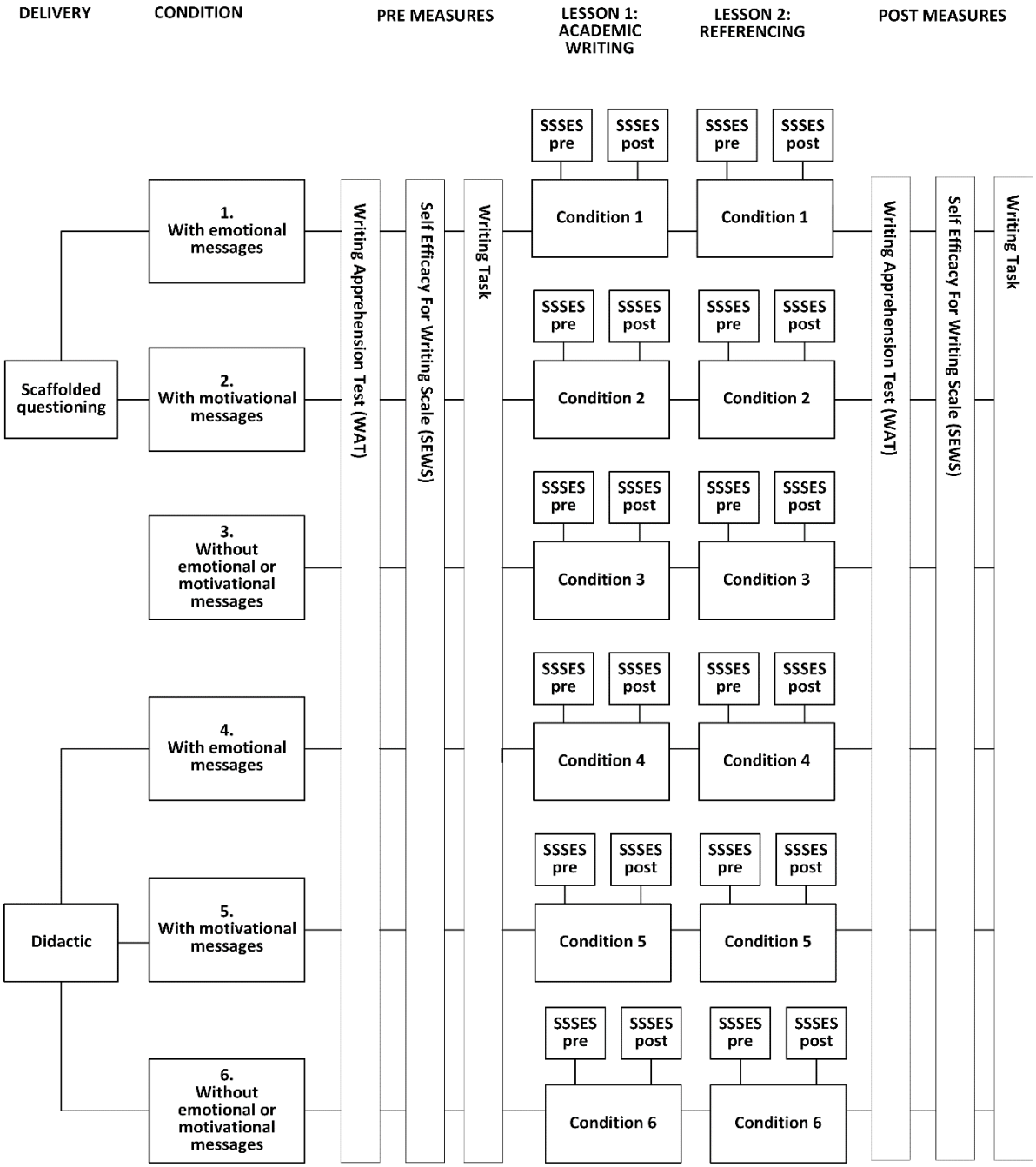
Once they completed their initial measures, participants were instructed to put on their headphones and to commence the lesson in accordance with the lesson procedures outlined earlier. Upon completion of the lesson, participants completed the SSSES Lesson 1 again, with identical questions and format to the one they had completed before the lesson.

Given that participants in all six experimental groups in each institution were likely to interact with each other, there was a possibility that contamination could occur due to intra-group communication about study conditions. As such and considering the predicted advantage of some of the conditions over the others**,** participants were informed from the outset that the study conditions between each participant would not be identical. Participants were allowed up to 2.5 hours to complete each lesson including the associated experimental processes.

Lesson 2 of Phase 1 of the study took place within two weeks of Lesson 1 where possible. The participants who had previously attended Lesson 1 of Phase 1, and who agreed to participate in Lesson 2 first completed the Lesson 2 SSSES (Appendix N). Next, they logged on to the CourseSites LMS using their earlier assigned IDs and completed the lesson. Participants then completed the post lesson measures comprising the WAT (Appendix O), the SEWS (Appendix L), the SSSES Lesson 2 again (Appendix N), and finally undertook the final essay writing task (Appendix J), which as before, required them to write a minimum of 300 words on the provided topic. These data collection stages are illustrated in Figure 4.4.

Participants who attended both lessons in Phase 1 of the study received incentives in the form of a $10 textbook voucher, an attendance token for each lesson they attended (which was placed in a draw for them to win an IPad mini), and a certificate of completion upon conclusion of the second lesson. Participants who only attended one of the two lessons were eligible to receive one attendance token for the draw, but not the textbook voucher or certificate of completion.

Figure 4.4 Schematic of data collection points in Phase 1 of the research study.



4.11.2 Phase 2 of the Study

Phase 2 of the study was intended to provide further insights into the quantitative data. To this end, the semi structured interview questions were designed to elicit the participants' perceptions about the extent to which the learning environment helped them to improve their writing competence and confidence; and reduced any writing anxiety they had, as well as any negative feelings that they may have experienced while

completing the lesson. Finally, it was designed to probe into their perceptions about the extent to which the presence of the APAs within the lesson helped them to improve their writing competence. Sample questions for this phase of the study are provided in Appendix U.

In this final, qualitative phase of the study, participants were selected from those who had completed both lessons in Phase 1 of the study. The sampling technique used was in compliance with the two goals of sampling to achieve representativeness and comparability as proposed by Teddie and Yu (2007). These potential interviewees were identified based on having attended both lessons in the series and having indicated their interest in being involved in this phase by ticking a box on the initial consent form.

Potential interviewees were contacted by telephone and invited to participate. Three participants from each of the six conditions were invited to participate in the interview phase. Those who agreed to participate in Phase 2 of the study were provided with another participant information letter (Appendix V) and consent form (Appendix W). The interviews were recorded (with permission) using a mobile telephone application called Call Recorder. These interviews were held approximately two weeks after the last lesson and lasted approximately 10 to 15 minutes. They were transcribed manually and stored in Word documents.

4.12 Qualitative Analysis: Overview of Approaches Used

This study can be classified as an integrated mixed method approach because of the *deliberate interdependenc*e between the various data sources and research methods. This approach is advocated by Bazeley (2018) who conceptualises the integrated mixed method approach as an essential interdependence between quantitative and qualitative

data collection and analysis, where information, inferences and/or analytic strategies between data sources flow between these elements, without which study objectives cannot be met (Bazeley, 2018).

The qualitative phase of the study adopts both an inductive and deductive approach in the qualitative data analysis when shifting between the data and theoretical concepts (Yin, 2011, p. 94). While an inductive or 'bottom up' approach tends to allow concepts to emerge from the data, which could potentially provide useful insights into the phenomena not captured in the quantitative analysis; a deductive 'top down' approach allows concepts to guide the definition of data for collection, which provides structure for interrogating these phenomena in greater depth.

With the inductive approach, themes emerging from the interview data that did not appear to relate explicitly to answering the research questions were coded inductively. The deductive approach was also used as a means of providing qualitative insights into the phenomena under investigation as discussed in Section 4.11.2. The themes that were sought were the qualitative insights into the reasons for the quantitative results obtained in the study pertaining to writing competence, learner self-efficacy, and writing anxiety.

Phase 2 of this mixed method study involved analysing qualitative data gleaned from participant interviews with three participants per condition. Specifically, these data were analysed using thematic analysis, a method of "identifying, analysing, and reporting patterns (themes) within data" (Braun & Clarke, 2012). The widespread use of thematic analysis is due to its suitability for analysing a wide range of research questions

and topics. It is a data analysis strategy that can be used across all qualitative designs (Castleberry & Nolan, 2018).

In undertaking the thematic analysis, a decision was made to analyse these data using qualitative data analysis software, in preference to doing so manually. The software chosen was NVivo 12.0 for Windows based on software affordances such as linguistic and semantic algorithms that would greatly assist in helping to discern patterns of codes, and link between codes across transcripts. A code in qualitative analysis is typically defined as "… a word or short phrase that symbolically assigns a summative, salient essence-capturing and/or evocative attribute for a portion of language based or visual data" (Saldana, 2009, p. 3). The qualitative data analysis proceeded along the five phases of data analysis as outlined by Yin (2011), namely compiling, disassembling, reassembling, interpreting and concluding.

4.12.1 Phase 1: Compiling

The first phase of data analysis, compiling, involves assembling the data (Yin, 2011). The qualitative data in this study were in the form of transcribed interviews within Ms Word documents. To quickly overview the participant interview data, the NVivo 12.0 for Windows word frequency query was run to identify the most frequently used words within the interview data. The resulting word frequency table and corresponding word cloud was useful for identifying phrases suitable for detailed coding and analysis from within the larger corpora, an approach suggested by Jackson and Bazeley (2019, p. 179). Closer observation of these visual displays can assist with discerning "patterns and relationships in data" and "clarifies … understanding of who or what is involved, their relationship and their relative importance, and perhaps even causal pathways" (Jackson & Bazeley, 2019, p. 287). The words within the display can be double-clicked to reveal

the word in context. It is important to note that the use of word clouds is based on frequency of occurrence, which is not analogous to importance (O'Neill, Booth, & Lamb, 2018). The results of the word frequency query are displayed and discussed in greater detail in Section 6.3.

4.12.2 Phase 2: Disassembling

The next phase of data analysis entails disassembling the data by deconstructing and grouping them meaningfully, a process usually done through coding (Castleberry & Nolan, 2018). In accordance with Saldana's (2009) guidelines, the interview transcripts were carefully read and reviewed before each datum of interest was coded to conceptualise and label its substance and significance as it relates to the inquiry. This coding allowed significance to emerge from the analysis, and was a simple process using the NVivo 12.0 for Windows software where the relevant text was highlighted by right-clicking it and assigning new or previously created codes (called 'nodes' in NVivo).

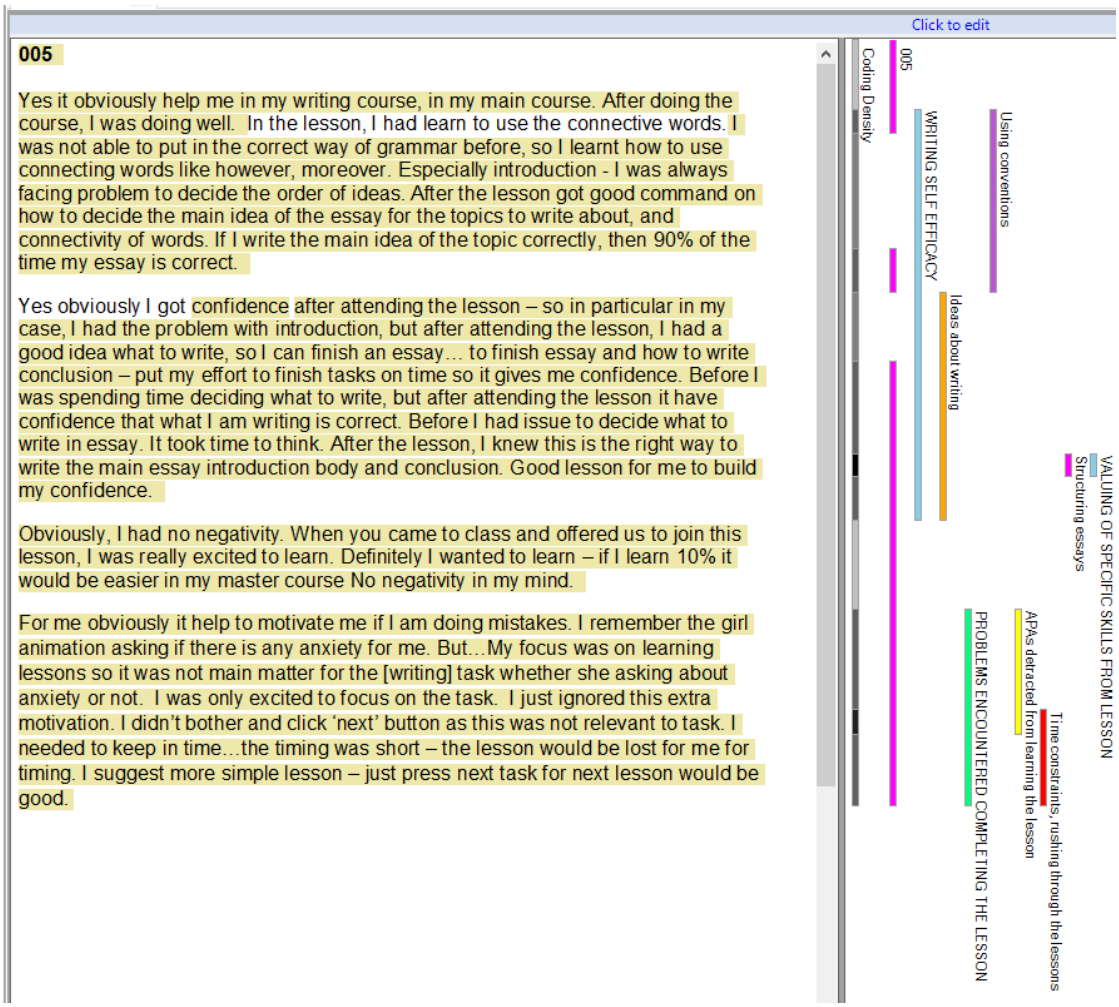
As mentioned earlier, the qualitative analysis proceeded along both inductive and deductive lines. It did so inductively by first capturing recurrent themes from the data that at face value did not appear to relate explicitly to the study hypotheses. Some of these themes included "problems encountered completing the lessons" and "mindfulness".

In addition to the inductive approach, the qualitative data was analysed deductively by analysing the data for codes embodying the primary concepts being investigated in the study. For example, when first encountering phrases embodying primary concepts relevant to the dependent and independent variables under investigation, namely perceived improvements to writing competence, increases to learner self-efficacy, and reductions in writing anxiety, these were assigned meaningful codes. As an illustration,

the code “writing self-efficacy” was created and assigned to a phrase embodying this concept. Thereafter, this newly created code “writing self-efficacy” became available for assignment to other phrases expressing this concept.

The coding is represented by coding stripes–coloured bars which show how content has been coded and is illustrated in Figure 4.5. This process of analysing the data and examining patterns of codes across the interview transcripts was greatly facilitated by using NVivo 12.0. As shown in Figure 4.5, the Interviews window lists the interview files (Name), the number of codes assigned to each one (codes), and the overall number of discrete instances of coding (references).

Figure 4.5 Coding of the data using NVivo 12 Software



4.12.3 Phase 3: Reassembling

In the reassembling phase, the codes are placed into new categories in order to determine emergent themes in the data and to answer the research questions. In this way, the assignment of a code to selected phrases uttered by the participants permitted the data to be, as Grbich (2007, p. 21) describes, “segregated, grouped, regrouped and relinked in order to consolidate meaning and explanation”.

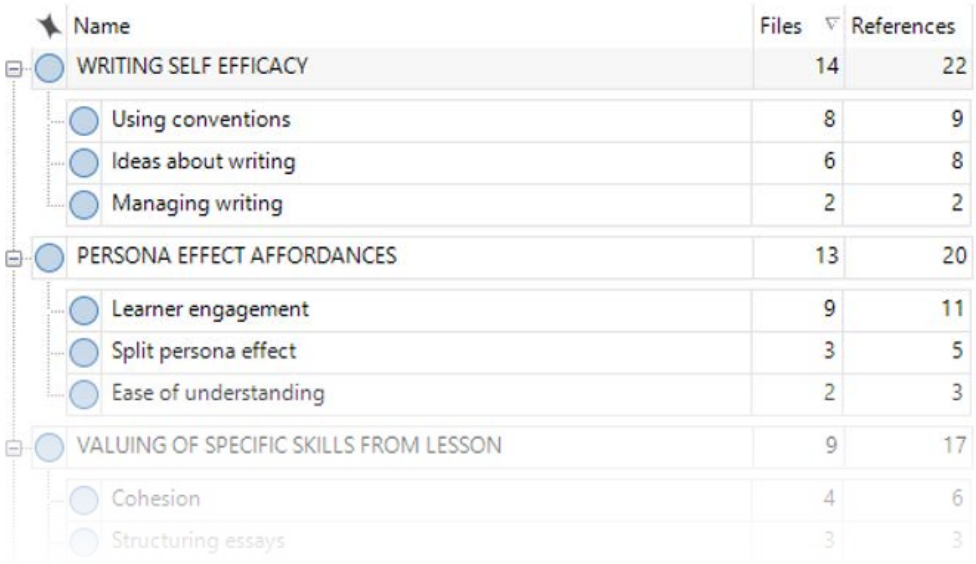
The two typical ways that qualitative researchers reassemble data within themes is through organising them hierarchically or interconnecting them via matrices (Castleberry & Nolan, 2018). Both approaches were used in this study. Firstly, as shown in Figure 4.6, the hierarchical approach was adopted. The thematic hierarchies enabled the researcher to visually articulate how each theme was subordinated or superordinated in relation to the others, as recommended by these authors.

This reassembly of codes as shown in the nodes view in NVivo 12.0 for Windows software (Figure 4.6) displays each superordinate node along with the number of files from which these nodes originated, the number of instances these were referred to (references); as well as the subordinate nodes subsumed within these superordinate nodes. For example, the superordinate node “writing self-efficacy” occurred in 14 files with 22 references in total across the files; under which the subordinate nodes (as indented) were arranged, namely “using conventions”, “ideas about writing” and “managing writing”. This organisation in turn enabled the researcher to analyse the restructured data at multiple levels.

The reassembly of the data was implemented deductively through a mixed method strategy with the aim of integrating these data with the quantitative data (Bazeley,

2018). In doing so, NVivo was used to perform a comparative analysis between the various interview files which first had to be converted to cases in NVivo, before being assigned demographic attributes with values. In NVivo, demographic categories are not confined to personal characteristics such as age and gender, but can be expanded to include other categorical labels to help facilitate inter-group analyses (Jackson & Bazeley, 2019). Consequently, the demographic values that were assigned to the attributes were the combination of delivery (didactic or scaffolded questioning) or support (emotional, motivational or neither) conditions.

Figure 4.6 Reassembling the data



Name	Files	References
WRITING SELF EFFICACY	14	22
Using conventions	8	9
Ideas about writing	6	8
Managing writing	2	2
PERSONA EFFECT AFFORDANCES	13	20
Learner engagement	9	11
Split persona effect	3	5
Ease of understanding	2	3
VALUING OF SPECIFIC SKILLS FROM LESSON	9	17
Cohesion	4	6
Structuring essays	3	3

Once the attributes had been assigned to the cases, the Crosstab Query feature of NVivo was used to glean a fast and flexible summary of the pattern of responses for the nodes across the attribute values. Essentially this feature showed which subgroups in the sample discussed specific themes. Double clicking on the cell provided the original narrative that had been coded. This feature enabled the researcher to catalogue the relevant comments according to the delivery and support condition in order to address the hypotheses in the study. This was done manually by copying and pasting the

relevant comments from the Crosstab Query display into a Microsoft Word table for further analysis.

4.12.4 Phase 4: Interpreting

The fourth phase entails creating a new narrative which involves interpreting the reassembled data and representing it graphically where relevant. This interpretation is provided in Chapter 6, with the ultimate aim of triangulating it with the quantitative data in this study as provided in Chapter 7. Triangulation is the means by which results from quantitative and qualitative aspects of a research study may be used to "confirm, cross-validate, or corroborate findings within a single study" (Creswell, Plano Clark, Gutmann, & Hanson, 2003, p. 229).

This phase was implemented in accordance with two of the three of Yin's (2011) modes of interpreting, namely describing and explaining. Specifically, the themes that were coded inductively were subsequently used to provide insights into answering the research questions in this study.

4.12.5 Phase 5: Concluding

The final phase, concluding, involves interpreting the results in their entirety, and can include answering the research questions for the study and generalising to a broader range of situations. The outcomes of this phase inform the discussion of both the qualitative and quantitative results provided in Chapter 8.

4.13 Summary of the Methodology

This chapter commenced with the theoretical and methodological underpinnings of this study in Section 4.2 where pragmatism was deemed the paradigm of choice. This pragmatic approach underpinned the choice of mixed methods research in this study.

Section 4.3 described the embedded nature of the mixed method design where the primary dataset was used to answer the primary research questions. These data were merged with the secondary data from the qualitative interviews to help triangulate the answers to the research questions. The independent variables in this study were defined, namely scaffolded questioning delivery (QA), emotional support messages (Emo), and motivational support messages (Mot). This section also defined the six experimental conditions in the study, and illustrated their levels along with their associated interventions.

Section 4.4 described the structure of both lessons. Whereas Lesson 1 covered the key elements of academic writing, Lesson 2 encompassed elements of referencing. Delivery of these lessons was either through scaffolded questioning (Conditions 1, 2, and 3) or didactic delivery (Conditions 4, 5, and 6). Quiz feedback and lesson segment summaries were provided either with emotional support (Conditions 1 and 4), motivational support (Conditions 2 and 5) or no support (Conditions 3 and 6).

In Section 4.5, the foundational design decisions for the lesson environments were provided. These included the principles for: designing experiments with APAs (Clark & Choi, 2005), effective multimedia design (Mayer, 2005a), and aesthetic design (Hilliard, 2016).

Section 4.6 described the design decisions that guided the development of the four APAs deployed in the study which was based on the adapted version of the Pedagogical Agent's Level of Design model (Domagk, 2010). This framework guided the design of the APAs in a series of three cascading levels of design decisions, namely those at the global, medium and detail levels.

In Section 4.7, the operationalisation of the independent variables for this study were explained, namely scaffolded questioning, based on question stems adapted from King (1992); emotional support, grounded on the provision of coping strategies developed by Carver et al.(1989) and the FEASP approach (Astleitner, 2000); and motivational support, based on research emphasising the malleability of intelligence being instrumental in improving self-efficacy (Blackwell et al., 2007; Dweck, 1999; Dweck & Leggett, 1988).

Section 4.8 explained the operationalisation and measurement of the dependent variables in this study, namely writing competence, writing self-efficacy and writing anxiety.

Section 4.9 discussed the ethical considerations of the study, while Section 4.10 explained the sampling techniques used to select participants for the study, namely the combination of purposive and self-selection sampling.

Section 4.11 detailed the data collection procedures implemented in the study, along with the rationale for the data collection decisions that were made. This section concludes with a schematic of Phase 1 of the data collection points in both lessons.

Finally, Section 4.12 provided an overview of the approaches in the qualitative analysis. This section described the analysis as an integrated mixed method approach which

utilised a combination of inductive and deductive approaches in analysing the data. It outlined the four phases of qualitative analysis, namely compiling, disassembling, reassembling, interpreting and concluding.

CHAPTER FIVE: QUANTITATIVE RESULTS

"Everything that can be counted does not necessarily count;
everything that counts cannot necessarily be counted."

Albert Einstein 1879–1955, German theoretical physicist

5.1 Chapter Overview

This chapter presents the results of the analysis of the quantitative data collected in Phase 1 of this study. The participant demographic profile is reported in Section 5.2, while Section 5.3 provides a description of the measures taken to establish reliability in this study. In Section 5.4, the distribution of participants across the six conditions is displayed. Finally, Sections 5.5 to 5.8 present the results of the hypothesis testing as they relate to addressing the research questions. This culminates in the summary of the quantitative results as presented in Section 5.9.

5.2 Participant Demographics

As described in Section 4.11.1, demographic data were collected using the Demographic Sheet (Appendix T). This sheet was designed to capture data on the participants' gender, age, institutions they were attached to, and their countries of origin.

In total, 106 participants attended Lesson 1 of Phase 1 of the study. Of these participants, 59 were females (55.7%) and 47 were males (44.3%). They ranged in age from 17 to 48 years *(M* = 24.4, *SD* = 7.5).

As shown in Table 5.1, the participants were newly enrolled students from three distinct groups organised by study level:

- University pathway programs (86 participants) from: Perth Institute of Business and Technology (Edith Cowan University), UniPrep (Edith Cowan University), Ontrack (Murdoch University), Murdoch Institute (Murdoch University), and Uniready (Curtin University).
- Undergraduate university students (7 participants).
- International postgraduate university students (13 Participants).

Table 5.1 Participants by study level

Study Level	Count	Percent
University pathway students	86	81.1%
Undergraduate students	7	6.6%
Postgraduate students	13	12.3%

The participants in the study were a culturally diverse group, originating from 25 countries, with those identifying Australia as their birth country comprising the largest group (43 participants, 40.6%), followed by India (21 participants, 19.8%). The remaining participants' countries of origin were dispersed among 23 other nations. These data are displayed in Table 5.2.

Table 5.2 Participant birth country

Birth Country	Count	Percent
Australia	43	40.6%
India	21	19.8%
Bhutan	6	5.7%
Vietnam	4	3.8%
Nepal	4	3.8%
China	3	2.8%
United Arab Emirates	3	2.8%
United Kingdom	2	1.9%
Philippines	2	1.9%
Malaysia	2	1.9%
Afghanistan	2	1.9%
South Africa	1	0.9%
Croatia	1	0.9%
New Zealand	1	0.9%
Iran	1	0.9%
Mauritius	1	0.9%
Sri Lanka	1	0.9%
Nigeria	1	0.9%
Bosnia	1	0.9%
Singapore	1	0.9%
Kenya	1	0.9%
Dubai	1	0.9%
Thailand	1	0.9%
Korea	1	0.9%
Pakistan	1	0.9%

In Lesson 2 of Phase 1 of the study, 69 out of the initial 106 participants returned to participate in the study. These participants ranged in age from 17 years to 48 years (*M = 25.4, SD = 8.2*) and comprised 37 females (53.6%) and 32 males (46.4%).

5.3 Evaluation of Reliability

Two methods were used to evaluate reliability in this study. The first method was deployed to evaluate internal reliability consistency in the items within the scales used, while the second one was designed to establish Interrater reliability for the coding of the essay writing task between the two coders.

5.3.1 Internal Consistency Reliability

In determining internal consistency, Cronbach's alpha (α) is the most commonly used statistic. Nunnally (1978) recommends a minimum level of .70, but this is dependent on the nature and purpose of the scale.

The WAT scale measures writing anxiety and consists of 26 items (α=.907). The SEWS scale consists of three subscales measuring writing ideation, using writing conventions and managing writing. The ideation subscale comprises five items (α=.829), the using writing conventions subscale comprises five items (α=.941), and the managing writing subscale comprises six items (α=.914).

The Lesson 1 Skill Self Efficacy Scale comprises four subscales, each respectively measuring self-efficacy for: writing in an academic style (four items, α=.9), writing introductions (four items, α=.9), writing paragraphs (four items, α=.952), linking ideas (four items, α=.956), and writing conclusions (four items, α=.924).

The ensuing Lesson 2 Skill Self Efficacy Scale comprises four subscales, each respectively measuring the self-efficacy for incorporating ideas (two items, α=.928), quoting (four items, α=.959), paraphrasing (four items, α=.855), and following referencing

conventions (three items, α=.918). The reliability coefficients for these scales are summarised in Table 5.3.

Table 5.3 Internal consistency reliability measures

Instrument	Dependent variable	Subscales	Number of Items	Cronbach's Alpha
Writing Apprehension Test (WAT)	Reductions in Writing anxiety	N/A	26	.907
Self-Efficacy for Writing Scale (SEWS)	Improvements in Writing Self Efficacy (Generating Ideas)	Generating ideas	5	.829
	Improvements in Writing Self Efficacy (Following Writing Conventions)	Following writing conventions	5	.941
	Improvements in Writing Self Efficacy (Self-regulating ideas)	Self-regulating ideas	6	.914
Skill Specific Self-efficacy Scale Lesson 1 (SSSES1)	Improvements in self-efficacy for:			
	• writing in an academic style	Academic style	4	.900
	• writing introductions	Introduction	4	.900
	• writing paragraphs	Paragraphs	4	.952
	• linking ideas	Linking ideas	4	.956
	• writing conclusions	Conclusion	4	.924
Skill Specific Self-efficacy Scale Lesson 2 (SSSES2)	Improvements in Self-Efficacy for:			
	• quoting	Quoting	4	.959
	• incorporating ideas	Incorporating ideas	2	.928
	• paraphrasing	Paraphrasing	4	.855
	• following referencing conventions	Following referencing conventions	3	.918

As displayed in Table 5.3, it is evident that the Cronbach's alpha for each scale in the study was more than 0.80, which according to Nunnally (1978) is more than adequate for the early stages of research for which 0.70 or higher is sufficient. Lance, Butts, and Michels (2006) later argued for .80 to be the more robust value for the majority of purposes. As such, it was unnecessary to drop any items from these scales.

5.3.2 Reliability of Content Analysis Coding

Section 4.8.1 describes the methods used to design the rubric for measuring the participants' writing competence in the essay writing tasks (Table 4.7), and those taken to establish its validity prior to content analysis coding.

Interrater reliability for the coding of the essay writing task was determined using the intraclass coefficient (ICC) (Koo & Li, 2016, p. 161). In particular, the ICC was used to determine the consistency in the coding between the two raters in their application of the scoring rubric (Table 4.7), as they graded the initial and final essay writing tasks (Appendices I and J respectively).

This was accomplished by computing the ICC estimates and their 95% confidence intervals using IBM SPSS Statistics for Windows, Version 25.0 based on a mean rating (k=2), absolute agreement, 2-way mixed effects model. Using the 95% confidence interval of the ICC estimate, "values less than 0.5 are indicative of poor reliability, values between 0.5 and 0.7 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.9 indicate excellent reliability" (Koo & Li, 2016, p. 161).

For the initial essay writing task, the average measure for the ICC was .831, and hence greater than .75 which indicates good reliability. Similarly, for the final essay writing task, the average measure for the ICC was .829, and again greater than .75 which was likewise indicative of good reliability. Taken together, the ICC for the coding of both essays may be considered reliable.

5.4 Distribution of Participants Across the Six Conditions

The participants were randomly allocated to the six experimental conditions as detailed in Section 4.11.1. The distribution of the 106 participants across these six conditions for Lesson 1 of Phase 1 is displayed in Table 5.4.

Table 5.4 Distribution of participants across the six conditions in Lesson 1 Phase 1

Condition	Description	Acronym	N	Percent
1	Scaffolded questioning delivery and emotional support	QA (Emo)	20	18.9%
2	Scaffolded questioning delivery and motivational support	QA (Mot)	21	19.8%
3	Scaffolded questioning delivery without support	QA	18	17.0%
4	Didactic delivery and emotional support	Did (Emo)	15	14.2%
5	Didactic delivery and motivational support	Did (Mot)	15	14.2%
6	Didactic delivery without support	Did	17	16.0%

Of these participants, 69 returned to complete Lesson 2 of Phase 1 of the study. The distribution of these participants across the six conditions is provided in Table 5.5.

Table 5.5 Distribution of participants across the six conditions in Lesson 2 Phase 1

Condition	Description	Acronym	N	Percent
1	Scaffolded questioning delivery and emotional support	QA (Emo)	13	18.8%
2	Scaffolded questioning delivery and motivational support	QA (Mot)	17	24.6%
3	Scaffolded questioning delivery without support	QA	12	17.4%
4	Didactic delivery and emotional support	Did (Emo)	9	13.0%
5	Didactic delivery and motivational support	Did (Mot)	9	13.0%
6	Didactic delivery without support	Did	9	13.0%

A Chi-square test of independence (with Yates' Continuity Correction) was performed on the data to ascertain if there was a difference in the return rate of participants dependent on delivery mode. The results indicated no significant association between return rate and lesson delivery mode, χ^2 (1, n = 106) = 1.61, p = .20, *phi* = -.14.

5.5 Do Learning Designs with APAs Increase Writing Competence and Self-Efficacy, and Reduce Writing Anxiety?

Paired sample t-tests were conducted to evaluate the effect of online lessons incorporating APAs on writing competence, writing self-efficacy, and writing anxiety. In the t-tests analyses to follow, the measurement for small, medium and large effect sizes is presented in Table 5.6.

Table 5.6 Measures of effect size statistics and their levels

Size	Eta squared (% of variance explained)
Small	.01 or 1%
Medium	.06 or 6%
Large	.138 or 13.8%

(Pallant, 2016, p. 212)

The descriptive statistics and t-test results for the analysis are shown in Table 5.7 and 5.8 respectively, and the discussion for each analysis follows.

Table 5.7 Descriptive statistics for initial and final measures of writing competence, writing self-efficacy and writing anxiety.

Initial and final measures (with score ranges provided)	Mean	N	Std Deviation	Std Error Mean
Initial writing competence (Range 10–50)	26.28	71	6.42	.76
Final writing competence (Range 10–50)	31.11	71	5.98	.71
Initial self-efficacy for generating ideas (Range 0–100)	48.77	70	13.34	1.59
Final self-efficacy for generating ideas (Range 0–100)	58.50	70	16.14	1.93
Initial self-efficacy for following writing conventions (Range 0–100)	43.75	70	16.39	1.96
Final self-efficacy for following writing conventions (Range 0–100)	59.03	70	20.74	2.48
Initial self-efficacy for self-regulating writing (Range 0–100)	50.21	70	19.19	2.29
Final self-efficacy for self-regulating writing (Range 0–100)	61.03	70	21.64	2.59
Initial self-efficacy for writing skills: Lesson 1 (Range 0–100)	47.82	102	18.16	1.80
Final self-efficacy for writing skills: Lesson 1 (Range 0–100)	66.78	102	17.18	1.70
Initial self-efficacy for writing skills: Lesson 2 (Range 0–100)	50.46	70	22.39	2.68
Final self-efficacy for writing skills: Lesson 2 (Range 0–100)	69.16	70	16.81	2.01
Initial writing anxiety levels (Range 26–130)	75.96	69	14.87	1.79
Final writing anxiety levels (Range 26–130)	71.75	69	14.39	1.73

Table 5.8 Paired Samples t-test for improvements in writing competence, writing self-efficacy and writing anxiety.

	Mean	Std. Deviation	95% Confidence Interval of the difference		t	df	p.
			Lower	Upper			
Improvements in writing competence	4.83	7.09	3.15	6.51	5.74	70	.000
Improvements in self-efficacy for generating ideas	9.73	15.14	6.12	13.34	5.38	69	.000
Improvements in self-efficacy for following writing conventions	15.29	15.32	11.63	18.94	8.35	69	.000
Improvements in self-efficacy for self-regulating writing	10.82	17.99	6.53	15.11	5.03	69	.000
Improvements in self-efficacy for writing skills: Lesson 1	18.96	15.56	15.90	22.02	12.30	101	.000
Improvements in self-efficacy for writing skills : Lesson 2	18.70	19.03	14.16	23.24	8.22	69	.000
Reduction in writing anxiety levels	-4.20	10.54	-6.74	-1.67	-3.31	68	.000

As shown in Table 5.8, the changes in writing competence and self-efficacy were in the predicted directions, as was the reduction in writing anxiety levels. With respect to self-efficacy, the largest improvements occurred for self-efficacy for following writing conventions. This was followed by self-efficacy for self-regulating writing, and the least for self-efficacy for generating ideas.

5.5.1 Do Learning Designs with APAs Improve Writing Competence?

As presented in Table 4.5, improvements in writing competence were calculated by subtracting the initial from the final writing competence scores. The descriptive statistics and t-test results for the analysis are shown in Table 5.7 and 5.8 respectively. There were statistically significant increases from initial writing competence scores (M = 26.28. SD = 6.42) to the final scores (M = 31.11, SD = 5.98), t (70) = -5.74, $p < .001$. The mean increase to improvements in writing competence was 4.83 with a 95% confidence interval ranging from 3.15 to 6.51. The eta squared statistic (.32) indicated a large effect size.

Thus, Hypothesis H1a is supported: completing two online lessons on writing for academic purposes incorporating APAs leads to improvements in writing competence.

5.5.2 Do Learning Designs with APAs Improve Writing Self-efficacy?

Improvements in all of the writing self-efficacy measures were calculated as the difference between the final self-efficacy scores and the initial self-efficacy scores as shown in Table 4.5.

The descriptive statistics and t-test results for the analysis are shown in Table 5.7 and 5.8 respectively. First, with respect to improvements in self-efficacy for generating ideas, there were statistically significant increases from the initial self-efficacy for generating ideas scores (M = 48.77, SD = 13.34) to the final scores (M = 58.50, SD = 16.14), t (69) = 5.38, $p < .001$. The mean increase in improvements to self-efficacy for generating ideas was 9.73 with a 95% confidence interval ranging from 6.12 to 13.34. The eta squared statistic (.30) indicated a large effect size.

With respect to improvements in self-efficacy for following writing conventions, there were statistically significant increases from the initial self-efficacy for following writing conventions scores (M = 43.75, SD = 16.39) to the final scores (M = 59.03, SD = 20.74), t (69) = 8.35, p < .001. The mean increase in improvements to self-efficacy for following writing conventions was 15.29 with a 95% confidence interval ranging from 11.63 to 18.94. The eta squared statistic (.50) indicated a large effect size.

With respect to improvements in self-efficacy for self-regulating writing, there were statistically significant increases in the initial self-efficacy for the initial self-regulating writing scores (M = 50.21, SD = 19.19) to the final scores (M = 61.03, SD = 21.64), t (69) = 5.03, p < 001. The mean increase in improvements to self-efficacy for self-regulating writing was 10.82 with a 95% confidence interval ranging from 6.53 to 15.11. The eta squared statistic (.27) indicated a large effect size.

As shown in Table 4.5, improvements in the self-efficacy measures for specific writing skills in both Lessons 1 and 2 were calculated as the difference between the final and initial scores for SSSES1 and SSSES2 respectively.

With respect to improvements in self-efficacy for writing skills covered in Lesson 1 (with subscales measuring self-efficacy for writing in an academic style, writing introductions, writing body paragraphs, linking ideas, and writing conclusions), there were statistically significant increases from the initial scores (M = 47.82, SD = 18.16) to the final scores (M = 66.78, SD = 17.18), t (101) = 12.30, p < .001. The mean increase in improvements to self-efficacy for writing skills covered in Lesson 1 was 18.96 with a 95% confidence

interval ranging from 15.90 to 22.02. The eta squared statistic (.60) indicated a large effect size.

With respect to improvements in self-efficacy for writing skills covered in Lesson 2 (with subscales measuring self-efficacy for incorporating ideas, quoting, paraphrasing, and following referencing conventions), there were statistically significant increases from the initial scores (M = 50.46, SD = 22.39) to the final scores (M = 69.16, SD = 16.81), t (69) = 8.22, $p < .001$. The mean increase in improvements to self-efficacy for writing skills covered in Lesson 2 was 18.70 with a 95% confidence interval ranging from 14.16 to 23.24. The eta squared statistic (.60) indicated a large effect size. The descriptive statistics and t-test results for the analysis are shown in Table 5.7 and 5.8 respectively.

Thus, Hypothesis H1b is supported: completing two online lessons on writing for academic purposes incorporating APAs leads to improvements in writing self-efficacy.

5.5.3 Do Learning Designs with APAs Reduce Writing Anxiety?

As displayed in Table 4.5, reductions in the writing anxiety measures were calculated as the difference between the final writing anxiety score (collected upon completion of Lesson 2), and the initial writing anxiety score (collected before commencing Lesson 1). The descriptive statistics and t-test results for the analysis are shown in Table 5.7 and 5.8 respectively.

With respect to reductions in writing anxiety, there were statistically significant reductions in final writing anxiety levels (M = 71.75, SD = 14.39) when compared with initial anxiety levels (M = 75.96. SD = 14.87), t (68) = 3.31, $p < .001$. The mean reduction

in writing anxiety was -4.20 with a 95% confidence interval ranging from -6.74 to -1.67. The eta squared statistic (.14) indicated a large effect size.

Thus, Hypothesis H1c is supported: completing two online lessons on writing for academic purposes incorporating APAs leads to reductions in writing anxiety.

5.6 Does Scaffolded Questioning Improve Writing Competence?

In order to determine the impact of scaffolded questioning on improvements to writing competence, two levels of analyses were conducted. First, a two-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of delivery and support on improvements to writing competence overall. The descriptive statistics for the analysis of the participants' improvements to writing competence are shown in Table 5.9.

Table 5.9 Descriptive statistics for improvements to writing competence.

		Improvements to writing competence		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	5.35	9.39	13
	Motivational	5.85	6.26	17
	Neither	1.12	4.60	13
	Total	4.27	7.11	43
Didactic delivery	Emotional	7.56	6.28	9
	Motivational	3.05	9.03	10
	Neither	6.78	4.98	9
	Total	5.70	7.10	28
Total	Emotional	6.25	8.16	22
	Motivational	4.81	7.36	27
	Neither	3.43	5.44	22
	Total	4.83	7.09	71

Table 5.10 Tests of between-subjects effects for improvements to writing competence

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Delivery	48.04	1	48.04	.98	.33	.015
Support	75.54	2	37.77	.77	.47	.023
Delivery*Support	211.31	2	105.66	2.16	.12	.062

With respect to delivery, there was no significant effect F (1, 65) = .98, p = .33). The improvement to writing competence by participants in the scaffolded questioning group (M = 4.27, SD = 7.11) was not significantly different from that of participants in the group with didactic delivery (M = 5.70, SD = 7.10). The effect size was small (partial eta squared = .015). Thus, scaffolded questioning does not significantly improve writing competence.

The interaction effect between delivery and support as shown in Table 5.10 was not statistically significant, F (1, 65) = 2.16, p > 0.05. Therefore, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This indicates that there is no significant difference in the effect of delivery on writing competence for emotional, motivational or no support.

Therefore, Hypothesis H2 is not supported: scaffolded questioning does not improve writing competence, beyond that achieved with didactic delivery.

5.7 Do Lesson Delivery and Support Improve Writing Self-Efficacy?

This section relates to H3, which corresponds to whether motivational messages can improve writing self-efficacy and reduce writing anxiety. The section also explores the possible role of support in writing self-efficacy. The extent to which support improves writing self-efficacy was determined on two levels. As discussed in Section 4.8.2, writing

self-efficacy in this study is conceptualised in two ways: first as a multifaceted construct (comprising the self-efficacy to generate ideas, follow writing conventions and self-regulate writing); and second, as one's perceived self-efficacy to execute specific writing tasks covered in that lesson. With the former, improvements were calculated based on self-efficacy scores gathered before the first lesson and after the second one; while the latter was calculated based on scores gathered before and after each lesson.

5.7.1 Do Lesson Delivery and Support Improve Self-efficacy to Generate Ideas, Follow Writing Conventions or Self-Regulate?

As displayed in Table 4.5, improvements in writing self-efficacy for generating ideas, following writing conventions, and self-regulating writing were calculated as the difference between the final and initial self-efficacy scores for each participant. The impacts on these scores are discussed in the following sub-sections.

5.7.1.1 Do Lesson Delivery and Support Improve Self-efficacy to Generate Ideas?

The self-efficacy for generating ideas construct comprises a student's self-efficacy to think about ideas for writing, put ideas into writing, use words to describe ideas, generate original ideas, and know where to place these ideas in a piece of text (Bruning et al., 2013). In order to determine the impact of delivery and support on improvements in self-efficacy for generating ideas after completing both lessons, a two way between-groups ANOVA was conducted. The descriptive statistics for the analysis of the participants' improvements to self-efficacy for generating ideas are displayed in Table 5.11.

Table 5.11 Descriptive statistics for improvements in self-efficacy for generating ideas.

		Improvements in self-efficacy for generating ideas		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	7.69	12.02	13
	Motivational	7.06	8.02	16
	Neither	10.51	20.46	13
	Total	8.32	13.80	42
Didactic Delivery	Emotional	15.68	15.91	10
	Motivational	14.25	15.36	8
	Neither	6.08	19.27	10
	Total	11.84	16.99	28
Total	Emotional	11.17	14.10	23
	Motivational	9.46	11.21	24
	Neither	8.58	19.63	23
	Total	9.73	15.14	70

Table 5.12 Tests of between-subjects effects for improvements to self-efficacy for generating ideas.

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Delivery	213.37	1	213.37	.91	.34	.014
Support	136.52	2	68.26	.29	.75	.009
Delivery*Support	541.58	2	270.79	1.16	.32	.035

Table 5.12 displays the results of the tests of between-subjects effects for improvements to self-efficacy for generating ideas. With respect to delivery, there was no significant effect, F (1, 64) = .91, p = .34. The improvement to self-efficacy for generating ideas by participants in the scaffolded questioning group (M = 8.32, SD = 13.80) was not significantly different from that of participants in the group with didactic delivery (M = 11.84, SD = 16.99). The effect size was small (partial eta squared = .014). Scaffolded questioning does not lead to greater self-efficacy for generating ideas.

With respect to support, there was no significant effect on self-efficacy for generating ideas, F (2, 64) = .29, p = .75. Improvements to self-efficacy for generating ideas of the emotional support group (M = 11.17, SD = 14.10), the motivational support group (M =

9.46, *SD* = 11.21), and the group without any support (*M* = 8.58, *SD* = 19.63) were not significantly different. The effect size was small (partial eta squared = .009). This shows that there was no significant improvement to self-efficacy for generating ideas between the groups resulting from the provision of motivational or emotional support. This was despite the fact that all the groups had shown significant improvements to self-efficacy overall.

The interaction effect between delivery and support as shown in Table 5.12, was not statistically significant, F (2, 64) = 1.16, $p > 0.05$. Therefore, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This indicates that there is no significant difference in the effect of delivery on improvements in self-efficacy for generating ideas regardless of whether emotional, motivational or no support is provided.

As such, providing additional motivational support does not lead to greater improvements in self-efficacy for generating ideas than are achieved with just providing no support or emotional support.

5.7.1.2 Do Lesson Delivery and Support Improve Self-efficacy to Follow Writing Conventions?

The self-efficacy for following writing conventions construct comprises a student's self-efficacy to write in an academic style, write a well-organised introduction, construct effective body paragraphs, use techniques to link ideas cohesively within a piece of writing, and write a well organised conclusion (Bruning et al., 2013). In order to determine the impact of delivery and support on improvements in self-efficacy for following writing conventions after completing both lessons, a two way between-groups

ANOVA was conducted. The descriptive statistics for the analysis of the participants' improvements to self-efficacy for following writing conventions are displayed in Table 5.13.

Table 5.13 Descriptive statistics for improvements in self-efficacy for following writing conventions.

		Improvements in self-efficacy for following writing conventions		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	14.54	12.73	13
	Motivational	12.07	15.27	16
	Neither	21.23	19.43	13
	Total	15.67	16.08	42
Didactic Delivery	Emotional	16.78	17.24	10
	Motivational	14.25	11.63	8
	Neither	13.00	14.48	10
	Total	14.71	14.38	28
Total	Emotional	15.51	14.54	23
	Motivational	12.80	13.94	24
	Neither	17.65	17.59	23
	Total	15.29	15.32	70

Table 5.14 Tests of between-subjects effects for improvements in self-efficacy for following writing conventions.

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Et Squared
Delivery	26.87	1	26.87	.11	.74	.002
Support	174.71	2	87.35	.36	.70	.011
Delivery*Support	406.78	2	203.39	.84	.44	.026

Table 5.14 displays the results of the tests of between-subjects effects for potential improvements to self-efficacy for following writing conventions. With respect to delivery, there was no significant effect, F (1, 64) = .11, p = .74. The improvement to self-efficacy for following writing conventions by participants in the scaffolded questioning group (M = 15.67, SD = 16.08) was not significantly different from that of participants in the group with didactic delivery (M = 14.71, SD = 14.38). The effect size was small

(partial eta squared = .002). Consequently, scaffolded questioning does not significantly improve self-efficacy for following writing conventions.

With respect to support, there was no significant effect, F (2, 64) = .36, p = .70. Improvements to self-efficacy for following writing conventions of the emotional support group (M = 15.51, SD = 14.54), the motivational support group (M = 12.80, SD = 13.94), and the group without any support (M = 17.65, SD = 17.59) were not significantly different. The effect size was small (partial eta squared = .011). This shows that there were no significant improvements to self-efficacy for following writing conventions between the groups resulting from the provision of motivational or emotional support despite the fact that all the groups had shown significant improvements to self-efficacy overall.

The interaction effect between delivery and support as shown in Table 5.14 was not statistically significant, F (2, 64) = 0.84, $p > 0.05$. Therefore, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This indicates that there is no significant difference in the effect of delivery on improvements in self-efficacy for following writing conventions regardless of whether emotional, motivational or no support is provided.

Thus, providing additional motivational support does not lead to greater improvements in self-efficacy for following writing conventions than are achieved with just providing no support or emotional support.

5.7.1.3 Do Lesson Delivery and Support Improve Self-efficacy for Self-Regulating Writing?

The self-efficacy for self-regulating writing construct comprises students' self-efficacy to focus on writing for at least an hour, avoid distractions while writing, start writing assignments quickly, control frustrations when writing, think of writing goals before commencement of writing, and keep writing even when it is difficult (Bruning et al., 2013). In order to determine the impact of delivery and support on improvements in self-efficacy for self-regulating writing after completing both lessons, a two way between-groups ANOVA was conducted. The descriptive statistics for the analysis are shown in Table 5.15.

Table 5.15 Descriptive statistics for improvements in self-efficacy for self-regulating writing

		Improvements in self-efficacy for self-regulating writing		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	3.91	15.42	13
	Motivational	10.24	20.006	16
	Neither	9.81	16.37	13
	Total	8.15	17.40	42
Didactic Delivery	Emotional	18.07	24.54	10
	Motivational	8.54	12.68	8
	Neither	16.63	15.58	10
	Total	14.83	18.44	28
Total	Emotional	10.07	20.68	23
	Motivational	9.68	17.62	24
	Neither	12.77	16.04	23
	Total	10.82	18.00	70

Table 5.16 Tests of between-subjects effects for Improvements to self-efficacy for self-regulating writing

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Delivery	686.58	1	686.58	2.11	.15	.032
Support	162.45	2	81.23	.25	.78	.008
Delivery*Support	691.40	2	345.70	1.06	.35	.032

Table 5.16 displays the results of the tests of between-subjects effects for improvements to self-efficacy for self-regulating writing. With respect to delivery, there was no significant effect, F (1, 64) = 2.11, p = .15). The improvements to self-efficacy for self-regulating writing by participants in the scaffolded questioning group (M = 8.15, SD = 17.40) was not significantly different from that of participants in the group with didactic delivery (M = 14.83, SD = 18.44). The effect size was small (partial eta squared = .032). Therefore, scaffolded questioning does not significantly improve self-efficacy for self-regulating writing.

With respect to support, there was no significant effect, F (2, 64) = 0.25, p = .78. Improvements to self-efficacy for self-regulating writing by the emotional support group (M = 10.07, SD = 20.68), the motivational support group (M = 9.68, SD = 17.62) the group without any support (M = 10.82, SD = 18.00) were not significantly different. The effect size was small (partial eta squared = .008). This shows that there was no significant improvement to the self-efficacy for self-regulating writing between the groups resulting from the provision of motivational or emotional support. Once again, this was despite the fact that all the groups had shown significant improvements to self-efficacy overall.

As shown in Table 5.16, the interaction effect between delivery and support was not statistically significant, F (2, 64) = 1.06, $p > 0.05$. Therefore, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This indicates that there is no significant difference in the effect of delivery on improvements in self-efficacy for self-regulating writing regardless of whether emotional, motivational or no support is provided.

Accordingly, providing additional motivational support does not lead to greater improvements in self-efficacy for self-regulating writing than are achieved without support or emotional support.

5.7.2 Do Lesson Delivery and Support Improve Self-efficacy for Writing Skills After completing each lesson?

A two way between-groups ANOVA was conducted to explore the impact of delivery and support on improvements in self-efficacy for the skills covered explicitly in Lessons 1 and 2 of the study.

The writing skills covered in Lesson 1 encompassed: (a) writing in an academic style, (b) writing introductions, (c) paragraphing, (d) linking ideas and (e) writing conclusions. A two way between-groups ANOVA was conducted to explore the impact of delivery and support on potential improvements in self-efficacy for these skills covered in Lesson 1. The descriptive statistics for the analysis are shown in Table 5.17.

Table 5.17 Descriptive statistics for improvements in self-efficacy for writing skills: Lesson 1

		Improvements to self-efficacy for writing skills: Lesson 1		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	16.83	13.28	19
	Motivational	13.89	16.06	22
	Neither	25.14	14.37	17
	Total	18.15	15.20	58
Didactic Delivery	Emotional	17.41	16.12	15
	Motivational	24.71	18.73	14
	Neither	18.28	13.53	15
	Total	20.03	16.15	44
Total	Emotional	17.08	14.37	34
	Motivational	18.10	17.71	36
	Neither	21.92	14.19	32
	Total	18.96	15.56	102

Table 5.18 Tests of between-subjects effects for improvements to self-efficacy for writing skills: Lesson1

Source	Type III Sum of Squares	df	Mean Square	F	P.	Partial Eta Squared
Delivery	57.61	1	57.61	.24	.62	.003
Support	344.37	2	172.19	.73	.49	.015
Delivery*Support	1305.98	2	652.99	2.77	.07	.055

Table 5.18 displays the results of the tests of between-subjects effects for improvements to self-efficacy for writing skills covered in Lesson 1. With respect to delivery, there was no significant effect, F (1, 96) = .24, p = .62. The improvements in self-efficacy for writing skill covered in Lesson 1 for participants in the scaffolded questioning group (M = 18.15, SD = 15.20) was not significantly different from that of participants in the group with didactic delivery (M = 20.03, SD = 16.15). The effect size was small (partial eta squared = .003). Therefore, scaffolded questioning does not lead to greater self-efficacy for the writing skills as a whole that were covered in Lesson 1.

With respect to support, there was no significant effect, F (2, 96) = .73, p = .49. The improvements to self-efficacy for the writing skills covered in Lesson 1 by the emotional support group (M = 17.08, SD = 14.37), the motivational support group (M = 18.10, SD = 17.71), and the group without any support (M = 21.92, SD = 14.19) were not significantly different. The effect size was small (partial eta squared = .015). This shows that there was no significant improvement to the self-efficacy for writing between the groups in Lesson 1 resulting from the provision of motivational or emotional support.

As shown in Table 5.18, the interaction effect between delivery and support was not statistically significant, F (2, 96) = 2.77, $p > 0.05$. Hence, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This

indicates that there is no significant difference in the effect of delivery on improvements in self-efficacy for the writing skills covered in Lesson 1 regardless of whether emotional, motivational or no support is provided.

The writing skills covered in Lesson 2 encompassed: (a) incorporating ideas, (b) quoting, (c) paraphrasing, and (d) following referencing conventions. A two way between-groups ANOVA was conducted to explore the impact of delivery and support on improvements in self-efficacy for these skills covered in Lesson 2. The descriptive statistics for the analysis are shown in Table 5.19.

Table 5.19 Descriptive statistics for improvements in self-efficacy for writing skills: Lesson 2

		Improvements to self-efficacy for writing skills: Lesson 2		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	15.35	17.04	12
	Motivational	18.02	21.91	17
	Neither	16.07	24.61	13
	Total	16.65	21.07	42
Didactic Delivery	Emotional	20.18	13.34	9
	Motivational	18.65	15.98	10
	Neither	26.84	16.83	9
	Total	21.78	15.32	28
Total	Emotional	17.42	15.39	21
	Motivational	18.25	19.59	27
	Neither	20.47	21.99	22
	Total	18.70	19.03	70

Table 5.20 Tests of between-subjects effects for improvements to self-efficacy for writing skills: Lesson2

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Delivery	486.94	1	486.94	1.29	.26	.020
Support	168.76	2	84.38	.22	.80	.007
Delivery*Support	296.97	2	148.48	.39	.68	.012

Table 5.20 displays the results of the tests of between-subjects effects for improvements to self-efficacy for writing skills covered in Lesson 2. With respect to delivery, there was no significant effect, F (1, 64) = 1.29, p = .26. The improvements to self-efficacy for writing skills covered in Lesson 2 for participants in the scaffolded questioning group (M = 16.65, SD = 21.07) was not significantly different from that of participants in the group with didactic delivery (M = 21.78, SD = 15.32). The effect size was small (partial eta squared = .02). Scaffolded questioning does not lead to greater self-efficacy for the writing skills covered in Lesson 2.

With respect to support, there was no significant effect, F (2, 64) = .22, p = .80. The improvements to self-efficacy for the writing skills covered in Lesson 2 by the emotional support group (M = 17.42, SD = 15.39), the motivational support group (M = 18.25, SD = 19.58), and the group without any support (M = 20.47, SD = 21.99) were not significantly different. The effect size was small (partial eta squared = .007). This shows that there was no significant improvement to the self-efficacy for writing between the groups in Lesson 2 resulting from the provision of motivational or emotional support.

As shown in Table 5.20, the interaction effect between delivery and support was not statistically significant, F (2, 64) = 0.39, p > 0.05. Therefore, the null hypothesis that the error variance of the dependent variable is equal across groups was supported. This indicates that there is no significant difference in the effect of delivery on improvements in self-efficacy for the writing skills covered in Lesson 2 regardless of whether emotional, motivational or no support is provided.

Therefore, providing additional motivational support does not lead to greater improvements in self-efficacy for the writing skills covered in Lesson 2 than are achieved with just providing no support or emotional support.

Accordingly, Hypothesis H3a is not supported: completing online lessons on writing for academic purposes incorporating APAs that provide motivational support does not lead to improvements in writing self-efficacy.

5.8 Do Lesson Delivery and Support Reduce Writing Anxiety?

In order to establish the impact of delivery and support on writing anxiety as measured by reduction in writing anxiety, a two way between-groups ANOVA was conducted. The descriptive statistics for the analysis are shown in Table 5.21.

Table 5.21 Descriptive statistics for reductions to writing anxiety.

		Reduction to writing anxiety		
Delivery	Support	Mean	Std. Deviation	N
Scaffolded questioning	Emotional	1.54	7.96	13
	Motivational	2.35	8.68	17
	Neither	5.25	9.22	12
	Total	2.93	8.55	42
Didactic Delivery	Emotional	9.89	19.24	9
	Motivational	4.80	8.97	10
	Neither	3.75	8.51	8
	Total	6.19	12.99	27
Total	Emotional	4.96	13.96	22
	Motivational	3.26	8.70	27
	Neither	4.65	8.74	20
	Total	4.20	10.54	69

Table 5.22 Tests of between-subjects effects for reduction in writing anxiety

Source	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Delivery	155.70	1	155.70	1.38	.24	.021
Support	52.72	2	26.36	.23	.79	.007
Delivery*Support	250.68	2	125.34	1.11	.34	.034

Table 5.22 displays the results of the tests of between-subjects effects for reductions in writing anxiety. With respect to support, there was no significant effect, F (2, 63) = 0.23, p = .79). The reduction in writing anxiety in the emotional support group (M = 4.96, SD = 13.96), the motivational support group (M = 3.26, SD = 8.70), and the group without any support (M = 4.65, SD = 8.74) were not significantly different. The effect size was small (partial eta squared = .007). This shows that there was no significant reduction to the writing anxiety between groups resulting from the provision of motivational or emotional support.

Hence, Hypothesis H3b is not supported: completing online lessons on writing for academic purposes incorporating APAs that provide motivational support does not lead to reductions in writing anxiety.

Additionally, Hypothesis H4 is not supported: completing online lessons on writing for academic purposes incorporating APAs that provide emotional support does not lead to reductions in writing anxiety.

5.9 Summary of Quantitative Results

A summary of the quantitative analysis is provided in Table 5.23. As can be seen in Table 5.23, completing two online lessons on writing for academic purposes that incorporate APAs led to improvements in writing competence, increased writing self-efficacy, and reduced writing anxiety for all participants across all six conditions. However, using scaffolded questioning beyond what was achieved with didactic delivery to deliver the lesson did not improve writing competence. Similarly, adding motivational support did

not improve writing self-efficacy or reduce writing anxiety. Finally, including emotional support did not reduce writing anxiety beyond what was achieved by the basic lessons.

Table 5.23 Summary of quantitative analysis

Hypothesis		Supported?
H1a:	Completing learning designs incorporating APAs will improve writing competence	Yes
H1b:	Completing learning designs incorporating APAs will increase writing self-efficacy	Yes
H1c:	Completing learning designs incorporating APAs will reduce writing anxiety	Yes
H2:	Scaffolded questioning will improve writing competence	No
H3a:	Motivational messages will improve writing self-efficacy	No
H3b:	Motivational messages will reduce writing anxiety	No
H4:	Emotional messages will reduce writing anxiety	No

CHAPTER SIX: QUALITATIVE RESULTS

"We do not describe the world we see.
We see the world we can describe."

Rene Descartes 1596–1650, French mathematician, and philosopher

6.1 Chapter Overview

This chapter displays and describes the results of the detailed analysis of the qualitative data collected in this study. Specifically, these results provide a means of triangulating the quantitative experimental data. In Section 6.2, the demographics of the interviewees in each condition is described. Section 6.3 illustrates and describes the results from the word frequency query generated in NVivo. Following on from this, Section 6.4 provides an overall qualitative analysis of the salient themes emanating from the corpus of data to glean global insights into the quantitative results from the study. In Section 6.5, an analysis of the qualitative results used to illuminate the effects of the different delivery and support interventions as perceived by the participants is provided. This chapter concludes with a summary of the results from the qualitative data analysis in Section 6.6.

6.2 Participants in Phase 2

The profile of the 19 participants who were interviewed is displayed in Table 6.1. As can be seen in this table, roughly equal numbers of participants were selected from each condition. There were three from Conditions 1, 2, 4, 5 and 6 respectively, and four from Condition 3. The profile of interviewees comprised 11 females and eight males. Of these participants, nine declared English to be their primary language spoken

at home, while the remaining 10 stated that they were from non-English speaking homes.

Table 6.1 Interviews: Participant background

ID	Condition	Condition description	Language at home	Gender
007	1 QA (Emo)	Scaffolded questioning delivery and emotional support	Other	Female
151			English	Male
403			English	Female
101	2 QA (Mot)	Scaffolded questioning delivery and motivational support	English	Female
200			Other	Female
817			Other	Female
220	3 QA	Scaffolded questioning delivery without support	Other	Male
401			English	Female
708			English	Male
186			English	Female
303	4 Did (Emo)	Didactic delivery and emotional support	Other	Male
811			Other	Female
005			Other	Male
161	5 Did (Mot)	Didactic delivery and motivational support	English	Male
706			English	Male
502			Other	Female
170	6 Did	Didactic delivery without support	English	Female
229			Other	Female
501			Other	Male

6.3 Word Frequency Query

As previously mentioned in Section 4.12, a word frequency query was run on the entire group's interview data. The purpose of running this word frequency query was to visualise the 100 most commonly occurring words within the dataset to gain an overall schemata on the data, as well as to help determine the coding scheme for the data analysis.

When running this query on the interview data files, the researcher specified a number of parameters to return the most relevant results. Specifically, only words with a minimum length of 4 were chosen for the query. Additionally, a grouping level higher than 'exact matches' (e.g. talk), namely 'stemmed words' (e.g. talking, talked) was selected. Irrelevant words were excluded from this search by adding them to a stop words list (e.g. and, but).

The resulting word frequency query provides four major viewing options accessed via several tabs on the right-hand side of the detail view in NVivo. The three viewing options that were utilised in this study were the summary table, word cloud and tree map; with the following explanatory notes on each of these provided by Jackson and Bazeley (2019). The summary table displays the most commonly occurring words, the frequency at which each word occurs, and other summary data. Each word within the table can be double-clicked to open a new window displaying all occurrences of the word within context.

The second viewing option is the word cloud tab which is useful for obtaining visual schemata of the interview data at a glance. The size of the font within the word cloud corresponds to the frequency at which the word occurs. The third viewing option is the

tree map which displays up to 100 of the most frequently occurring words, by placing them in rectangles of various sizes. As with the word cloud, the size of the rectangle corresponds to the frequency at which the word occurs (Jackson & Bazeley, 2019).

The summary table (listing the first 22 of the most commonly occurring words) and word cloud are displayed in Figure 6.1. As illustrated in the word cloud in Figure 6.1, the most prominent words in the analysis were positively valanced words: adjectives (e.g. helpful, good, better); nouns (confidence, able, learning); and verbs (improve, understand). This initial visual summary provided the researcher with assurances that the participants had found the lessons beneficial. The researcher verified the use of these words by double clicking on each one to see how they appeared in context.

From the data tabulated in Figure 6.1, it can be seen that the three most frequently used words in order of decreasing occurrences were ‘helpful’ (69 instances), ‘confidence’ (48 instances) and ‘good’ (33 instances). These popular words are also displayed in the tree map in Figure 6.2, which provides some context as to the proximity at which these words occurred.

Figure 6.1 Entire group's interview data: Summary table and word cloud

Word	Count	Frequency
helpful	69	3.78
confidence	48	2.63
good	33	1.81
time	27	1.48
feel	25	1.37
learning	22	1.20
first	22	1.20
animations	19	1.04
referencing	18	0.99
ideas	17	0.93
start	17	0.93
read	16	0.88
felt	15	0.82
improve	15	0.82
much	15	0.82
able	14	0.77
introduction	13	0.71
words	13	0.71
understand	12	0.66
negative	12	0.66
paragraphs	12	0.66
better	11	0.60

<Files\\Interviews\\007> - § 3 references coded [1.38% Coverage]

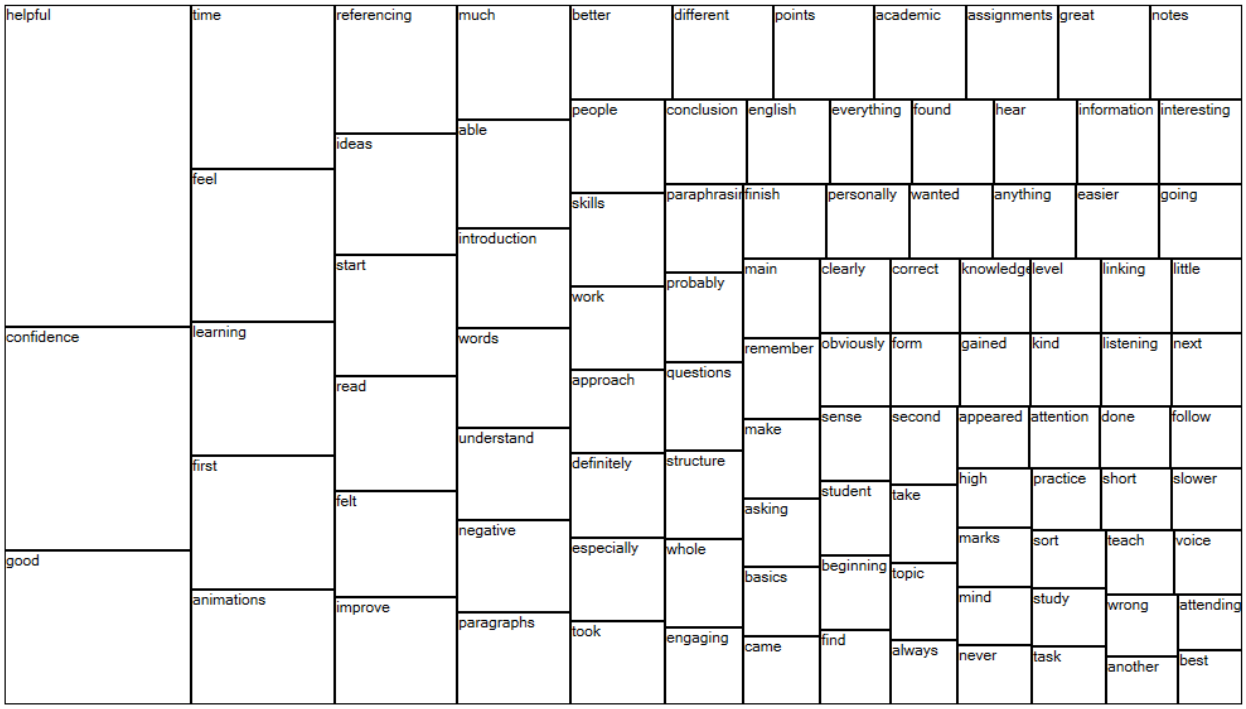
Reference 1 - 0.57% Coverage

The lesson was very helpful because English is not my first language. The English course is the beginning of study in the university so it give me confidence, the practice of doing two essays. If you didn't understand something we could ask and you would explain that if we had some questions I could go to your office. It give me confidence.

Reference 2 - 0.41% Coverage

I felt nervous because I don't know what words to use in essay. Feel uncomfortable and unconfident. We do the practice so we have more chance to use words so it helps.

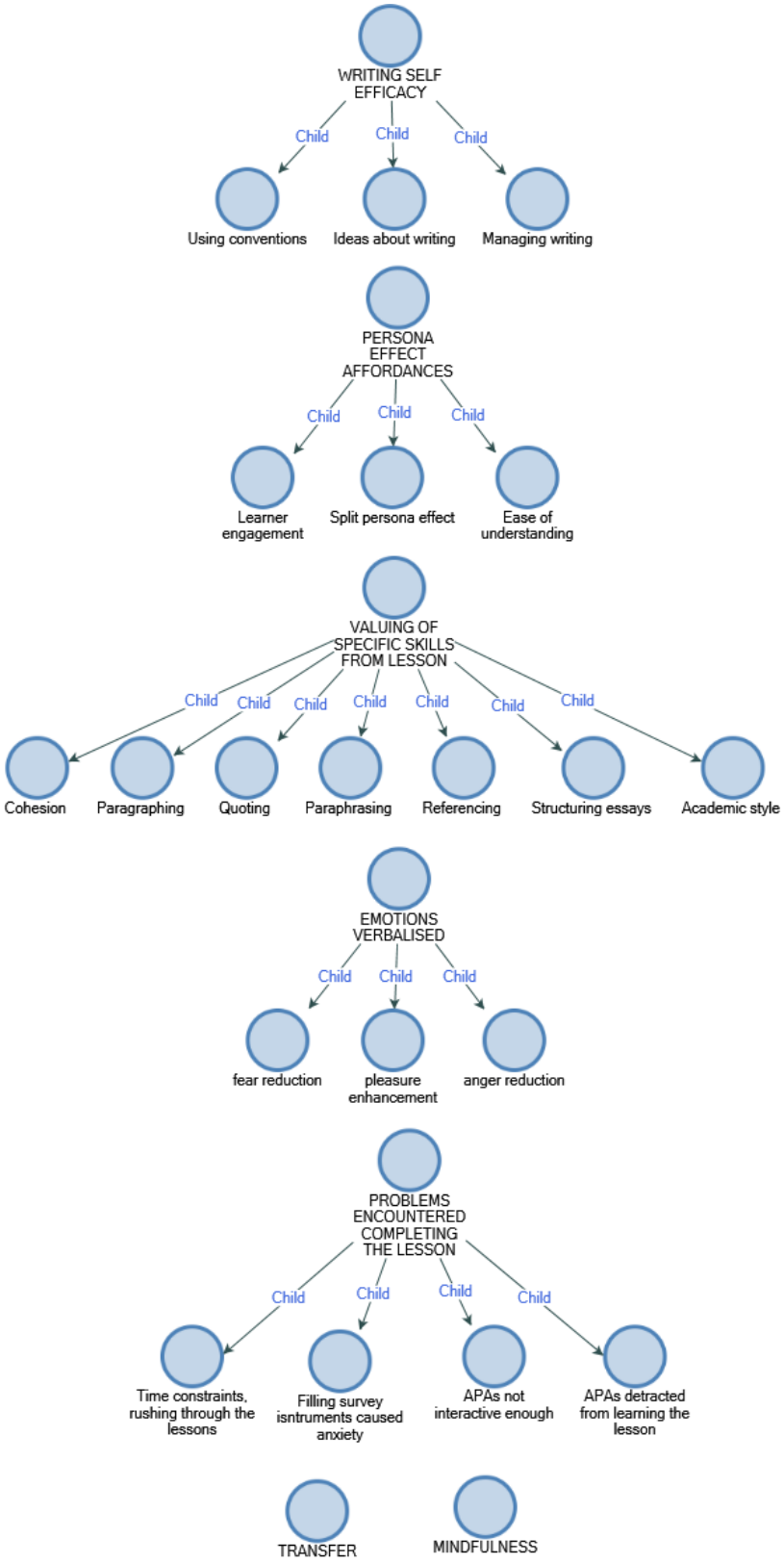
Figure 6.2 Entire group's interview data: Tree map



6.4 Qualitative Results from the Data as a Corpus

As discussed in Section 4.12, this study proceeded along both inductive and deductive lines. It did so along inductive lines by first capturing recurrent themes from the data that at face value did not appear to relate explicitly to answering the research questions. The major themes in this study in order of frequency are displayed in a project map which illustrates the final coding structure of the project, and the interrelationships between each interview's data. This is shown in Figure 6.3.

Figure 6.3: Project map of the final coding structure of the interview data



The node structures within Figure 6.3 are provided in Table 6.2 below which displays the main and sub-themes within the data.

Table 6.2 Themes and sub-themes within the data

Theme and sub themes	Files	References
Writing self-efficacy	14	22
Using conventions	8	9
Managing writing	6	8
Ideas about writing	2	2
Persona effect affordances	13	20
Learner engagement	9	11
Split persona effect	3	5
Ease of understanding	2	3
Valuing of specific skills from the lesson	9	17
Cohesion	4	6
Referencing	3	3
Structuring essays	2	2
Paraphrasing	2	3
Paragraphing	1	1
Quoting	1	1
Academic style	1	1
Emotions verbalised	8	10
Fear reduction	5	5
Anger reduction	4	4
Pleasure enhancement	1	1
Problems encountered completing the lessons	6	8
Time constraints, rushing through the lessons	3	3
APAs were not interactive enough	2	2
APAs detracted from learning the lesson	2	2
Filling survey instruments caused anxiety	1	1
Writing transfer	5	6
Mindfulness	3	5

6.4.1 Writing Self Efficacy

The most prevalent theme from the corpus of data was the sentiment that the lessons improved the participants' writing self-efficacy. Comments exemplifying this theme include:

> I definitely feel a lot more confident in writing essays. The skills I gained from the lessons, I can see improvement in my writing and marks, easier to read. Because of that I have gained so much more confidence. Didn't know what I was doing in the beginning (Participant 186, scaffolded questioning delivery and no support)

> I always use to think I am always bad in writing, and obviously my writing wasn't that good. I wasn't confident in writing, I didn't feel I could do it. Yeah. It think the class helped me–it was the first class I took in terms of writing (Participant 200, scaffolded questioning delivery and motivational support)

6.4.2 Persona Effect Affordances

The second most prevalent theme from the data was that of the *persona effect affordances* as reviewed in Section 2.10.1. This theme is evidenced by participants expressing higher learner engagement as result of interacting with the APAs within the lesson, as distinct from their interactions with the lesson content more generally. The following comments exemplify this:

> If it just had been text and I had to read it myself, I wouldn't have understood as clearly as what having the little cartoon people telling me what to do and explaining things and stuff was. Yeah I think it made it easier for the way I learnt. " (Participant 101, scaffolded questioning delivery and motivational support)

> I think it would have been much more difficult to actually learn anything if you didn't have the people in there because you would not have been paying attention I think. That is what I assume would have happened to me because I get distracted terribly easily (Participant 161, didactic delivery and motivational support)

> It was good to hear the other voice come up. It was good to hear the different voice come through and give me the advice on how to be a bit more confident in the writing and just to hear that third voice I think, more than anything (Participant 151, scaffolded questioning delivery and emotional support)

6.4.3 Valuing of Specific Skills Covered in the Lessons

The third most prevalent theme was the valuing of specific skills within the lessons. This is evidenced by participants expressing their appreciation of the aspects of the lessons that they felt really helped them in their writing. The following comments exemplify this:

> In the first lesson, it helps me a lot …it gives me new words on how to link the sentences (Participant 501, didactic delivery and no support)

> It certainly did I think I picked up especially with the second set of lessons I think were really good for me especially paraphrasing and the linking was a big thing (Participant 706, didactic delivery and motivational support)

> It just help me you know with the referencing because I didn't have like any idea about referencing because in high school they didn't teach us how to do the referencing in a specific order APA or another type of the referencing so I learnt how to do the referencing correctly (Participant 817, scaffolded questioning delivery and motivational support)

6.4.4 Emotions Verbalised

The third most prevalent theme from the data analysis were the emotions that were verbalised by the participants about the lessons, particularly the reduction of fear and anger, as well as one expression of pleasure. The following comments respectively exemplify each of these emotions:

> Well I think you have that natural fear of writing–I'm not sure if negative or positive. Definitely helped me improve my approach to academic writing, I guess. Definitely help me kind of ease my fear of writing (Participant 303, didactic delivery and emotional support)

> In the beginning, I had negative feelings that came more towards confidence and knowing what to do and what was expected, but after the course, it erased all those feelings (Participant 170 didactic delivery and no support)

> I remember the whole exercise, and everything was fun to do, I was enjoying the whole process…(Participant 303, didactic delivery and emotional support)

6.4.5 Problems Encountered

An analysis of the problems encountered by the participants revealed three major areas that presented problems for some of them. Difficulties included time constraints, the APA's not behaving as interactively as they had expected them to, the feeling that the APAs did not add value to achieving lesson objectives, and two other issues unrelated to these.

In regard to keeping to lesson time constraints, three references were made to this theme from three participants:

> I needed to keep in time…the timing was short–the lesson would be lost for me for timing. I suggest more simple lesson–just press next task for next lesson would be good (Participant 005, didactic delivery and emotional support)

> I think that if I thought that I had had more time, I probably wouldn't of rushed some of the things that did rush (Participant 101, scaffolded questioning delivery and motivational support)

> I think part of me wished I had more time (Participant 161, didactic delivery and motivational support)

Additionally, two participants expressed that they considered the APA's behaviours as falling short of their performance expectations, particularly to do with their perceived lack of interactivity and affordances:

> There was no engagement with the animated people on the screen so if you didn't quite understand something you couldn't ask questions to clarify. (Participant 170, didactic delivery and no support)

> The [animation] graphic was too basic……generated by machine……that's why it did not help or stop me to be good with writing. It did not bother me, and it did not help me (Participant 708, scaffolded questioning delivery and no support)

Additionally, two participants felt that the presence of the APAs in the lesson did not add value to achieving lesson objectives:

> I remember the girl animation asking if there is any anxiety for me. But…My focus was on learning lessons so it was not main matter for the [writing] task whether she asking about anxiety or not. I was only excited to focus on the task. I just ignored this extra motivation. I didn't bother and click 'next' button as this was not relevant to task (Participant 005, didactic delivery and emotional support)

> Yah–I prefer reading rather animations because I think like it's a bit slower. It's interesting but a bit slower to wait for them to like … the pace is a bit slower than how we normally read. I was indifferent really. Because, you know, the animations, they are I think intentionally … the way they speak is intentionally a bit slower so that students can understand as well. But, for me personally it was a bit slower so you were waiting for it to finish, I was a bit impatient. I read a lot as so I prefer reading than watching animations (Participant 229, didactic delivery and no support)

An interesting but unsurprising comment which was more to do with the overall research process than the lesson itself was made by one participant. This was about the anxiety that was felt because of the requirement to complete numerous questionnaire instruments before starting the lesson:

> Uhmmm. I found that when I had to fill out the questionnaire at the start, I found it really daunting and I thought I felt like oh my God, I don't know what any of these words mean. I guess it made me feel really incompetent to start with…(Participant 101, scaffolded questioning delivery and motivational support)

6.4.6 Writing Transfer

The fifth theme from the data was the actual perceived transferability of the writing skills that participants had learnt from the lessons to writing tasks beyond the experimental setting. These were explicitly mentioned as being the direct result of completing both lessons, and are illustrated in the following comments:

> and an improvement to the point that we just handed in some essay plans in our academic writing class and I got a 95% on it. And the introduction that I wrote I would say would be the best introduction I have ever written for an essay [post doing the lesson] (Participant 151, scaffolded questioning delivery and emotional support)

> ….especially paraphrasing and the linking was a big thing. And I have incorporated that since then in my essay writing really handy. That where I get the bulk of my essay writing really (Participant 706, didactic delivery and motivational support)

> Because before I used to be stuck before writing, you know how to start but after the lesson, because there was structure …. I wasn't stuck at writing. (Participant 229, didactic delivery and no support)

6.4.7 Mindfulness

The final theme in the qualitative data was the mindful manner in which some participants approached the lessons. This attentiveness to one's pursuits and the contexts within which these are embedded while self-monitoring thinking processes are important because they promote near and far transfer (Adler-Kassner et al., 2017). These participants' volitional, effortful approach to the lessons is apparent in the following comments:

> Its more just to learn really. The essay writing in the lesson was not …it didn't really have to matter if you completed it or not. It was just mostly about learning you know. I sort of surprised myself a bit so it was helpful for my confidence because it made me feel I could think on my feet a bit so it was very good (Participant 161, didactic delivery and motivational support)

> I think that that format worked well for me personally because the main thing that helped me was being able to take notes. A teacher talking would not have given me time to take notes. The main thing was you could take notes in your own time. I have six pages of notes from the lesson (Participant 186, scaffolded questioning delivery and no support)

> For me initially, I didn't feel I had a huge struggle in a sense but I was certainly keen to try to push myself up to the next level (Participant 706, and motivational support)

6.5 Perceived Effects of Delivery and Support Interventions

The qualitative comments provided valuable insights into the participants' experiences during and after completing the lessons under the combination of delivery (didactic or

scaffolded questioning) or support (emotional, motivational or neither) conditions. The coding process that was used to analyse the qualitative data is discussed in Section 4.12.3. The Crosstab Query display along with the Crosstab Query results preview are provided in Figure 6.4, and these results are discussed in Sections 6.5.1, 6.5.2, 6.5.3 and 6.5.4.

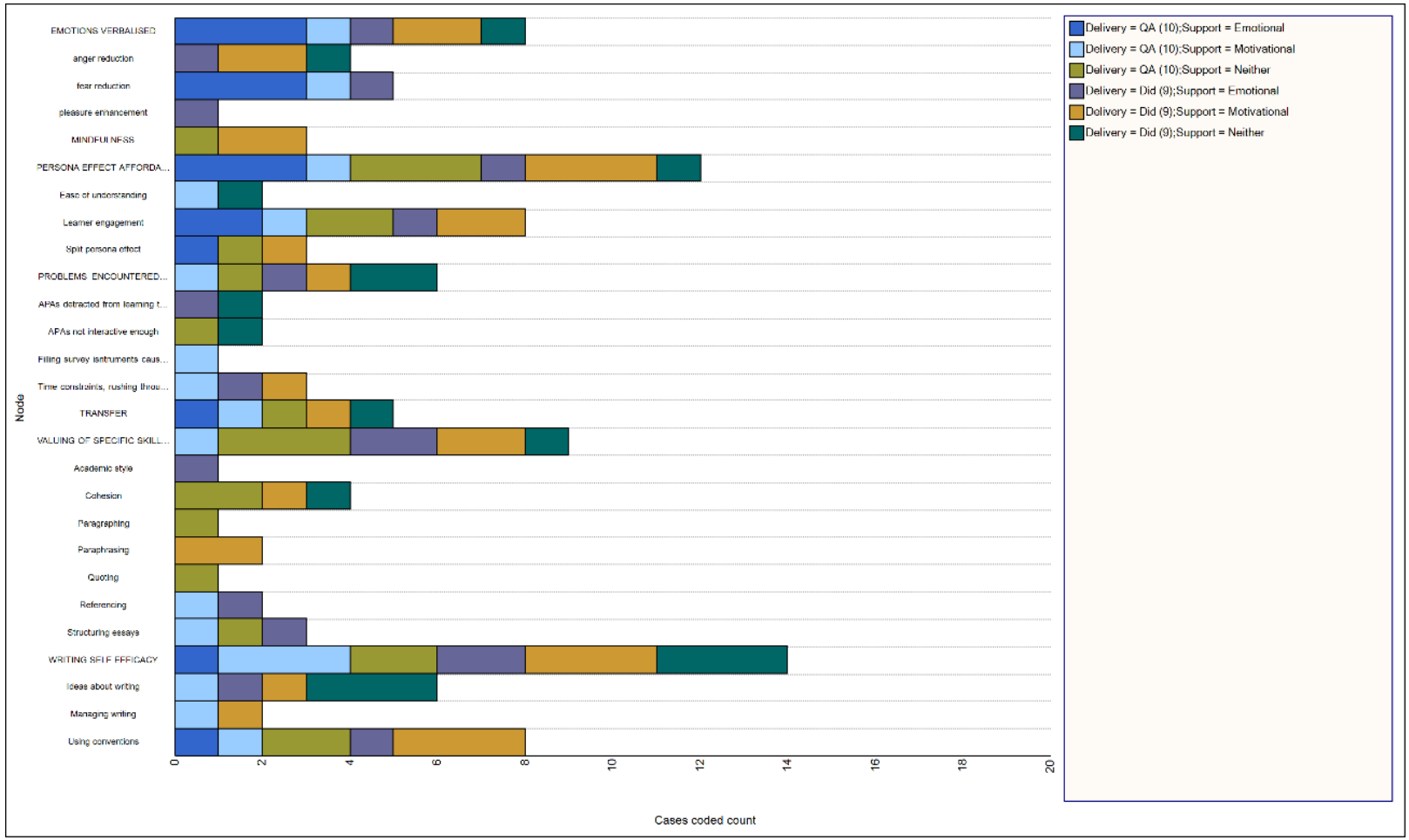
NVivo was used to perform a comparative analysis between the various interview files which first had to be converted to cases in NVivo, before being assigned demographic attributes with values. (In NVivo, demographic attributes can include other unique individual identifiers to facilitate sorting into sub groupings). The demographic values that were assigned to the attributes were a combination of delivery (didactic or scaffolded questioning) or support (emotional, motivational or neither) conditions.

Once the attributes had been assigned to the cases, the Crosstab Query feature of NVivo was used to glean a fast and flexible summary of the pattern of responses for the nodes across the attribute values. Essentially, this feature showed which subgroups in the sample discussed specific themes.

Double clicking on the cell provided the original narrative that had been coded. This feature enabled the researcher to catalogue the relevant comments according to the delivery and support condition in order to address the hypotheses in the study. This was done manually by copying and pasting the relevant comments from the Crosstab Query display into a Microsoft Word table for further analysis.

Figure 6.4 Crosstab Query display and graphical preview

Demographics	Delivery = QA (10)			Delivery = Did (9)			**Total (19)**
	Support = Emotional (3)	Support = Motivational (3)	Support = Neither (4)	Support = Emotional (3)	Support = Motivational (3)	Support = Neither (3)	
FEELINGS EXPRESSED	3	1	0	1	2	1	8
anger reduction	0	0	0	1	2	1	4
fear reduction	3	1	0	1	0	0	5
pleasure enhancement	0	0	0	1	0	0	1
MINDFULNESS	0	0	1	0	2	0	3
PERSONA EFFECT AFFORDANCES	3	1	3	1	3	1	12
Ease of understanding	0	1	0	0	0	1	2
Learner engagement	2	1	2	1	2	0	8
Split persona effect	1	0	1	0	1	0	3
PROBLEMS ENCOUNTERED	0	1	1	1	1	2	6
APAs detracted from learning the lesson	0	0	0	1	0	1	2
APAs not interactive enough	0	0	1	0	0	1	2
Filling survey isntruments caused anxiety	0	1	0	0	0	0	1
Time constraints, rushing through the lessons	0	1	0	1	1	0	3
TRANSFER	1	1	1	0	1	1	5
VALUING OF SPECIFIC SKILLS FROM LESSON	0	1	3	2	2	1	9
Academic style	0	0	0	1	0	0	1
Cohesion	0	0	2	0	1	1	4
Paragraphing	0	0	1	0	0	0	1
Paraphrasing	0	0	0	0	2	0	2
Quoting	0	0	1	0	0	0	1
Referencing	0	1	0	1	0	0	2
Structuring essays	0	1	1	1	0	0	3
WRITING SELF EFFICACY	1	3	2	2	3	3	14
Ideas about writing	0	1	0	1	1	3	6
Managing writing	0	1	0	0	1	0	2
Using conventions	1	1	2	1	3	0	8
Total (unique)	3	3	4	3	3	3	19


EMOTIONS VERBALISED
anger reduction
fear reduction
pleasure enhancement
MINDFULNESS
PERSONA EFFECT AFFORDA...
Ease of understanding
Learner engagement
Spit persona effect
PROBLEMS ENCOUNTERED...
APAs detracted from learning t...
APAs not interactive enough
Filling survey instruments caus...
Time constraints, rushing throu...
TRANSFER
VALUING OF SPECIFIC SKILL...
Academic style
Cohesion
Paragraphing
Paraphrasing
Quoting
Referencing
Structuring essays
WRITING SELF EFFICACY
Ideas about writing
Managing writing
Using conventions
Node
0
2
4
6
8
10
12
14
16
18
20
Cases coded count
Delivery = QA (10);Support = Emotional
Delivery = QA (10);Support = Motivational
Delivery = QA (10);Support = Neither
Delivery = Did (9);Support = Emotional
Delivery = Did (9);Support = Motivational
Delivery = Did (9);Support = Neither

6.5.1 Qualitative Results for Delivery

With respect to delivery, scaffolded questioning was not found to have a significant effect on improvements to writing competence when contrasted with didactic delivery in the quantitative analysis. Nevertheless, the qualitative analysis of the data provided some interesting insights into this apparent lack of difference in writing competence between the two delivery conditions. In particular, participants in both modes showed high levels of cognitive engagement. Cognitive engagement in online learning environments is characterised by the depth with which participants reflect on and work through the learning material (Kennedy, 2020). There were 11 references from nine participant files expressing cognitive engagement as a result of participating in the lessons, and this seemed to be independent of lesson delivery modes. Comments exemplifying this theme include:

> Animations definitely made it more interesting, it was not so boring as say reading the words on the screen. I paid more attention because the characters were interesting (Participant 403, scaffolded questioning and emotional Support)

> Having the visual representation regardless of what they look like, it was much easier to hold your attention I think as opposed to listening to a podcast or something. Because you might be listening to the audio but then you are looking around the room and something catches your attention but with this I think it would have been much more difficult to actually learn anything if you didn't have the people in there because you would not have been paying attention I think (Participant 161, didactic delivery and motivational support)

> I like the whole idea of the more human approach of animation and actually bringing it to life on the screen it's probably a big thing for me. I suppose my brain responds to that well. I think it's good, it captures interest I think and I find I interact a bit better with that. I think I engaged more with it mentally no doubt. I certainly did…The whole engagement of it—having animations, having people talking etc really helps bring out that learning. It's like bridging that gap really (Participant 706, didactic delivery and motivational support)

> I think adding that teacher and student during the story made it more engaging than writing off PowerPoint slides. I personally think that stories are a great

> way to learn, because you tend to remember much more (Participant 186, scaffolded questioning and no support)
>
> it did make the presentation interactive and attractive rather than the common boring slides where you see the words without any animations. It kept us engaged (Participant 220, scaffolded questioning and no support)
>
> If is just read, I will do skim reading, I will forget in half an hour. If I see these animation videos, it will keep in your mind for long time. It help me grab everything (Participant 501, didactic delivery and no support)

In short, a heightened cognitive engagement appeared to be more important in most of the participants who were interviewed than the hypothesised impact of mode of delivery for the participants in the scaffolded questioning group.

Related to this theme was the ease of understanding of the material that the participants in both the scaffolded questioning and didactic delivery conditions expressed (two of the three participants from each of these conditions expressed this theme), which provides further evidence of cognitive engagement generated by the presence of an APA:

> It was easier to follow because they were there so it felt that someone was talking to me rather than just reading the text (Participant 101, scaffolded questioning and motivational support)
>
> Because you might be listening to the audio but then you are looking around the room and something catches your attention but with this I think it would have been much more difficult to actually learn anything if you didn't have the people in there because you would not have been paying attention I think. That is what I assume would have happened to me because I get distracted terribly easily (Participant 161, didactic delivery and motivational support)

Despite the similarities between the scaffolded questioning and didactic delivery conditions with respect to engagement and ease of understanding, there was one theme that was unique only to the scaffolded questioning group. It was the cognisance

of various and distinct APA personalities in the lessons (mentioned by three of the scaffolded questioning participants), which is suggestive of the effects of the hypothesised *social interaction schema*. For example:

> It was good to hear the other voice come up. It was good to hear the different voice come through and give me the advice on how to be a bit more confident in the writing and just to hear that third voice I think, more than anything… it was like getting advice off a third or fourth person. (Participant 151, scaffolded questioning and emotional support)

> It was easier to follow because they were there so it felt that someone was talking to me rather than just reading the text…If it just had been text and I had to read it myself, I wouldn't have understood as clearly as what having the little cartoon people telling me what to do and explaining things and stuff was. Yeah I think it made it easier for the way I learnt. (Participant 101, scaffolded questioning and motivational support)

> It thought it was relatable. …the questions being asked by student animation won't seem as intimidating as if I had to ask them by myself (Participant 401, scaffolded questioning and no support)

6.5.2 Qualitative Results for Motivational Support

As with the quantitative results for delivery, the quantitative results for motivational support failed to demonstrate a significant increase in self-efficacy within the motivational support groups relative to groups without this support. However, the qualitative results are more revealing of more subtle effects of the APA motivational support on the participants' self-efficacy and anxiety. In fact, every one of the six participants provided with motivational support expressed the view that various aspects of their writing self-efficacy had improved as a direct result of attending these lessons. This is to be contrasted with only three out of six of the participants from the emotional support groups and five out of seven of the no support groups.

These qualitative comments were coded into three major areas that paralleled the quantitative measure of writing self-efficacy, namely the SEWS identified by Bruining et al. (2013) and described in Section 4.8.2.1. Specifically, these were self-efficacy for generating ideas, using conventions, and managing writing.

In addition to there being more comments attesting to their perceived increase in self-efficacy for writing, participants in the motivational support groups provided much richer discussions about how they believed their confidence in the skills in certain areas of writing had improved, particularly for the aspect about using writing conventions, described as the deliberate deployment of language based tools to express ideas (Bruning et al., 2013). There were four comments expressing this theme:

> before coming to those classes I didn't know like any information about referencing but like after I came to those classes I hear those information about referencing, how to write the introduction and conclusion and the paragraphs linking between those ideas to each other, after that when I knew how to write down the paragraph and the essay, I just had like high confidence to write down my essay or writing. I helped improve my confidence because if you don't have any information or knowledge, how do you want to get your confidence to write down the essay or writing but with knowledge you know the information, you will write it down with confidence (Participant 817, scaffolded questioning and motivational support)

> Basically, it gave me like a better ability and a better understanding of paraphrasing. Yeah… so that was like …I think mostly just having a opportunity to practise paraphrasing…and…and….that was probably the best thing that helped me out because paraphrasing is quite difficult as you probably know (Participant 161, didactic delivery and motivational support)

> I've gained a lot of ideas, how to study. First we have to collect the key points, then we have arrange the essay in such a way that in three or four subjects—first thing is introduction, then body, then lastly the conclusion part. So, basically it is like first of all we have to collect the key points, where we can note it down ideas and then only we can start writing like expressing points in the paragraph form. That lesson helps a lot. (Participant 502, didactic delivery and motivational support)

> It certainly did I think I picked up especially with the second set of lessons I think were really good for me especially paraphrasing and the linking was a big thing. … Yeah its been great–it's certainly made a big difference being actually being able to do the paraphrasing and how to actually write in that sense. It's been a bit of a step up on what I have been doing previously. And the great thing is that it has actually made some difference (Participant 706, didactic delivery and motivational support)

Two comments were also expressed about how their self-efficacy for managing their writing had improved. These comments are closely aligned with the concept of writing self-regulation, defined as the acts involved in governing writing decisions and behaviours (Bruning et al., 2013). It is noteworthy that such comments concerning managing writing were not found in the non-motivational conditions:

> I found that after that course I found that a lot easier to get on and just write it. I had a better understanding of where to start, how to go about it, and how to I don't know.. how to proof it myself, like what it is that's required and everything. Yeah it helped like lots (Participant 101, scaffolded questioning and motivational support)

> referencing just takes practice that's all it is, and you get used to it. It's a bit frustrating because it's so particular–I was getting frustrated because there is so many rules to it. But now I realise you just have to work within the boundaries of it and its fine, you know really (Participant 161, didactic delivery and motivational support)

With respect to their confidence in generating ideas, one participant provided a unique insight into the benefits derived from having attended the motivational lesson. This comment aligned with the concept of ideation, underpinned by cognitive process sub-domains of semantics and schemata (Bruning et al., 2013).

> we can able to write the essay so we took the class, and after gaining some more advance knowledge, we feel confident and we are able to ... we feel like writing on any topic that comes in our way. That confidence is very much developed in us (Participant 502, didactic delivery and motivational support)

As with the beneficial but subtle effects on writing self-efficacy, APA motivational support was perceived by only one participant to have influenced writing anxiety. In particular, this participant disclosed that the lesson had helped alleviate his fear of writing:

> Before I did that, I was really scared about doing my academic writing course and doing my assignments, cos I have an essay that I have to write, and I had no clue where to even start, whereas I found that after that course I found that a lot easier to get on and just write it (Participant 101, scaffolded questioning and motivational support)

6.5.3 Qualitative Results for Emotional Support

As with the quantitative results for delivery and motivational support, emotional support was not found to have a greater effect on reducing writing anxiety within the emotional support groups than in the other conditions. This was despite the fact that average writing anxiety levels had significantly decreased across all groups.

As with the qualitative results for delivery and motivational support, the qualitative comments provided useful insights into the participants' thoughts on the emotional support they received as they navigated both lessons. Notably, four of the six participants from the emotional support groups verbalised how their emotions were impacted by the lesson. In contrast, only four participants out of the remaining 13 from the non-emotional support groups verbalised their emotions. It was also noteworthy that of these four participants, three of them were from the motivational support groups, in contrast with only one from the no support group.

From the theme *emotions verbalised*, three sub themes emerged: two involving the reduction of negative valanced emotions, namely *fear reduction* and *anger reduction*;

and one involving the increase in a positively valanced emotion, namely *pleasure enhancement*.

With respect to fear reduction, four participants in the emotional groups commented on how the lessons helped to alleviate their fear. For example:

> I felt nervous because I don't know what words to use in essay. Feel uncomfortable and unconfident. We do the practice so we have more chance to use words so it helps. (Participant 007, scaffolded questioning and emotional support)

> the one at the end that asked how I felt and every time I wrote confident, it was the next week I felt that at certain points I was not confident and the other voice came up. It was good to hear the other voice come up. It was good to hear the different voice come through and give me the advice on how to be a bit more confident in the writing and just to hear that third voice I think, more than anything (Participant 151, scaffolded questioning and emotional support)

> First, I was confused about writing. I didn't know how to do stuff good, but now I feel good–feeling much better and not as stressed (Participant 403, scaffolded questioning and emotional support)

> Well I think you have that natural fear of writing–I'm not sure if negative or positive. Definitely helped me improve my approach to academic writing, I guess. Definitely help me kind of ease my fear of writing (Participant 303, didactic delivery and emotional support)

This is contrasted with only one comment expressing the sentiment of fear reduction by a participant from a group where motivational support was provided:

> Before I did that, I was really scared about doing my academic writing course and doing my assignments, cos I have an essay that I have to write, and I had no clue where to even start, whereas I found that after that course I found that a lot easier to get on and just write it (Participant 101, scaffolded questioning and motivational support)

An interesting result was with the reduction of anger (frustration) experienced by one participant in the emotional support group, two in the motivational support group, and one in the no support group:

> If you did something wrong it didn't bother you that much because it was an animation. It didn't feel all that serious in that sense. If you did something wrong, you didn't feel like you did something awfully wrong. IT was more like don't worry, do it again. The whole learning experience was a positive one (Participant 303, didactic delivery and emotional support)

> I used to get a bit frustrated with referencing and the particulars of it, but then I think the lesson helped me with referencing a little bit more because of the fact that it really … referencing just takes practice that's all it is, and you get used to it. It's a bit frustrating because it's so particular–I was getting frustrated because there is so many rules to it. But now I realise you just have to work within the boundaries of it and its fine, you know really (Participant 161, didactic delivery and motivational support)

> Before the negative feelings was there. Because In the initial stage we don't know how to write essay. So negative feeling was there. Like we are not able to write essay in a proper way (Participant 502, didactic delivery and motivational support)

> In the beginning, I had negative feelings that came more towards confidence and knowing what to do and what was expected, but after the course, it erased all those feelings (Participant 170, didactic delivery and no support)

With respect to the only positively valanced emotion, that of pleasure, only one participant from the emotional support group expressed this:

> I remember the whole exercise, and everything was fun to do, I was enjoying the whole process…(Participant 303, didactic delivery and emotional support)

6.5.4 Qualitative Results for No Support

Whereas the didactic delivery and no support conditions were hypothesised to be the least effective in influencing any of the dependent variables (writing competency, writing self-efficacy and writing anxiety), the qualitative comments told a different

story. This was certainly the case with respect to increasing self-efficacy, particularly the self-efficacy to generate ideas as all three interviewees from the no support group expressed how effective the lessons had been. For example:

> It just gives you more confidence I think, to be able to articulate yourself on paper…It improved my confidence like what I said before. It gives you an understanding of what needs to be written, and what to start with, then followed by what so you're not writing all over the place…. and also uhm. With those skills, it gives you the confidence to be able to have people read your work. In the second one [essay] I felt way better than the first. The first one I felt aaah shame! But I was a bit more confident after going through the course that I didn't mind that the second one was going to be marked. (Participant 170, didactic delivery and no support)

> Because before I used to be stuck before writing, you know how to start but after the lesson, because there was structure …. I wasn't stuck at writing…I was excited yea…. because as I said earlier, like before writing any essay I used to spend a long time just to think how to start the essay…so I thought that the lesson would help me not to be stuck (Participant 229, didactic delivery and no support)

> it boosted confidence–it helps me how write a good essay, as before I have to think about ideas, a lot of ideas coming into my mind…I don't know how to sort them out..which one goes first, which one goes last and these lessons help me to rearrange and manage my ideas and pick out the best ones from them and put them in the essay (Participant 501, didactic delivery and no support)

In the scaffolded questioning and no support conditions, improvements to self-efficacy, but particularly in relation to using writing conventions were noted in two out of the four participants who were interviewed from this condition. For example:

> I guess, before I didn't understand paragraphs and how they work. After doing that, now I am very confident in writing paragraphs—on what to include and how to make them strong (Participant 186, scaffolded questioning and no support)

> as I come from the Indian background as I have never used to practise assignment writing. So introduction to your classes helped me to you know, starting the introduction, and doing the paragraphs, and especially the referencing. I had no clue. And how to structure the whole topic sentence and paragraphs…Now if someone ask me to write an assignment, I can do it. Yah I

> know how to write, when to start, how to paraphrase, paragraph structure, citing the work of other people, references (Participant 220, scaffolded questioning and no support)

6.6 Summary of the Qualitative Results

In Phase 2 of the study, 19 participants were interviewed, with three participants representing each of the six conditions with the exception of Condition 3 that had four participants.

The word frequency query that was run on the entire group's interview data revealed that the most prominent words in the analysis were positively valanced words, which assured the researcher of the appreciation the students expressed for the lessons.

This qualitative analysis first proceeded along the inductive bottom-up approach to capture recurrent themes from the data that did not necessarily relate explicitly to answering the research questions. Improved writing self-efficacy was the most prevalent theme emanating from the analysis with 14 of the 19 participants expressing that they felt more confident with using writing conventions, producing ideas about writing and managing their writing.

The next most prevalent theme was the persona effect affordances experienced by 13 of the participants. These participants alluded to higher learner engagement caused by interacting with the APAs in the lessons. Following on from this was the theme to do with the valuing of specific skills from the lesson, namely cohesion, referencing, structuring essays, paraphrasing, paragraphing, quoting and writing in an academic style. The verbalisations of emotions about the lessons, particularly the reduction of fear and anger, was the subsequent theme.

Problems encountered by participants included time constraints, mismatched expectations about the level of interactivity and role of the APAs, and one final problem which involved the pre-lesson research processes as some felt that there were too many pre lesson questionnaires to complete as distinct from the lesson proper. Next, some participants shared that they had begun to apply these skills to different contexts and had achieved success in doing so. The final theme was the mindfulness that some participants expressed that they had applied to the lessons which demonstrated deliberate effortful processes were in play with these individuals.

The results of the Crosstab Query analysis provided a summary of the pattern of responses for the nodes across the various delivery and support experimental conditions which helped elaborate on the results of the hypotheses testing.

With respect to the hypothesised impact of motivational support to improve writing self-efficacy and reduce writing anxiety, every one of the six participants within the motivational groups expressed that various aspects of their writing self-efficacy had improved as a result of attending these lessons. This is contrasted with only half the participants from the emotional support groups and five out of seven in the no support groups.

In regard to the hypothesised impact of emotional support on writing anxiety, four out of the six participants in the emotional support groups verbalised that their negatively valanced feelings, particularly fear and anger had decreased, with one participant from this group expressing that they had felt pleasure from doing the lesson. This is contrasted with only four comments from the remaining 13 participants without

emotional support where the lessons were found to decrease the participants' anger in three participants and fear in the fourth one.

Although the no support conditions were hypothesised to be the least effective intervention for influencing any of the dependent variables, the qualitative comments revealed that even the most rudimentary lesson design with no supports could engender writing self-efficacy in learners.

To conclude, these results demonstrate that the deployment of APAs within learning environments have the potential to yield higher learner self-efficacy in the majority of learners through the persona effect affordances, and with thoughtful emotional and motivational supports, it can potentially reduce negative feelings like fear, and anger in some students.

CHAPTER SEVEN: DISCUSSION

Knowledge comes, but wisdom lingers. It may not be difficult to store up in the mind a vast quantity of facts within a comparatively short time, but the ability to form judgments requires the severe discipline of hard work and the tempering heat of experience and maturity.

Calvin Coolidge 1872–1933, American president

7.1 Chapter Overview

The overarching aim of this research was to examine the impact of learning designs employing APAs on students' writing competence, writing self-efficacy, and writing anxiety from two levels of analysis. The first aim was to investigate the impact of APA lessons on the three dependent variables based on participation in the lessons collectively as a group. The second was to examine the effect of delivery (scaffolded questioning or didactic) and support interventions (emotional, motivational or neither) on these aspects of academic writing.

This work contributes to the body of knowledge on the effectiveness of using APAs to enhance academic writing competency for students studying in an online learning environment, particularly as it relates to fostering writing self-efficacy and reducing writing anxiety. It supports the idea that the progression of academic writing genre knowledge is a significant threshold concept that all novice learners grapple with, and that it is possible for it to be transferred to learners.

This chapter commences with the synthesis of both the quantitative and qualitative results in Section 7.2, before proceeding to address each research hypothesis. It does so by amalgamating the quantitative and qualitative results of the study. Section 7.3

provides an explanation for the results for H1 (with its corresponding hypotheses H1a, H1b and H1c) which found that learning designs incorporating APAs improve writing competence, increases writing self-efficacy and reduces writing anxiety.

Next, Section 7.4 explains the results for H2 which found that learning designs with APAs in scaffolded questioning delivery conditions do not demonstrate significantly greater improvements to their writing competence compared with those working in didactic delivery conditions.

Section 7.5 discusses progress towards explaining the results for H3 which found that learners working with APAs within lessons that provide motivational support messages do not demonstrate significantly more writing self-efficacy and less writing anxiety when compared with those who experience lessons without such motivational support.

Section 7.6 explicates the results for H4 which found that learners working with APAs within lessons that provide emotional support messages do not demonstrate significantly less writing anxiety when compared with those who experience lessons without such emotional support. Finally, Section 7.7 provides a summary of the discussion.

7.2 Summary of the Quantitative and Qualitative Results

Overall, the quantitative findings demonstrated improvements in the participants' writing competence, self-efficacy and anxiety after completing both lessons on academic writing, consequently supporting hypothesis H1 along with its corresponding sub-hypotheses H1a, H1b and H1c.

However, the remaining hypotheses, H2, H3 and H4, were not supported. In particular, using scaffolded questioning instead of didactic delivery to deliver the lesson did not improve writing competence (H2). Similarly, providing motivational support did not lead to further improvements in writing self-efficacy or reductions in writing anxiety (H3) beyond the basic lessons. Finally, including emotional support did not lead to further reductions in writing anxiety (H4), beyond what was achieved by the basic lessons.

Despite these latter three hypotheses not being supported statistically, a number of inferences were made based on the systematic analysis of the qualitative data. These results are suggestive of a number of possible improvements being experienced by the participants in the various conditions. A synthesis of the study results is provided in Table 7.1.

Table 7.1 Synthesis of the qualitative and quantitative analyses

Hypothesis	Quantitative results	Summary of the qualitative results
H1: Completing learning designs incorporating APAs will improve writing competence, increase writing self-efficacy and reduce writing anxiety.	Supported	• The lessons improved writing self-efficacy (14 participants, 22 references) • Persona effect affordances were experienced (13 participants, 20 references) • Emotions were verbalised e.g. fear and anger reduction (8 participants, 10 references) • Writing transfer evidenced (5 participants, 6 references) • Mindfulness in approaching the lessons (3 participants, 5 references)
H2: Scaffolded questioning will improve writing competence.	Not supported	Independent of lesson delivery mode, there were expressions of: • strong cognitive engagement (9 participants, 11 references) • ease of understanding the material (2 participants from each condition) Only participants in the scaffolded questioning groups were cognisant of the other APAs in the lesson (3 participants) in contrast to the didactic delivery groups
H3a: Motivational messages will improve writing self-efficacy	Not supported	• Each of the six participants provided with motivational support expressed that various aspects of their writing self-efficacy had improved as a direct result of attending these lessons. This is in contrast to three out of six of the participants from the emotional support groups and five out of seven of the no support groups.
H3b Motivational messages will reduce writing anxiety	Not supported	• One participant in the motivational support group disclosed that the lesson had helped alleviate his fear of writing. No other interviewees did.
H4: Emotional messages will reduce writing anxiety.	Not supported	• Four out of the six participants in the emotional support group commented on how the lessons helped to alleviate their fear/anxiety about writing. No others did.

7.3 Do Learning Designs with APAs Increase Writing Competence and Self-Efficacy, and Reduce Writing Anxiety?

The intention of RQ 1 was to examine the extent to which learning designs incorporating APAs can be used to increase writing competence and writing self-efficacy, while reducing writing anxiety. The quantitative results showed that learning designs incorporating APAs increased writing competence (H1a) and self-efficacy (H1b) while reducing writing anxiety (H1c), thus collectively providing unequivocal support for H1.

These results are consistent with the findings of previous empirical work on APAs in other domains that demonstrate positive results when deploying APAs into multimedia environments due to the persona effect affordances that APAs bring to the learning environment (Atkinson, 2002; Fountoukidou, Ham, Matzat, & Midden, 2019; Lester et al., 1997; Lusk & Atkinson, 2007; Moreno et al., 2000; Moreno et al., 2001). Accordingly, the presence of the APA provides affordances such as higher learner engagement (Fountoukidou et al., 2019; Okonkwo & Vassileva, 2001), lesson enjoyment and reductions in perceptions of difficulty (Andre et al., 1999; Dehn & Van Mulken, 2000; Moundridou & Virvou, 2002; van Mulken et al., 1998).

Similarly, the qualitative results from Section 6.5.2 support that the persona effect affordances help engage learners. In particular, participants expressed that the APAs influenced them to engage with the content of the lesson, diminished their perceptions of difficulty of the lesson content, directed their attention towards the lesson, and soothed them when they listened to supportive APA voices.

The prevalence of these positive participant comments appeared to outweigh those to the contrary. Very few participants did not appreciate the APA's roles within these lessons. One negative sentiment concerned unrealised expectations of APA affordances where the participant felt that the APAs should have been able to clarify their questions about the lesson content, which they were not equipped to do. This participant's reaction may be explained by Norman (1997) who cautions against deploying seemingly realistic APAs as this has the potential to establish unrealistic performance expectations. Another negative sentiment in this study was related to a participant choosing to ignore the APAs because these personas were deemed distractions, despite the fact that the particular participant was in a group without additional APA support in his intervention.

With respect to self-efficacy, the largest improvements were in self-efficacy for following writing conventions followed by self-efficacy for self-regulating writing, with less improvement achieved in self-efficacy for generating ideas. The superior result for self-efficacy for following writing conventions may be explained by the fact that this short-term experiment had lesson content that was designed primarily to impart writing conventions. While self-efficacy for self-regulating writing, and self-efficacy for generating ideas both improved, had the lessons been more overtly structured to scaffold each of these, it is likely that higher gains would have been realised for these aspects of writing self-efficacy. In one study that was conceived to determine the effects of scaffolding self-regulation in a multi-agent intelligent tutoring system, (Duffy & Azevedo, 2015), undergraduate university students benefitted from prompts and feedback in comparison to the control group which did not receive them. These prompts were based on the work of Winne and Hadwin (2007) on self-regulated

learning and on achievement motivation. In Duffy and Azevedo's (2015) study, the lessons were designed with a self-regulated learning menu to enable learners to initiate contact with an APA to obtain learning strategies and be orientated to learning objectives. Accordingly, had strategies to enhance self-regulated learning been built into the motivational lesson, improvements to learners' self-efficacy for self-regulating writing are likely to have been higher for the group receiving motivational supports in comparison to those participating in the regular lessons. Similarly, self-efficacy for generating ideas could have benefitted more from scaffolds to achieve this, namely providing participants access to mind-mapping and free writing tools as provided by an APA.

The results relating to H1 add to the existing body of work on APAs in two ways. First, they provide quantitative and qualitative support for the usefulness of enriching writing instructions with APAs in order to increase far transfer in writing over a relatively short timeframe. Given that the lessons were instructional and provided scaffolded support immediately before completing an unstructured writing task, it could be argued that this learning transfer would be classed as high road transfer which entails purposeful mental effort and the deployment of higher cognitive processes (Perkins & Salomon, 1992) in order to produce an essay. These findings therefore provide evidence in support of APAs being deployed to teach academic writing to novice students. Second, as indicated by the qualitative results, APAs appeared through the persona effect to engender learner engagement as predicted in a number of previous studies deploying APAs (Govindasamy et al., 2010; Moreno et al., 2001; Pareto et al., 2012; Schroeder & Traxler, 2017).

Having explored the impact of APAs from a holistic perspective, this discussion next narrows its focus on examining the effect of delivery (scaffolded questioning or didactic) and support interventions (emotional, motivational or neither) on writing competence, writing self-efficacy and writing anxiety. Specifically, it explains the results of RQ 2, which was to examine the effect of emotional support messages, motivational messages and scaffolded questioning respectively on writing competence, writing self-efficacy and writing anxiety. These results are discussed in the following sections.

7.4 Does Scaffolded Questioning Improve Writing Competence?

This section discusses the results about the effect of scaffolded questioning on writing competence. The quantitative results for H2 were that learning designs with APAs that employ scaffolded questioning do not lead to significantly greater improvements to student writing competence compared with only didactic delivery. This finding is contrary to previous empirical studies reporting superior learning outcomes that have been achieved by learners viewing dialogues between teacher and student in contrast to watching lecture style monologue videos (Chi et al., 2017; Fox Tree, 1999; Muldner et al., 2014).

There are two possible explanations for this lack of difference. First, although the researcher had conceptualised the scaffolded questioning condition as more interactive and therefore more effective for eliciting learning transfer, based on the (ICAP) conceptual framework (Chi, 2009), this conceptualisation of interactivity may have been too narrow when applied to this multimedia context. In multimedia instruction, an alternate definition of interactivity is the “reciprocal activity between a

learner and a multimedia learning system, in which the [re]action of the learner is dependent on the [re]action of the system and vice versa" (Domagk, Schwartz, & Plass, 2010, p. 1025). Accordingly, given that the lessons were the only points at which the scaffolded questioning and didactic delivery conditions were operationalised, this meant that these learning experiences within the scaffolded questioning group did not present sufficient opportunity for the learners to gain extra benefit from the scaffolded questioning.

The other is the delimitations placed on the experimental timeframe which may have minimised differential improvements to writing transfer in the longer term between the two groups. This was found to be the case in a study investigating the transfer of physics problem solving by observing human tutoring videos. In this timeframe sensitive study, Craig, Chi, and VanLehn (2009) examined the effectiveness of pairs of students watching videos of two human tutoring sessions between an expert tutor and a novice student who posed questions (similar to the scaffolded questioning conditions in this study), and pairs or individual students watching an expert tutor solving identical physics problems (similar to the didactic delivery conditions in this study). The students who observed videos of the tutoring sessions (with novice questions directed at the tutor) as contrasted with student pairs and individuals who watched videos of the expert problem solving showed consistent learning improvements favouring the students who observed the videos of the tutoring sessions with the question-and-answer format. However, this improved problem solving only manifested in the longer term, and was observed in homework (combination of a retention problem and three each of long-term near transfer and far transfer problems). In fact, there was no difference between the groups immediately after the experiment (Craig et al., 2009).

Accordingly, it is plausible to conclude that writing transfer resulting from a scaffolded questioning intervention could take a longer time to develop, requiring an extension into the medium to longer term in order to detect further improvements from scaffolded questioning.

7.5 Does Motivational Support Improve Writing Self-Efficacy or Reduce Writing Anxiety?

This section discusses the quantitative and qualitative results relating to the potential role of motivational support in addressing writing self-efficacy and writing anxiety. The quantitative results for H3a showed that completing online lessons on writing for academic purposes that incorporate APAs that provide motivational support does not lead to improvements in writing self-efficacy beyond those achieved by completing the basic lessons. Writing self-efficacy pertains to both multifaceted self-efficacy comprising self-efficacy for generating ideas, following writing conventions and self-regulating writing (Bruning et al., 2013), and to specific writing skills efficacy for the discrete writing skills. There were no significant differences in improvements to writing self-efficacy of either type between the groups with motivational support and those without. Thus, these results for H3a do not support previous empirical research for increased learner self-efficacy by the deployment of incremental ability messages delivered by APAs (Donohoe et al., 2012; Im, 2012).

The effectiveness of the motivational messages used in this study could have been diminished by the participants' perceived dissimilarity to the educational psychologist APA delivering the motivational messages. While many of the study participants were in their 20s *(M* = 24.4, *SD* = 7.5) and primarily from an Australian background, the

motivational APA was much older in appearance and had an overtly different ethnicity and corresponding foreign-accented voice. These differences could have given rise to effects resulting from the similarity attraction hypothesis which states that people are more likely to be interested in, and attentive to, social models with characteristics that resemble their own (Bersheid & Walster, 1969). This tendency has been shown to translate into the way in which people react to APAs in the virtual world by the triggering of relevant associative schemata (Moreno & Floweday, 2006). Similarly, another study has shown that students' self-efficacies in a domain task will be improved when they observe virtual models whose character resembled them perform a particular task (Rosenberg-Kima et al., 2008). As such, this phenomenon could have reduced the effectiveness of motivational messages delivered by the educational psychologist APA.

Additionally, the APA used to deliver motivational messages had a strongly Indian-accented voice, which may have contravened the voice principle for the majority of participants who would have been more accustomed to a standard-accented voice. The voice principle or voice effect, as propounded by Mayer states that "people learn more deeply when narration in a multimedia lesson is spoken in a standard-accented human voice rather than in a machine voice or foreign-accented human voice" (Mayer, 2005b, p. 208). This effect was demonstrated in a study by Mayer, Sobko, et al. (2003), which found that participants in the group with a standard-accented APA voice, in contrast to the participants in the group with the foreign-accented APA voice, performed better on a transfer test, and provided more positive ratings on the APA.

It is also plausible that the foreign-accented voice may have distracted the learner or increased cognitive load, therefore reducing the quantity of information being processed, a factor identified by Sinatra et al. (2021). This is explained by cognitive load theory (Paas et al., 2003, 2004; Sweller et al., 1998) which informs instructional design principles as they relate to the limitations of human cognitive architecture. This theory posits the existence of three types of cognitive load, namely intrinsic, extraneous, and germane cognitive load (Sweller, 2005). Intrinsic cognitive load arises out of the inherent complexity of the learning material that learners must assimilate, while extraneous cognitive load emanates from instructional designs that are ill suited to the limitations of working memory, and that neglects processes that centre working memory on building schemata and achieving automatisation. Finally, germane cognitive load is productive cognitive load that results from learners engaging with the learned information, and building schemata (Sweller et al., 1998). Whereas intrinsic cognitive load is out of the sphere of influence of instructors, effective instructional design can minimise extraneous cognitive load. While research into the relationship between cognitive load and self-efficacy has been somewhat limited (Zimmerman, 2015), empirical research supports the notion that inappropriate instructional design results in unnecessary additional cognitive load, which has an inverse relationship to learner self-efficacy (Zheng, McAlack, Wilmes, Kohler-Evans, & Williamson, 2009). Consequently, it cannot be discounted that the strong Indian accented voice could have contributed to the extraneous cognitive load of the lessons with motivational support, and that in turn served to dampen the intended impact on learner self-efficacy.

Similar to H3a, the quantitative results for H3b revealed that completing online lessons on writing for academic purposes incorporating APAs that provide motivational support does not lead to improvements in writing anxiety beyond those achieved by completing the basic lessons. Once again, this outcome is contrary to previous research (albeit, research into mathematics anxiety), where APA research deploying enactive mastery messages resulted in the reduction of mathematics anxiety (Im, 2012). Thus, these results for H3b do not support previous research. More research is needed to understand this lack of additional reduction in writing anxiety through the provision of incremental ability messages. Nevertheless, it is noteworthy that the relationship between self-efficacy and anxiety is an inverse one (Bandura, 1997), and the domain of writing is no exception to the rule (Martinez et al., 2011; Prat-Sala & Redford, 2012); therefore, given the lack of additional impact on self-efficacy beyond that achieved by lessons without motivational support, it is not surprising that writing anxiety also did not improve further when motivational support was provided.

Despite the lack of differential statistical effect on writing self-efficacy and writing anxiety between conditions providing motivational support and those that did not, the qualitative results reveal subtle changes to self-efficacy. Specifically, each of the six participants in the motivational support condition indicated that they felt their writing self-efficacy had in fact improved as a result of having attended the lessons. This is in contrast to only half of the six participants from the emotional support group and five of the seven of the no support groups commented that aspects of their writing self-efficacy had improved because of attending those lessons. In addition, the participants in the motivational support group were more descriptive about how they believed their confidence in the skills had improved, particularly with respect to their self-

efficacy in using writing conventions followed by managing their writing, whereas only one participant receiving motivational support had verbalised that the motivational support had reduced his writing anxiety. Accordingly, both the quantitative and qualitative results concur.

These results corroborate the findings of previous work on foreign language anxiety (Ko, 2010). In Ko's (2010) study, APAs were used to provide motivational messages to students in a multimedia lesson to examine their effects on foreign language listening anxiety. This study (which had a comparable sample size to the present study), found a lack of statistical effect for motivational feedback on learners, but a notable difference was discerned between groups in the descriptive feedback as to the emotions felt as a result of dealing with the APA. Thus, while studies citing statistical improvements to mathematics anxiety were the premise upon which the hypotheses of the present study was designed, its results along with the results from the study by Ko (2010) suggest that changes to emotional affect resulting from motivational support messages deployed in language related domains, for example listening and writing, may not be as apparent using nomothetic approaches requiring large sample sizes, especially with short-term interventions. Instead, combining such approaches with idiographic approaches will enable subtle changes to be discerned which would otherwise be missed.

7.6 Does Emotional Support Reduce Writing Anxiety?

The intention of RQ 2 was to examine the effect of emotional support messages, motivational messages and scaffolded questioning respectively on writing competence, writing self-efficacy and writing anxiety. The intention of addressing this

research question was to determine the effects of providing emotional support on reducing writing anxiety. This section discusses the results relating to the effect of providing emotional support on writing anxiety. The results from the quantitative analysis showed that providing emotional support was no more successful in reducing writing anxiety than the provision of no support (see Section 5.8). Specifically, emotional support did not reduce learner's writing anxiety levels beyond the reductions achieved by completing the basic lessons.

These results may be partially explained by a recent study into mathematics anxiety (Y. Kim et al., 2017) which was designed to explore the efficacy of using APAs to reduce mathematics anxiety in high school students. Similar to the current study, this study used an APA to deploy anxiety reducing messages to help students cope with any anxieties that arose during their algebra lessons. This study was based on the work of Robichaud and Dugas (2006) for the treatment of generalised anxiety disorder. This cognitive behavioural approach involved a process of helping students' achieve self-awareness about their anxiety, assisting them to improve their tolerance for this uncertainty, and encouraging them to face rather than avoid unpleasant situations. In the study by Y. Kim et al. (2017), a one-hour APA lesson was delivered daily over one week. Similar to the present study, students in the control group who did not receive anxiety reducing messages and the experimental group who did receive them registered a drop in their anxiety levels as well as increased learning as measured at pretest and again at posttest (Y. Kim et al., 2017). Interestingly, and similar to the present study, the anxiety messages were not tailored to each specific student's needs, and was a relatively short intervention. The authors concluded that anxiety reduction

requires a long-term approach instead of a relatively brief intervention, and this is also likely to be the case in the context of academic writing.

Despite this, the qualitative results were more revealing as to the perceptions of the emotional support group participants' emotional states. In fact, the emotional support that was provided by the APAs was perceived by a higher proportion of participants in the emotional support groups in contrast to the non-emotional support groups. In particular, a higher proportion of participants from these emotional support groups expressed that these lessons helped support them to reduce their fear and anger while increasing their pleasure of the lessons. Contrastingly, only four out of the 13 participants from the non-emotional support group referred to having discerned support of their negative feelings, and of these, three were from the motivational support groups. Only one from the no support group in fact mentioned having discerned receiving any support for their feelings.

7.7 Summary of the Discussion

This chapter discussed the quantitative and qualitative results for this study, which are summarised in Table 7.1. The study confirmed the potential of APAs to improve writing competence, self-efficacy and anxiety. However, scaffolded questioning did not provide improvements in writing competence beyond just completing the basic lessons. Reasons for this were considered, and these include the possible need for further interactivity in questioning and the need for a longer intervention.

Motivational messages were also not found to provide the hypothesised further improvements in writing self-efficacy and reductions in writing anxiety. This may have

been attributable to the similarity attraction hypothesis effects (Bersheid & Walster, 1969), resulting from the culturally different appearance and accented voice of the APA delivering the motivational messages.

Emotional messages also did not result in reducing writing anxiety when compared to the basic lessons. This finding is consistent with the results of Y. Kim et al. (2017) and may indicate that a longer term approach to anxiety reduction is needed.

Despite the lack of anticipated additional improvements resulting from scaffolded questioning, motivational support and emotional support, the qualitative results provide valid insight into benefits perceived by some students, and demonstrate the potential of using APAs to support students as they learn academic writing.

The final chapter summarises the findings of this study, and elaborates on its limitations while providing a number of implications for practice and future research.

CHAPTER EIGHT: CONCLUSIONS

"Knowledge is a process of piling up facts;
wisdom lies in their simplification."

Martin Fischer 1879–1962, American physicist

8.1 Chapter Overview

This final chapter concludes the research into the use of APAs in academic writing described in this thesis by summarising findings and consolidating the various empirical and theoretical strands within this body of work. The primary aim of this study was to examine the impact of learning designs with APAs on students' writing competence, writing self-efficacy, and writing anxiety. Its second aim was to investigate the effects of manipulating these learning designs by varying their delivery options (didactic or scaffolded questioning) along with support interventions (emotional support messages, motivational support messages, or no such messages) to study their effects on writing competence, writing self-efficacy and writing anxiety.

This thesis commenced with a broad overview of tertiary student under preparedness for academic writing in Australia, the mass migration of courses online and the need to upskill students with the requisite writing skills to navigate these courses. In order to overcome the inherent weaknesses of traditional online delivery methods, this research underscored the need to couple online courses with writing instruction endowed with technological innovations. One such technological innovation, the APA, has shown promise in its ability to engage learners, but research into the field of APA pedagogy has tended to proliferate in the Science Technology Engineering and Mathematics (STEM) areas, with inroads being made into non-STEM areas.

Accordingly, the driver for this research project was to address the paucity of APA literature on academic writing skills for incoming tertiary level students. The two main research questions that were answered in this study were:

1. To what extent can learning designs incorporating APAs be used to increase writing competence and writing self-efficacy, while reducing writing anxiety?
2. What effect do emotional support messages, motivational messages and scaffolded questioning have respectively on writing competence, writing self-efficacy and writing anxiety?

Section 8.2 provides a summary of the study and its findings. The study's limitations and the means for overcoming them are addressed in Section 8.3, while Section 8.4 discusses the study's delimitations and their implications for this research project. Section 8.5 offers some implications for practice. This chapter concludes with some implications for future research in Section 8.6.

8.2 Summary of the Study and its Findings

The two main questions of this study were addressed by testing the following four hypotheses and associated sub-hypotheses:

H1: Completing learning designs incorporating APAs will improve writing competence, increase writing self-efficacy and reduce writing anxiety

H1a: Completing learning designs incorporating APAs will improve writing competence

H1b: Completing learning designs incorporating APAs will increase writing self-efficacy

H1c: Completing learning designs incorporating APAs will reduce writing anxiety

H2: Scaffolded questioning will improve writing competence

H3: Motivational messages will improve writing self-efficacy and reduce writing anxiety

H3a: Motivational messages will improve writing self-efficacy

H3b: Motivational messages will reduce writing anxiety

H4: Emotional messages will reduce writing anxiety

Overall, results from this study indicate that the completion of academic writing lessons that use APAs leads to improvements in writing competence and improved self-efficacy for generating ideas, following writing conventions and self-regulating ideas. Self-efficacy improvements were also observed for the specific writing skills covered in each lesson, namely writing in an academic style, writing introductions, paragraphing, linking ideas, writing conclusions, citing ideas, quoting, paraphrasing and using referencing conventions. The same positive result was achieved with respect to the reduction in writing anxiety.

However, scaffolded questioning delivery evidently appears to improve writing competence more than didactic delivery in short interventions such as this one. Despite this, the scaffolded questioning groups were cognisant of the presence of other entities within the lesson that were perceived to be helping them, which encouraged more effortful processing of the learnt material. Such perceptions should be beneficial in engaging learners to develop their academic writing skills that require considerable practice.

Motivational support similarly did not appear to improve writing self-efficacy or reduce writing anxiety more than was achieved with lessons without this support. However, comments from the groups receiving motivational support suggest that a disproportionately higher proportion of the participants in these groups perceived

improvements as a result of attending the lessons compared with the groups that had not, and their comments were more descriptive about how they believed their confidence in the skills had improved.

Finally, emotional support was not found to improve writing anxiety more than was achieved with lessons without such support. Nevertheless, the qualitative responses from the group receiving emotional support included a much higher proportion of comments on how the lessons helped them to alleviate fearful and anxious emotions about writing, compared with comments from the groups that had not received such support.

8.3 Study Limitations

No study is exempt from limitations, and with careful analysis and faithful reporting, valuable insights may be gained to illuminate the path for future research into this area. The five main limitations of this study are: (a) the high participant attrition rate between Lessons 1 and 2 which may have caused attrition bias; (b) the related problem of the relatively small sample size of participants in the six experimental groups which had the potential of causing Type 2 errors; (c) lesson time pressures faced by the participants; (d) the potential for cross contamination, and (e) the Hawthorne effect.

The study's first limitation was the high attrition rate between Lessons 1 and 2. Attrition is a phenomenon where the number of participants in a study is reduced over time. While attrition tends to occur to some extent in research studies with sequential interventions, large numbers of participants prematurely leaving the study can have

the potential to introduce bias (Bankhead, Aronson, & Nunan, 2018). As Bankhead et al. (2018) explain, attrition bias is the phenomenon where the differences in the rate of loss between participants within experimental groups in a study may change the composition of the groups independent of the actual intervention, and can threaten the study's validity. As applied to this study, the participants who decided to continue in the study may have had different characteristics from those who did not continue. Consequently, participants who decided to persist with the study could have possessed more self-efficacy than those who did not, and this may have influenced the study results.

This large participant attrition rate from Lesson 1 to Lesson 2 caused the numbers who had completed both lessons to dwindle to only 11.5 participants on average per experimental group, resulting in the study's second limitation: the increased possibility of Type 2 errors being committed. Type 2 errors occur where the researcher fails to reject the null hypothesis when it is in fact false. This could potentially have resulted in a wrongful conclusion that the groups did not differ when they in fact did, particularly when testing H2, H3 and H4 which involved examining the participants for intergroup differences on the dependent variables of interest.

Another limitation of this study was the enforcement of strict time limits on the participants to complete extensive experimental protocols in addition to the actual lesson. Participants were under time pressure to complete the large bundles of survey instruments and writing tasks prior to commencing Lesson 1 and upon concluding Lesson 2. Specifically, prior to completing Lesson 1, participants spent up to 60 minutes completing the pre-lesson questionnaire bundle comprising a consent form,

demographic sheet, the WAT, SEWS, and the SSSES for Lesson 1 and then finishing the writing task. This sequence was mirrored in Lesson 2, but proved less of a problem because most of the instruments were completed at the end of the lesson. It was therefore inevitable that participants would have experienced some level of survey fatigue. This is a phenomenon where survey respondents can become bored or tired while completing survey instruments, consequently causing them to perform at a sub optimal level and to deliberately withhold information or provide erroneous data as a result (Porter, Whitcomb, & Weitzer, 2004).

In addition to causing survey fatigue, the requirement to complete the survey instruments and writing task could also have cannibalised the time available to complete the lessons, particularly with Lesson 1. This may have been the reason for some participants expressing that they felt that they were rushing through the lessons. The fact that these participants were from motivational and emotional support groups upholds the argument that this problem is likely to have been more acutely experienced by the participants within both support conditions especially since they entailed extra lesson time for participants to interact with the emotional and motivational messages throughout these lessons. Thus, in both these support conditions, the possible interference of time constraints cannot be ruled out.

Compounding this problem is the seductive details effect, which as discussed in Section 2.9.2, has been identified in experimental conditions where time limits are imposed on study participants (Rey, 2012). This phenomenon may have manifested particularly in some study participants within the motivational and emotional support conditions who may have considered the additional support messages as unnecessary,

thus rendering them seductive details. It is possible that these seductive details, when combined with the imposition of time constraints could have caused some degradation to learning transfer in the motivational and emotional support groups.

The next major limitation of the study was the potential for "contamination or treatment spillage" (Rhoads, 2011, p. 102). Given that a randomised block design was used where participants were randomly assigned to treatments within clusters, the potential for contamination was present given that the intervention was conducted in the same physical location. In order to control for contamination, participants were provided with headphones, informed that this was an experimental design and that they should therefore not discuss their experience of the lesson with each other as their experiences would not be identical. Nevertheless, observant and determined participants could have discerned differences between the lessons as they were often seated in close proximity to each other in the small computer laboratories. Also, they could have communicated amongst themselves after the first lesson, thereby potentially contaminating the results. This is problematic because contamination has the potential to make study results of various experimental groups more homogenous than what they really are (Rhoads, 2011).

The final limitation was the possible influence of the Hawthorne Effect, namely the phenomenon that people being observed will behave differently to the way they normally do due to being singled out for observation, thereby confounding the results of the experiment (Cook, 1962). This effect is named after a series of influential illumination experiments conducted at the Hawthorne plant of the Western Electric Company in 1924 by Massachusetts Institute of Technology researchers (Cook, 1962).

Despite subsequent research raising some questions on the validity of the initial findings (Levitt & List, 2011), it would be remiss to ignore the possibility of the potential influence of the Hawthorne Effect in this study due to the highly obtrusive measures used in data collection as opposed to the participants being observed in their more naturalistic settings. Additionally, as Shaughnessy, Zechmeister, and Zechmeister (2000) caution, survey data is particularly susceptible to this effect because participants may provide survey responses that they feel the researcher expects or do so to present themselves in a favourable light.

In order to counter the high participant attrition rates between lessons, future research of this nature will need to include retention tactics to establish participant contact and scheduling as recommended by a systematic review on strategies for retaining study participants (Robinson, Dennison, Wayman, Pronovost, & Needham, 2007). This may include sending out lesson reminders 24 hours beforehand, and scheduling lessons to accommodate participants' needs rather than subjecting them to the constraints of venue availabilities, for example by using the participant's own mobile devices to access the study environment.

The time pressures to complete the lessons could easily be eliminated by requiring participants to complete the survey bundles just before attending the lessons using online surveying tools such as Qualtrics.

The ever-present issue of treatment spillage which has the potential to make experimental groups more homogenous could be overcome by requiring participants to sign a confidentiality agreement. This level of formality is anticipated to

communicate the importance of preserving confidentiality, which will in turn increase the study's rigour.

Finally, the problem of the Hawthorne Effect may be overcome with a research design that is contextualised in a more naturalistic setting, for example, by including the lessons as part of regular coursework participation.

8.4 Study Delimitations and Their Implications

This study was delimited by a number of parameters within the researcher's control, which had a number of implications.

The decision to restrict the target population from cohorts of pre-university or new to university students from colleges and universities around Perth, Western Australia who were hoping to improve their writing skills constrained the number of eligible and willing participants for the study. As such, the recruitment of a sufficient number of participants for the study was an obstacle to attaining sufficient statistical power for the quantitative aspect of the study.

Providing only two exposures to the experimental condition instead of more was made due to the concern that high participant attrition rates with each consecutive exposure would compromise the validity of study results. As such, a trade-off had to be made between having a higher number of lessons in the series, and the loss of participants through attrition with each subsequent lesson. Ultimately, the need to retain study participants was deemed more important than requiring them to return to the lesson more than twice, although it was not optimal for educational interventions that require multiple exposures in order to facilitate the consolidation of writing transfer

(Adler-Kassner et al., 2017). Consequently, more longitudinal lesson exposures would have increased the likelihood of registering discernible intra-group changes to the dependent variables.

With respect to writing competence, the decision to restrict the lesson content to mainly structural and referencing elements of English for Generic Academic Purposes, thereby deliberately excluding the more microscopic features of writing was deemed appropriate for this study. Empirical support for this decision was twofold. First, studies surveying university instructors about their students' communication skills have ranked their students' shortcomings in organising writing to express key and supporting ideas when addressing writing tasks as paramount for development (L.-S. Huang, 2010; Lockwood, 2013). Second, evidence of improvements to writing skills such as structural adequacy and the reductions of informal expressions, can be discerned even in relatively short experimental interventions (Felix & Lawson, 1994; Knoch et al., 2014; Shaw & Liu, 1998; Storch, 2009).

The final study delimitation, the decision to subject the participants to highly contrived experimental conditions, while not ideal, was necessary in order to facilitate participant access to the lessons given the research study time and scope constraints.

8.5 Implications for Practice

The findings of this study suggest applicable and rewarding possibilities for learning support that APAs can provide as institutions continue to grapple with issues of student under preparedness for academic study, of which academic writing is an important element. Given the lack of distinction between APA conditions in improving

writing competence and self-efficacy and reducing writing anxiety, it may not be necessary to go to extreme lengths in customising APAs to produce positive learning gains.

As Briguglio and Watson (2014) argue, the provision of academic support should be a key component of contemporary tertiary institutions and must be accessible to students in a myriad of ways. These authors argue for a multi-pronged approach that includes the provision of self-access materials, generic workshops, discipline specific material and academic skills development offerings that are fully integrated into subject content. Indeed, each of these levels of support can be imbued with persona effect affordances offered by APAs as an antidote for the anti-affordances of the largely text-based medium that is still the mainstay of contemporary online education. As a result, APAs will have an increasingly important role to play in humanising the learning environment given the widely acknowledged limitations of computer mediated communication being a "lean medium" where the transmission of information that establishes and maintains group dynamics is compromised by the absence of face to face contact (Garrison, Anderson, & Archer, 1999, p. 90).

Considering the benefits of their application, APAs should be a welcome ally for student learning and support at this critical period in history where acts of God such as global pandemics can, at a moment's notice, obstruct the provision of learning and writing support offered by educational institutions. It is therefore recommended that to realise the potential benefits, tertiary educators developing multimedia resources deploying APAs should be provided with opportunities and resources to do so. For example, by acquiring APA software and platforms, allowing time for staff to create

such reusable resources and to facilitate the adaptation of such resources for multiple uses. This systemic approach recognises the longitudinal patterns of learning characterised by the process of writing transfer as espoused by Moore (2017).

8.6 Implications for Future Research

This research extends the knowledge of the use of APAs in writing for higher education and makes several valid and noteworthy contributions to the field of academic language and learning.

Given the APAs in the present study were not equipped with the technological sophistication to be responsive to the users' affective and motivational states, future research is required to further develop models that integrate physiological sensors that imply affective and motivational states, for example heart rate monitors and skin conductance with artificial intelligence (Thompson & McGill, 2015; Thompson & McGill, 2012, 2017). Such physiological signs would be monitored and the most suitable APA(s) deployed when required, which would provide a crucial level of authenticity to the APA.

APPENDICES

Appendix A: The FEASP Approach

	Emotional strategies
Fear reduction	F1 Ensure success in learning
	F2 Accept mistakes as opportunities for learning
	F3 Create a relaxed situation
	F4 Be critical, but sustain a positive perspective
Envy reduction	E1 Encourage comparisons with autobiographical and criterion referenced standards instead of social standards
	E2 Use consistent and transparent methods of evaluating and grading
	E3 Inspire a sense of authenticity and openness
	E4 Avoid unequal distribution of privileges among students
Anger reduction	A1 Stimulate the control of anger
	A2 Show flexible view of things
	A3 Let anger be expressed constructively
	A4 Do not show or accept any form of violence
Sympathy increase	S1 Intensify relationships
	S2 Install sensitive interactions
	S3 Establish cooperative learning structures
	S4 Implement peer helping programs
Pleasure increase	P1 Enhance well being
	P2 Establish open learning opportunities
	P3 Use humour
	P4 Install play like activities

(Astleitner & Leutner, 2000)

Appendix B: Structure of the Learning Materials

Lesson 1

Conditions	1 QA (Emo)	2 QA (Mot)	3 QA	4 Did (Emo)	5 Did (Mot)	6 Did
Lesson Intro and learning outcomes	Lesson Intro 	Lesson Intro 	Lesson Intro 	Lesson Intro 	Lesson Intro 	Lesson Intro 
Academic style Lesson						
Quiz 1	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 2	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Intro Lesson						
Quiz 3	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 4	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 5	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 6	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Introduction Summary	Summary	Summary	Summary	Summary	Summary	Summary
Paragraphing sub-lesson 1						
Quiz 7	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Paragraphing sub-Lesson 2						
Quiz 8	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Paragraphing sub-lesson 3						
Paragraphing Summary	Summary	Summary	Summary	Summary	Summary	Summary
Linking ideas Sub-Lesson 1 2						
Quiz 9	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 10	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Linking idea Summary	Summary	Summary	Summary	Summary	Summary	Summary
Conclusion Sub-lesson						
Quiz 11	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 12	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Conclusion Summary	Summary	Summary	Summary	Summary	Summary	Summary

Legend:
Accompanied by emotional support messages
Accompanied by motivational support messages.

 Scaffolded questioning delivery

 Didactic delivery

Lesson 2

Conditions	1 QA (Emo)	2 QA (Mot)	3 QA	4 Did (Emo)	5 Did (Mot)	6 Did
Lesson Intro and learning outcomes	Lesson Intro	Lesson Intro	Lesson Intro	Lesson Intro	Lesson Intro	Lesson Intro
Citing sub-Lesson 1,2						
Quoting sub-Lesson 1						
Quiz 13	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 14	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 15	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quoting Sub-Lesson 2						
Quiz 16	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quoting Sub-lesson 3						
Quiz 17	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quoting Summary	Summary	Summary	Summary	Summary	Summary	Summary
Paraphrasing Sub Lesson 1,2,3,4						
Quiz 18	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 19	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 20	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Quiz 21	Feedback	Feedback	Feedback	Feedback	Feedback	Feedback
Paraphrasing Summary	Summary	Summary	Summary	Summary	Summary	Summary
Conventions Sub-lesson and summary						
Totals	29  14	29  14	29  14	29  14	29  14	29  14

Legend:
Accompanied by emotional support messages
Accompanied by motivational support messages.

 Scaffolded questioning delivery

 Didactic delivery

Appendix C: Activities and Time Taken for Lesson Creation

Task	Time weeks	
Project setup	4	Investigating various options to host the lessons. Correspondence with, and ultimate selection of the Blackboard CourseSites LMS to host the lessons.
Lesson Storyboarding	15	Formulating lesson narrations and APA dialogues to operationalise the independent variables in the six conditions incorporating Delivery (Scaffolded questioning vs Didactic) and Support (Emotional, Motivational, No support), Creation of in-lesson quiz questions and feedback
Creation of Articulate Storyline lessons using Flash animation	14	Creating the lesson platform for delivery including lesson interactivities using course authoring software—Articulate Storyline (2014), and its six different instantiations.
APA design	20	Using Character Builder (2014) APA design software to perform the following: Designing the APAs (selecting images and modifying them to suit their roles), posing and animating their gestures and facial expressions, recording their voices (from three separate voice actors), editing this audio, and embedding these APAs into the Articulate Storyline environment.
Integrating the six files into the LMS environment,	6	Converting the six Articulate files with the APAs embedded within into Sharable Content Object Reference Models (SCORM) format–a set of technical standards for eLearning software products. These SCORM files were uploaded to the Blackboard CourseSites LMS.
Testing and debugging	3	Setting up several dummy student accounts to test and debug the finished product before commencing the study.
Total	62	

Appendix D: Embedded Emotional Messages in Quiz Feedback (Conditions 1 and 4)

Note the FEASP strategies numbered below are explained in Appendix A

Quiz	Correct response	FEASP/ COPE	Incorrect response	FEASP/ COPE
1	You handled this question well by not panicking and staying relaxed. If you keep working on these activities to improve your writing, imagine how pleased you will be when you are able to impress your teachers with your writing ability.	F3 P1	Don't be too concerned though, as recognising good academic writing takes time and practice. I want you to know that this exercise will help you to recognise good academic writing even if you haven't got it right the first time. So keep on trying.	F1 F2 Positive reinterpretation and Growth, COPE
2	You did well in this question by being calm and focussed. Keep up the good work and you will do really well at uni.	F3 P1	Even though you didn't get this right, remember that this is just the beginning of the Lesson. Don't be worried because by the end of the Lesson, you will be much better at recognising good academic writing. Be thankful for this opportunity to learn from your mistake, as it's easy to get something right without knowing the reasons for getting it right.	F1 F2 Positive reinterpretation and Growth, COPE
3	See how keeping relaxed has helped you to work through this challenging problem.	F3	Don't be stressed though, as working through a few more activities will easily help you identify how a good introduction is structured. Keep on trying!	F1 Positive reinterpretation and growth, COPE
4	Keep up the good work with introductions, to impress your teachers. Imagine how thrilled you would feel when you achieve well in your writing.	P1	You are probably annoyed at getting this wrong, but don't give up. You can use this feeling to try figuring out where you went wrong so you don't repeat this mistake.	A3 Positive reinterpretation and growth, COPE
5	If you keep perfecting your introductions, your teachers will love reading your work, and imagine how happy you will be when you get a good mark for your writing.	P1	Mistakes are opportunities to improve. So learn from them and remember what not to do next time!	A3 Positive reinterpretation and growth, COPE
6	You should feel more confident with this achievement as you had 5 sentences to sort instead of 3. You should now know much more about writing introductions than before you started this lesson.	E1	Don't panic about not getting this right, as this quiz had 5 sentences to sort instead of three. Use the feedback to figure out how the paragraphs were sorted.	F2

7	This was not an easy task, so you should feel proud for managing to do it.	E1	This task was not easy, so don't be discouraged at this point about not getting this right. You will see that once you have mastered it, you will feel so proud of yourself.	F2 Positive reinterpretation and growth, COPE
8	Read the answer carefully in case you guessed the right answer before. If you master the skill of writing good body paragraphs, you will be considered a writing superstar, and everybody want your autograph. Well, not really but it sounds good anyway!	P3	If you want to become a writing superstar, you should work on mastering this skill. Imagine everybody falling at your feet and worshiping the ground you walk on just because you can write good body paragraphs! You can do it!	P3
9	You should feel empowered to use these words to connect ideas in your writing.	P1	Don't be concerned about not getting this right. You should be appreciative of the list of words you can use to link your writing	F1 F2
10	You should be pleased that you can see how connectors are used in writing. If you write using these connectors, your writing will be much easier to read, which will help you do well at school and uni	P1	Don't be concerned about not getting this right. You should feel proud at working through so many questions, and that you are now so much more aware of connectors even though you probably used them in your writing before.	F1 E1
11	You should be open to structuring your conclusions, now that you got this right! I can visualise you impressing your teachers and uni lecturers when you write your great conclusions	P1	Don't be worried that you got this wrong. Instead, be happy that you can now see how to break down a conclusion, a skill that you can use when you do your own writing.	P1
12	You should feel proud that you got this right. Compared with when you first started this Lesson, you have a better understanding of how to write a conclusion	E1	It doesn't matter that you got this wrong. Compared with when you first started this Lesson, you now have a better understanding of how to write a conclusion.	E1
13	You handled this question well by not panicking and staying relaxed. If you keep working on these activities to recognise how quotations are used in academic writing, imagine how pleased you will be when you are able to use them correctly in your own writing.(P1, FEASP)	F3 P1	Don't be too concerned though, as recognising how to use quotes takes time and practice. I want you to know that this exercise will help you to recognise how quotations are used in academic writing even if you haven't got it right the first time. So keep on trying.	F1 F2 Positive reinterpretation and Growth, COPE
14	You handled this question well by being calm and focussed. Keep up the good work and you will do really well when quoting in your own work.	F3 P1	Even though you didn't get this right, remember that you have just learnt about quoting. Don't be worried because by the end of the Lesson, you will be much better at recognising how quotes are used in academic writing.	F1 F2 Positive reinterpretation and Growth, COPE

			Be thankful for this opportunity to learn from your mistake, as it's easy to get something right without knowing the reasons for getting it right.	
15	You should be pleased that you can see how quotes are used to in essays.	P1	Don't be concerned about not getting this right. You should feel proud at working through so many questions, and that you are now so much more aware of how quotes are used in essays.	F1 E1
16	This was not an easy task, so you should feel proud for managing to do it. Recognising when and why quotes are used in academic writing will help you to use quotations wisely in your own writing.	E1	This task was not easy, so don't be discouraged at this point about not getting this right. You will see that once you have mastered how to use quotations in your own writing, you will feel so proud of yourself.	F2 Positive reinterpretation and growth, COPE
17	You should feel empowered to know how to format your quotes!	P1	Don't be bothered about not getting this right. You should be appreciative that you now know what to look for when formatting quotes.	F1 F2
18	Read the answer carefully as there was a 50% chance of getting this right just by guessing. If you just guessed the right answer, how about expending some brain power to figure out how this paraphrase was used to support the main idea of this passage of text!	P3	Even though there was a 50% chance of guessing the right answer, your luck ran out. Why not expend some brain power to figure out how this paraphrase was used to support the main idea of this passage of text?	P3
19	You did well in this question by being calm and focussed. Invest the time in figuring this out now, so that you can use paraphrases appropriately when you are at university.	F3 P1	Even though you didn't get this right, remember that this is just the beginning of the paraphrasing Lesson. Don't be worried because by the end of the Lesson, you will be much better at knowing how paraphrases are used in academic writing. Be thankful for this opportunity to learn from your mistake, as it's easy to get something right without knowing the reasons for getting it right.	F1 F2 Positive reinterpretation and Growth, COPE
20	You should feel proud that you got this right. Compared with when you first started learning how to paraphrase, you now have a better understanding of how to paraphrase.	E1	It doesn't matter that you got this wrong. Compared with when you first started this lesson, you now have a better understanding of how to paraphrase.	E1
21	If you keep working on your paraphrasing, your writing will be much more academic, and imagine how happy you will be when you start doing well in your assignments.	P1	Mistakes are opportunities to improve. So read the commentary on the answers so you understand WHY you got this wrong and remember what not to do the next time!	A3 Positive reinterpretation and growth, COPE

Appendix E: Inventory of Feelings

Feelings when your needs are satisfied	Feelings when your needs are not satisfied
Affectionate compassionate friendly loving open hearted sympathetic tender warm	**Afraid** apprehensive dread foreboding frightened mistrustful panicked petrified scared suspicious terrified wary worried
Confident empowered open proud safe secure	**Annoyed** aggravated dismayed disgruntled displeased exasperated frustrated impatient irritated irked
Engaged absorbed alert curious engrossed enchanted entranced fascinated interested intrigued involved spellbound stimulated	**Angry** enraged furious incensed indignant irate livid outraged resentful
Excited amazed animated ardent aroused astonished dazzled eager energetic enthusiastic giddy invigorated lively passionate surprised vibrant	**Aversion** animosity appalled contempt disgusted dislike hate horrified hostile repulsed
Exhilarated blissful ecstatic elated enthralled exuberant radiant rapturous thrilled	**Confused** ambivalent baffled bewildered dazed hesitant lost mystified perplexed puzzled torn
Grateful appreciative moved thankful touched	**Disconnected** alienated aloof apathetic bored cold detached distant distracted indifferent numb removed uninterested withdrawn
Hopeful expectant encouraged optimistic	**Disquiet** agitated alarmed discombobulated disconcerted disturbed perturbed rattled restless shocked startled surprised troubled turbulent turmoil uncomfortable uneasy unnerved unsettled upset
Inspired amazed awed wonder	**Embarrassed** ashamed chagrined flustered guilty mortified self-conscious
Joyful amused delighted glad happy jubilant pleased tickled	**Fatigue** beat burnt out depleted exhausted lethargic listless sleepy tired weary worn out
Peaceful calm clear headed comfortable centred content equanimous fulfilled mellow quiet relaxed relieved satisfied serene still tranquil trusting	**Pain** agony anguished bereaved devastated grief heartbroken hurt lonely miserable regretful remorseful
Refreshed enlivened rejuvenated renewed rested restored revived	**Sad** depressed dejected despair despondent disappointed discouraged disheartened forlorn gloomy heavy hearted hopeless melancholy unhappy wretched
	Tense anxious cranky distressed distraught edgy fidgety frazzled irritable jittery nervous overwhelmed restless stressed out
	Vulnerable fragile guarded helpless insecure leery reserved sensitive shaky
	Yearning envious jealous longing nostalgic pining wistful

(The Centre for Nonviolent Communication, n.d.)

Appendix F: Examples of Growth Mindset Messages Used in This Study (Adapted from Brainology)

Screen capture	APA	Example of APA script
	Inexperienced Student:	I am not sure that I will be able to do all of these even if I try to learn it.
	Educational psychologist:	Why do you think so?
	Inexperienced Student:	Well, I wasn't born with the gift of writing like some people are. I am just a bad writer.
	Educational psychologist:	I disagree! With practice, everybody can learn to be a better writer. The human brain is a learning organ and adapts to the environment. Newborns' brains are made up of many individual cells called neurons. At 1 month old, the neurons have started to form connections as a result of learning. Here is the brain of a 9-month-old, 2-year-old and an adult—there are many more connections. These changes show that the human brain is plastic, it changes in response to learning.
	Inexperienced Student:	Do you have other proof that learning helps to change my brain?
	Educational psychologist:	Yes, there is a famous study of London taxi drivers. In order to qualify as a London taxi driver, drivers have to memorise all the street names in London, and be asked to take somebody from point A to B just using their memory. The part of the brain related to storing memories (the hippocampus) was bigger in London taxi drivers than in other people. In fact, the longer they drove their taxis, the larger their hippocampus.
	Inexperienced Student:	So what does this mean for me learning to write?
	Educational psychologist:	This shows that learning and practicing something helps grow the part of the brain that is used, and the longer that part of the brain is used, the more connections are formed and the more it is strengthened. This makes you smarter!!!

Appendix G: Embedded Motivational Messages in Quiz Feedback (Conditions 2 and 5)

Goal focus (GF)—goals with the aim of increasing as opposed to documenting ability
Effort orientation (EO)—utility as opposed to futility of effort in the face of challenges
Failure attributions (FA)—attributions to failure are towards low effort as opposed to low ability
Strategies displayed (SD)—strategies that demonstrate adaptability as opposed to helplessness

Quiz	Correct response	Incorrect response
1	Even though you got this right, still read the feedback. This will help to further improve your writing ability (GF)	Thinking carefully about this feedback will transform your brain structures. In fact, the more you engage with this material, the stronger your learning will be, so you are actually getting smarter even with each mistake you make (GF)
2	Read and think carefully about this feedback as it will make you a better writer (GF)	Think carefully about this feedback, and just keep trying. In fact, the more you engage with this material, the more you are learning. You are becoming a smarter writer by learning from your mistakes (GF)
3	Very good. It looks like you are highly motivated to achieve your goal of improving your academic writing ability (GF)	You will gradually achieve your goal of becoming a good writer, so just stay motivated and keep trying (GF)
4	Getting the right answer is good, but since the goal of these activities is to give you a chance to learn as much as possible, the feedback may be very helpful (GF)	Remember, what is most important is to achieve your goal of improving your writing skills, so just keep trying (GF)
5	Great you got the right answer, but continue trying to improve your skills further. Learning from the feedback is very important (GF)	You didn't get this right, but just keep in mind that improving your writing skills is the goal, so just keep learning (EO)
6	This quiz was more challenging than the rest as there were five sentences to sort instead of three. Your persistence in working through these problems means that you are able to work through more complex problems (SD)	This quiz was more challenging than the rest as there were five sentences to sort instead of three. The more challenging questions will help you further improve your skill, so just try to understand the feedback. You can learn this (EO)
7	It will be useful to read the feedback carefully, so that you can learn even more (GF)	This was a challenging question, so learn from the feedback. This will show you how to break down a paragraph into meaningful sections in your own writing (EO)
8	Each time you try to learn how to do something new, it will expand your capacity for further learning, for example making your own paragraphs (GF)	This was a tough question, but the tougher questions give you the chance to try and understand the feedback which will help you to further improve this skill. You can learn paragraph construction. (EO)
9	Getting the right answer is good, but since the goal of these activities is to give you a chance to learn as much as possible, the feedback may be very helpful (GF)	Although you didn't categorise them correctly, what is more important is using these connectors in your own writing which will strengthen it (EO)
10	You are getting more skilled at identifying linking words, and will continue to improve your writing skills the more you use them in your own writing (GF)	Even though you weren't able to identify all the linking words, don't give up. You are now aware of how they are used in writing, so you will become a better writer by thinking about and using these linking words in your own writing (EO)

11	Reading the feedback carefully and thinking about it, will make you a better writer if you practise it in your own writing (SD)	Often getting a question wrong gives you the chance to really think deeply about it, and that helps you learn something in a deeper way (SD)
12	Was this question too easy for you? Don't waste this learning opportunity. Study the feedback carefully so that you can really understand how conclusions are written (SD)	Was this question too difficult for you? Don't waste this learning opportunity. Study the feedback carefully so that you can really understand how conclusions are written. (SD)
13	This will help you to understand how to use quotations in your writing (GF)	Thinking carefully about this feedback will help you to recognise how to use quotations in your own writing. In fact, the more you engage with this material, the better your learning will be, so you are actually getting smarter and smarter (GF)
14	Read and think carefully about this feedback as it will reinforce what you are learning about how to quote (GF)	Think carefully about this feedback, and just keep trying. In fact, the more you engage with this material, the more you are learning. You will then be a step closer to using quotes wisely (GF)
15	Reading the feedback carefully and thinking about it, will make you a better at using quotes properly in academic writing (SD)	Often getting a question wrong gives you the chance to really think deeply about the subject. Doing so will help you to learn how quotes are used in academic writing in a deeper way (SD)
16	You are getting more skilled at recognising how quotations are used in academic writing, and this should translate into you using quotations correctly in your own writing as you practise quoting some more (GF)	Even though you weren't able to work out whether all the quotations were used appropriately here, you are now much more aware of how they are used, so you will become better at using quotations in your own writing (EO)
17	Great you got the right answer, but continue trying to improve your referencing skills further. Learning from the feedback is very important. (GF)	You didn't get this right, but just keep in mind that improving your referencing skills is the goal, so just keep working at it. (GF)
18	Even though you got this right, still read the feedback. This will help you to see how the paraphrase supports the main idea of the essay which will strengthen your ability to use paraphrases appropriately in future. (GF)	Thinking carefully about this feedback will transform your brain structures. In fact, the more you engage with how paraphrases are used in writing, the stronger your learning will be, so you are actually getting smarter even with each mistake you make (GF)
19	Reading the feedback carefully and thinking about it, will make you better at pinpointing how to use paraphrases to support your own argument (SD)	Often getting a question wrong gives you the chance to really think deeply about it, and this will help you to get better at pinpointing exactly how to use paraphrases to support your own argument (SD)
20	This quiz was more challenging than the rest because you really had to focus on how the paraphrase was worded AND formatted. Your persistence in working through this problem will help you become better at understanding how to paraphrase (GF)	This quiz was more challenging than the rest because you really had to focus on how the paraphrase was worded AND formatted. Your persistence in engaging with the feedback even though you got this wrong will help you to further improve your skill. You can learn this (EO)
21	Was this question too easy for you? Don't waste this learning opportunity—study the feedback carefully so that you can really recognise how to paraphrase so you are not just changing a few words (GF)	Was this question too challenging for you? Don't waste this learning opportunity—study the feedback carefully so that you can really understand how to format and construct paraphrases (SD)

Appendix H: Lesson Learning Outcomes

Lesson 1 Learning outcomes	Lesson 2 Learning outcomes
1. Apply some techniques for writing in an academic style: • using formal words • using full words instead of contractions • not writing in the first person • not using slang • being specific. 2. Write a well-organised introduction: • identifying the three moves in an introduction • identifying the most appropriate introduction for a question • organising text in an introduction so that it reflects the three moves. 3. Construct effective body paragraphs: • defining a paragraph • understanding the need for writing in paragraphs • ascertaining the appropriate length of a paragraph • structuring a paragraph • breaking down a larger body of text into smaller paragraphs • identifying the elements of a paragraph • sorting sentences in a paragraph logically • recognising five different paragraph types. 4. Use techniques to link ideas cohesively within a text: • contrasting the differences between cohesion and coherence • improving cohesion by using connectors, pronouns consistently, and repeating key nouns • using the most appropriate connectors to make a piece of text more cohesive. 5. write a well-organized conclusion: • identifying the three moves in a conclusion • organising text in a conclusion so that it reflects the three moves.	1. Cite other peoples' ideas in your own writing, and why you need to do it. 2. Quote other authors' ideas: • knowing when to use a quotation • knowing how to format a quotation. 3. Paraphrase other authors' ideas: • knowing when to use a paraphrase • knowing how to paraphrase. 4. Use referencing conventions: • using author prominent or idea prominent in text citations appropriately • formatting a journal article entry using the APA referencing style.

Appendix I: Initial Essay Writing Task

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Now, a final small writing exercise

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Writing exercise 1

1. Read the following essay question carefully,
2. Write a short essay with an introduction, body and conclusion to address this question.
3. Please include some ideas from the two articles provided on the last page of this answer booklet and ensure that you reference them.

Describe and discuss the advantages and disadvantages of studying at university with students from a wide range of cultural backgrounds.

Use some ideas from each of the following articles in support of your essay. Ensure that you reference them **in the body** of your essay. They is no need to provide a reference list.

Article name: Drawing with Difference: Challenges faced by international students in an undergraduate business degree
Author: Marianne Grey
Year of publication: 2002
Journal: Teaching in Higher Education
Volume: 7, Issue 2
Pages: 153-166

Abstract:
The impact of the internationalization of Australian Higher education is being experienced at all levels. Administrators and academic staff are attempting to develop policy and design, and implement 'internationalized' curricula. However, there is a lack of awareness and engagement with cultural diversity and the politics of difference when considering the skills and literacies needed by students in a changing world. Often, international students are overlooked and not given a chance for their voices to be heard. This paper presents a case study of three international students' social, cultural and study experiences in a Business Communication class in their undergraduate degree, and some questions and concerns they raised in this context. The study showed that the students not only have a pragmatic view of their education, but also have specific expectations and goals which in many cases are not being met. In a pedagogical process where the students are actively involved in a struggle for meaning this provides a space where their voices can be heard. To accomplish this we as educators need to think about different ways of planning and teaching programmes in Higher Education.

Article name: Effects of Cultural Diversity on In-Class Communication and Student Project Team Dynamics: Creating Synergy in the Diverse Classroom
Authors: Vasyl Taras and Julie Rowney
Year of publication: 2007
Journal: International Studies in Educational Administration
Volume: 35, Issue 2
Pages: 66-81

Abstract:
Most colleges and universities around the world have experienced an increasing cultural diversification of their student body. Foreign student enrolment has been especially high in North American, West European and Australian institutions of higher education where in some classes the number of international students sometimes surpasses the number of locals. The benefits of diversity for international groups are great and undisputable, but if not managed properly cultural differences can have adverse effects on in-class discussions and student project team dynamics. This paper discusses the challenges that international student groups may experience, with the focus on the issues related to communication across cultures. The article offers guidelines for educators for creating synergy in the diverse classroom and in student project teams, and provides an important context for those managing internationalisation of universities at all levels from the classroom to the whole institution.

Appendix J: Final Essay Writing Task

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Now, a final small writing exercise

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Writing exercise 2

1. Read the following essay question carefully,
2. Write a short essay with an introduction, body and conclusion to address this question.
3. Please include some ideas from the two articles provided on the last page of this answer booklet and ensure that you reference them.

'English is the international language of business and everyone should learn how to speak it'. Discuss how much you agree or disagree with this statement, giving reasons for your opinion.

Use some ideas from each of the following articles in support of your essay. Ensure that you reference them **in the body** of your essay. There is no need to provide a reference list.

Article name: World Englishes in 2000 and beyond
Author: Yasukata Yano
Year of publication: 2001
Journal: World Englishes
Volume: 20, Issue: 2
Pages: 119-131

Paragraph extract (taken from pg. 120):

When we rethink what it is to learn English as a second or foreign language, we first need to think of the unique situation the English language has come to occupy as the result of its unparalleled spread over the world, especially to non-Western societies. The important features of English are what may be called hybridity and permeability, which helped it to expand quickly as a world language. English has changed substantially in its 1,500 years of history, reflecting contact with other languages and freely borrowing from them - in its early days, from indigenous Celtic and Latin, later from Scandinavian Norse and Norman French, and more recently from languages spoken in the British colonies. Today English has spread globally among second-language users and those who use it as a foreign language.

Article name: Global English: gift or curse?
Author: Ross Smith
Year of publication: 2005
Journal: English Today
Volume: 21, Issue 2
Pages: 56-62

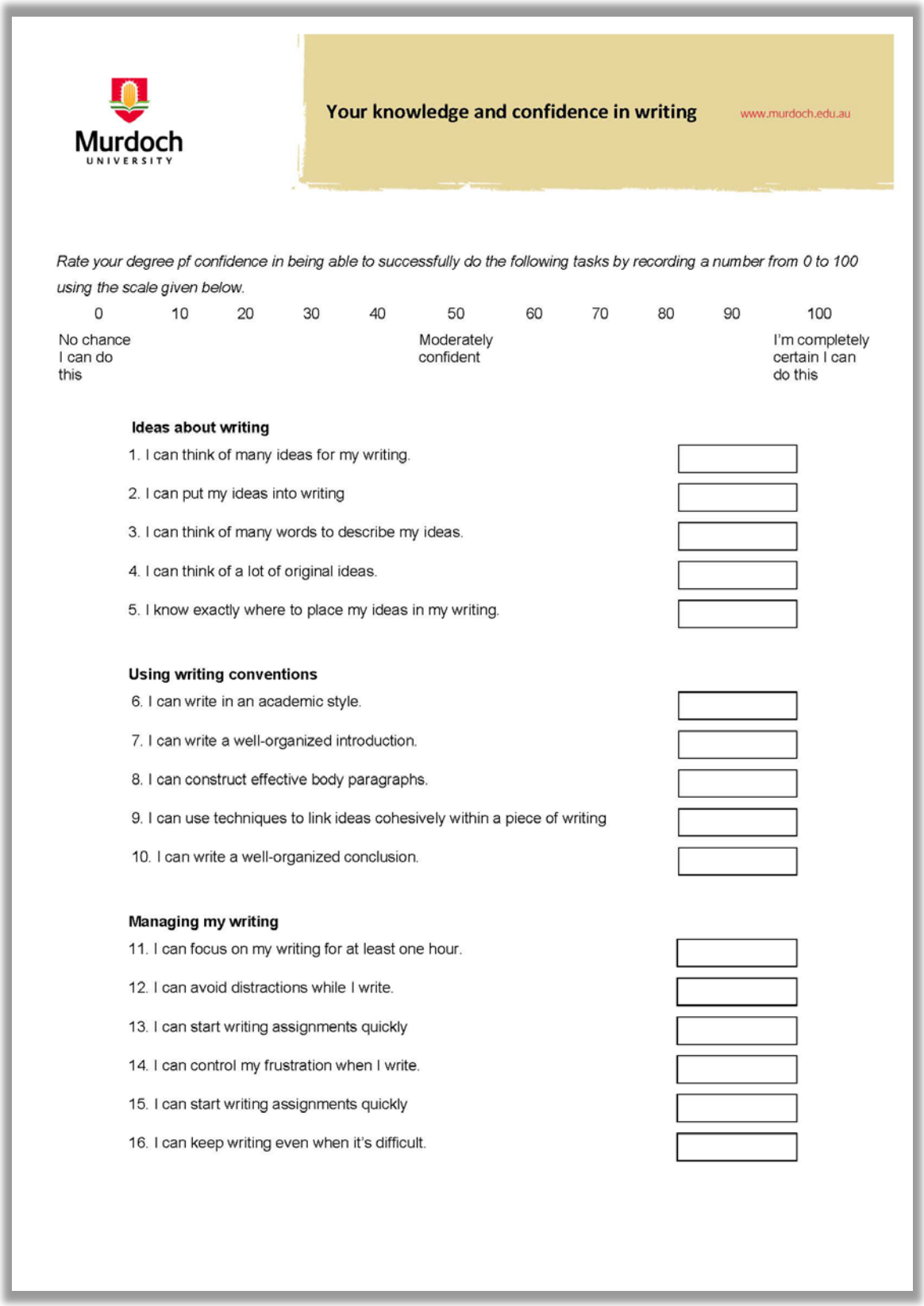
Paragraph extract (taken from pg.61):

There is no doubt that English is a wonderful language for its own native speakers or those who have made the effort to achieve proficiency in it. Its broad range of phonemes, enormous lexicon, inherent onomatopoeia and morphological laxness offer a tremendous variety of creative possibilities. However, some of these strengths become weaknesses when considering English as an international auxiliary language. As we have seen, the English language is hard to pronounce, irregular, and over-complex, making it difficult to learn; and it is ambiguous, making it difficult to understand. In addition, it resembles no other language closely enough for there to be a group of 'natural learners' among other language speakers, as occurs, for instance, among Romance or Nordic languages.

Appendix K: Interrater Scoring Information

		Res	M1	M2	M3	Res	M1	M2	M3	Res	M1	M2	M3	M2	M1	M3	Action taken
writing criterion	Label	Record 6	Record 6	Record 6	Record 6	Record 32	Record 32	Record 32	Record 32	Record 39	Record 39	Record 39	Record 39				
Pretest 1	Academic style	2	4	2	3	5	3	2	3	5	3	4	4	Difficult to quantify. Qualitative descriptors would be better	Worked well	n/a	Made this into a more qualitative scale. Removed the percentages which were not helpful.
Pretest 2	Introductions	2	2	1	2	2	2	2	3	5	5	4	2	Well articulated	Worked well	n/a	Gave an example of where the two latter moves are amalgamated
Pretest 3	Effective paragraphs	2	3	2	2	3	2	1	3	5	3	4	4	Well articulated	Somewhat difficult - It wasn't that the percentage of the paragraphs were effective, but that most paras weren't complete. The only option looked like 0 and yet students had attempted some of the elements		Made this into a more qualitative scale. Removed the percentages which were not helpful. Included a statement saying that bulleted point 3 need not be counted if the evidence sentence does not support the main idea in the paragraph. This will help add consistency across markers.
Pretest 4	Coherence cohesion	2	3	2	2	3	2	3	3	4	4	4	3	Well articulated	Worked well		Seems to work well
Pretest 5	Conclusions	1	1	1	1	1	1	1	1	3	3	3	3	Well articulated	Worked well		Seems to work well
	Writing subtotal pre	**9**	**13**	**8**	**10**	**14**	**10**	**9**	**13**	**22**	**18**	**19**	**16**				
Pretest 6	Integrating ideas effectively	2	3	2	2	3	3	2	3	4	4	4	3	clear	Changed 'integrating ideas effectievely' into 'effective use of sources'	Should be called 'effective use	Changed 'integrating ideas effefctively' into effective use of sources
Pretest 7	Quoting paraphrasing	2	3	2	2	3	3	2	3	4	4	4	3	Desc of quoting and paraphrasing too restricting because it focussed on format rather than the ability to parahrase appoprpriately or the decision when to use a quote or paraphrase. Some students had plagiarised and there was no way to indicate this	Similar to 8 and had trouble distinguising between the two		Added clarification in the top three bands about what constitutes a sound paraphrase, and what a poor one looks like.
Pretest 8	Effective use of sources	2	3	2	2	3	2	3	3	5	3	4	4		Similar to 7, and had trouble distinguising between the two. Iw asnt sure if 8 was about author's voice in which case 9 is also an issue	Should be called integrating ideas effectively	Changed criterion name to integrating ideas effevtively
Pretest 9	Reporting verbs	1	1	1	1	1	1	3	2	4	4	3	4	clear	Not sure about author's voice		Added clarification about what a reporting verb is not to reduce the possiblity of false positives.
Pretest 10	Reference list	1	1	1	1	1	1	1	1	1	1	1	1	clear			
	Referencing subtotal pre	**8**	**11**	**8**	**8**	**11**	**10**	**11**	**12**	**18**	**16**	**16**	**15**				
Posttest 1	Academic style	4	4	2	3	4	4	3	4	4	4	3	4				
Posttest 2	Introductions	2	2	2	4	4	4	4	4	5	5	3	4				
Posttest 3	Effective paragraphs	2	2	2	4	3	3	2	3	4	3	3	3				
Posttest 4	Coherence cohesion	4	4	3	4	4	2	3	3	4	4	3	4				
Posttest 5	Conclusions	3	3	3	4	2	2	1	2	2	2	1	2				
	Writing subtotal post	**15**	**15**	**12**	**19**	**17**	**15**	**13**	**16**	**19**	**18**	**13**	**17**				
Posttest 6	Integrating ideas effectively	3	4	4	4	3	4	3	4	4	3	4	3				
Posttest 7	Quoting	3	4	4	5	5	5	3	5	3	3	4	3				
Posttest 8	Effective use of sources	5	4	4	4	5	3	3	4	5	5	4	3				
Posttest 9	Reporting verbs	1	1	1	1	1	1	1	1	2	2	1	2				
Posttest 10	Reference list	1	1	1	1	1	1	1	1	1	1	1	1				
	Referencing subtotal post	**13**	**14**	**14**	**15**	**15**	**14**	**11**	**15**	**15**	**14**	**14**	**12**				
	Total pre	**17**	**24**	**16**	**18**	**25**	**20**	**20**	**25**	**40**	**34**	**35**	**31**				
	Total post	**28**	**29**	**26**	**34**	**32**	**29**	**24**	**31**	**34**	**32**	**27**	**29**				
	Difference	11	5	10	16	7	9	4	6	-6	-2	-8	-2				

Appendix L: Self Efficacy for Writing Scale (SEWS)



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Your knowledge and confidence in writing www.murdoch.edu.au

Rate your degree pf confidence in being able to successfully do the following tasks by recording a number from 0 to 100 using the scale given below.

0	10	20	30	40	50	60	70	80	90	100
No chance I can do this					Moderately confident					I'm completely certain I can do this

Ideas about writing

1. I can think of many ideas for my writing.
2. I can put my ideas into writing
3. I can think of many words to describe my ideas.
4. I can think of a lot of original ideas.
5. I know exactly where to place my ideas in my writing.

Using writing conventions

6. I can write in an academic style.
7. I can write a well-organized introduction.
8. I can construct effective body paragraphs.
9. I can use techniques to link ideas cohesively within a piece of writing
10. I can write a well-organized conclusion.

Managing my writing

11. I can focus on my writing for at least one hour.
12. I can avoid distractions while I write.
13. I can start writing assignments quickly
14. I can control my frustration when I write.
15. I can start writing assignments quickly
16. I can keep writing even when it's difficult.

Appendix M: Skill Specific Self-efficacy Scale Lesson 1 (SSSES1)

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Finally, please rate your confidence in being able to do the following when writing.

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Rate your degree pf confidence in being able to successfully do the following tasks by recording a number from 0 to 100 using the scale given below.

0	10	20	30	40	50	60	70	80	90	100
No chance I can do this					Moderately confident					I'm completely certain I can do this

Writing in an academic style:

1. I can write in a way that avoids using contractions (shortened form of words) ☐
2. I can write using third person language ☐
3. I can write using formal language ☐
4. I can write in a concise way (without rambling) ☐

Writing introductions:

5. I can identify the attributes of a good introduction ☐
6. I can identify the three moves of an effective introduction ☐
7. I can organize sentences in an introduction so it follows the three moves ☐
8. I can construct an effective introduction ☐

Writing body paragraphs

9. I can construct a paragraph that develops only one idea ☐
10. I can structure a basic paragraph ☐
11. I can organize sentences in a paragraph so that it is logical ☐
12. I can construct different types of paragraphs according to what is needed in an essay question ☐

Linking ideas

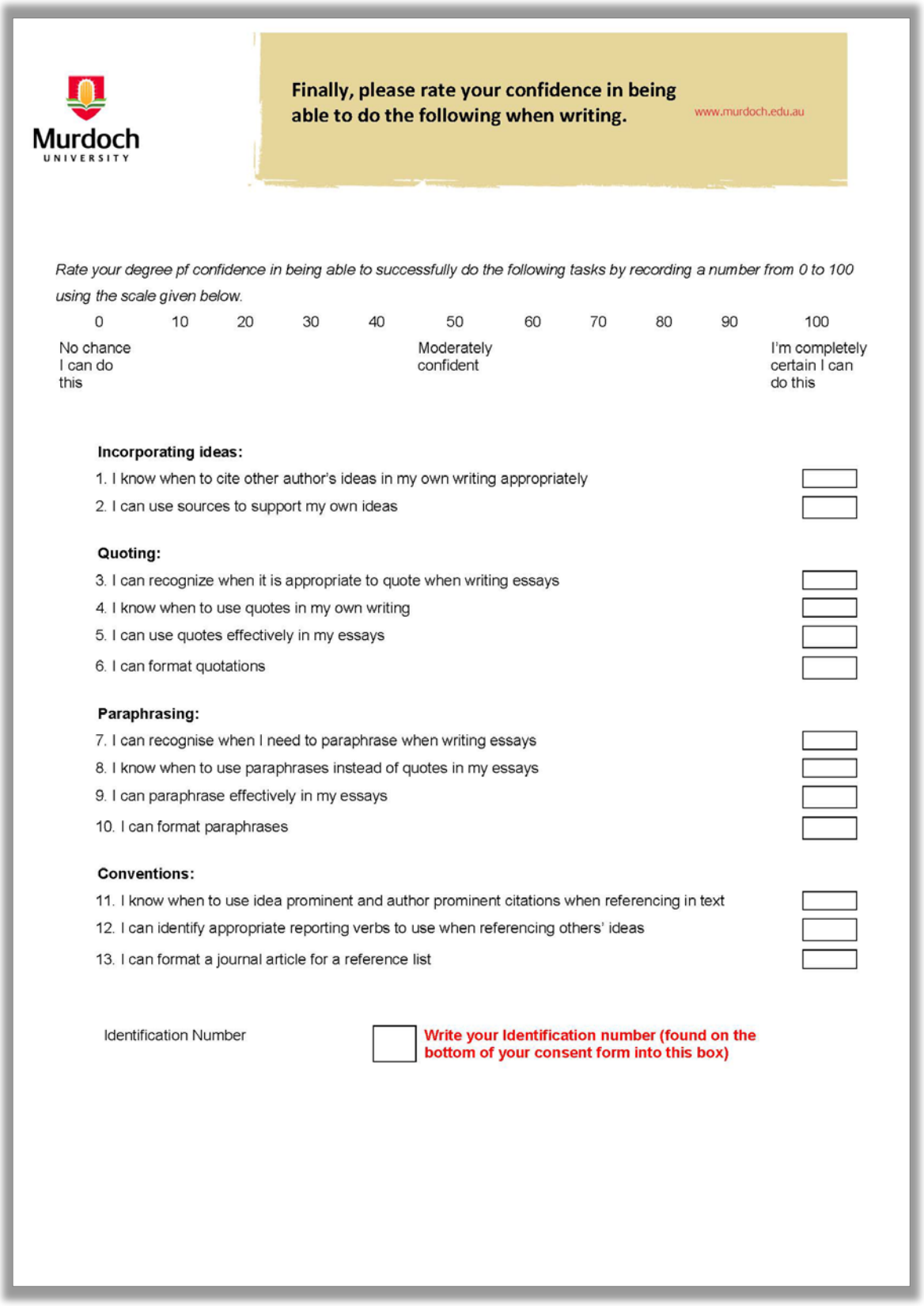
13. I can identify connectors (linking words) in a piece of writing ☐
14. I can use connectors (linking words) in my writing to make it flow more logically ☐
15. I can use repetition of key nouns in my writing so that the ideas flow more clearly ☐
16. I can use pronouns consistently in my writing ☐

Writing conclusions

17. I can identify the attributes of a good conclusion ☐
18. I can identify the three moves of an effective conclusion ☐
19. I can organize sentences in a conclusion so it follows the three moves ☐
20. I can construct an effective conclusion ☐

Thank You

Appendix N: Skill Specific Self-efficacy Scale Lesson 2 (SSSES2)



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Finally, please rate your confidence in being able to do the following when writing.

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Rate your degree pf confidence in being able to successfully do the following tasks by recording a number from 0 to 100 using the scale given below.

0	10	20	30	40	50	60	70	80	90	100
No chance I can do this					Moderately confident					I'm completely certain I can do this

Incorporating ideas:

1. I know when to cite other author's ideas in my own writing appropriately ☐
2. I can use sources to support my own ideas ☐

Quoting:

3. I can recognize when it is appropriate to quote when writing essays ☐
4. I know when to use quotes in my own writing ☐
5. I can use quotes effectively in my essays ☐
6. I can format quotations ☐

Paraphrasing:

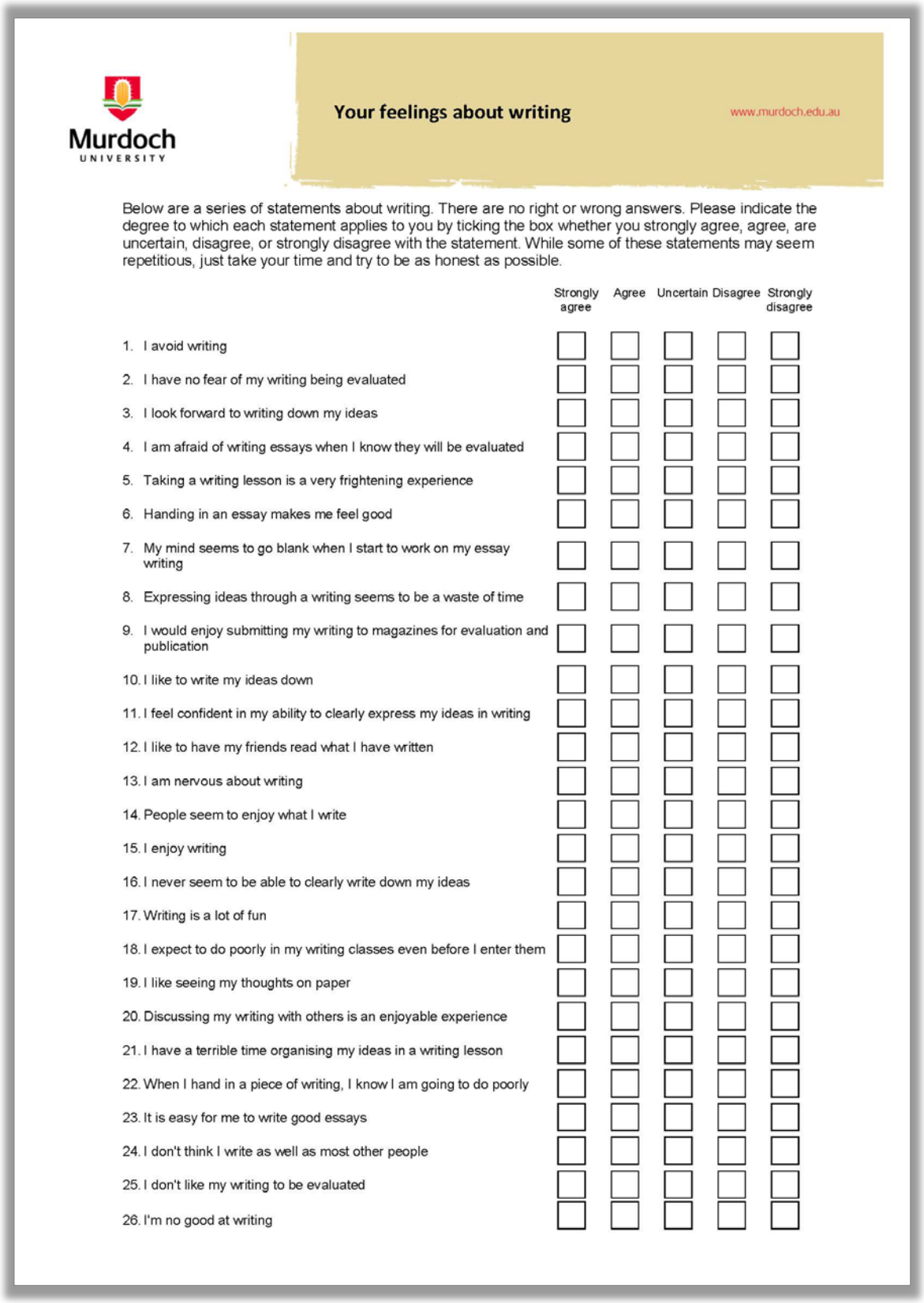
7. I can recognise when I need to paraphrase when writing essays ☐
8. I know when to use paraphrases instead of quotes in my essays ☐
9. I can paraphrase effectively in my essays ☐
10. I can format paraphrases ☐

Conventions:

11. I know when to use idea prominent and author prominent citations when referencing in text ☐
12. I can identify appropriate reporting verbs to use when referencing others' ideas ☐
13. I can format a journal article for a reference list ☐

Identification Number ☐ **Write your Identification number (found on the bottom of your consent form into this box)**

Appendix O: Writing Apprehension Test



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Your feelings about writing

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Below are a series of statements about writing. There are no right or wrong answers. Please indicate the degree to which each statement applies to you by ticking the box whether you strongly agree, agree, are uncertain, disagree, or strongly disagree with the statement. While some of these statements may seem repetitious, just take your time and try to be as honest as possible.

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1. I avoid writing	☐	☐	☐	☐	☐
2. I have no fear of my writing being evaluated	☐	☐	☐	☐	☐
3. I look forward to writing down my ideas	☐	☐	☐	☐	☐
4. I am afraid of writing essays when I know they will be evaluated	☐	☐	☐	☐	☐
5. Taking a writing lesson is a very frightening experience	☐	☐	☐	☐	☐
6. Handing in an essay makes me feel good	☐	☐	☐	☐	☐
7. My mind seems to go blank when I start to work on my essay writing	☐	☐	☐	☐	☐
8. Expressing ideas through a writing seems to be a waste of time	☐	☐	☐	☐	☐
9. I would enjoy submitting my writing to magazines for evaluation and publication	☐	☐	☐	☐	☐
10. I like to write my ideas down	☐	☐	☐	☐	☐
11. I feel confident in my ability to clearly express my ideas in writing	☐	☐	☐	☐	☐
12. I like to have my friends read what I have written	☐	☐	☐	☐	☐
13. I am nervous about writing	☐	☐	☐	☐	☐
14. People seem to enjoy what I write	☐	☐	☐	☐	☐
15. I enjoy writing	☐	☐	☐	☐	☐
16. I never seem to be able to clearly write down my ideas	☐	☐	☐	☐	☐
17. Writing is a lot of fun	☐	☐	☐	☐	☐
18. I expect to do poorly in my writing classes even before I enter them	☐	☐	☐	☐	☐
19. I like seeing my thoughts on paper	☐	☐	☐	☐	☐
20. Discussing my writing with others is an enjoyable experience	☐	☐	☐	☐	☐
21. I have a terrible time organising my ideas in a writing lesson	☐	☐	☐	☐	☐
22. When I hand in a piece of writing, I know I am going to do poorly	☐	☐	☐	☐	☐
23. It is easy for me to write good essays	☐	☐	☐	☐	☐
24. I don't think I write as well as most other people	☐	☐	☐	☐	☐
25. I don't like my writing to be evaluated	☐	☐	☐	☐	☐
26. I'm no good at writing	☐	☐	☐	☐	☐

Appendix P: Letter to the Institutional Leadership

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Dear Sue,

Project title: Learning designs incorporating animated pedagogical agents (APAs)

Further to my brief discussion with you, I am writing to formalise my request for your assistance with approaching your students to be involved in a research project under the direction of Associate Professor Tanya McGill and Professor Simone Volet at Murdoch University.

The focus of the research is on students' development of academic writing skills for university study. Specifically, the project examines the value of online instruction and the use of animated pedagogic agents (APAs), namely computerised personas that guide the learner through multimedia learning environments by focusing attention and providing instructions, to improve students' academic writing.

We anticipate that your students will benefit from their involvement in the study in one or more of the following ways: increased writing competence, improved writing self-efficacy, and reduced writing anxiety. It is likely that any benefits gained in these areas will be transferable to other writing contexts, in particular, further studies at university.

This study will entail each student attending two successive writing sessions covering different aspects of academic writing over a period of approximately two weeks. Two separate sessions were chosen instead of one because writing is a complex and multi-faceted skill, and one-off interventions are typically insufficient to produce noticeable learning outcomes.

The following is a proposed plan on how the study could be implemented. Of course, this plan can be adapted to accommodate local circumstances, and I am happy to discuss the details with you. The participants will require the use of a networked laboratory at your premises to enable access to the learning environment.

Session	Purpose of the session	How this can help your students	Time
Session 1: Academic writing Lesson			
Pre-test measures: Gauging Students' unique profile at pre-test	To gather data about the students': • level of anxiety about completing writing tasks, • confidence in performing some general writing tasks • proficiency in writing	Once the study concludes, students will be made aware of any changes to their writing anxiety, confidence and proficiency profiles compared to pre-test levels.	60 min
Lesson content	Academic style Introductions Paragraphing Cohesion and coherence Conclusions	This session should give students the confidence and skills to structure their writing so that it is logical and easy to follow. We will cover topics on writing in an academic style, writing introductions, conclusions and paragraphs, and using cohesive devices.	60 min
Session 2: Referencing			
Lesson content	Citing ideas Quoting Paraphrasing	This session should equip students with the skills that many first year university students struggle with, such as citing in text, quoting, summarizing and paraphrasing.	45 min
Post-test measures: Measuring students' profile at post-test	To find out if students': • level of writing anxiety, • confidence in performing some general writing tasks, • writing proficiency have changed over the two sessions.	Now that they have finished this program, they can find out if there are any changes to their writing anxiety and confidence as well as writing proficiency	45 min

Page 1 of 2

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I would also like to have a short 15 minute interview with a few of your students for Phase 2 of the study. A convenient time and place will be negotiated with individual students at the end of the second session. These interviews will be audio-recorded with students' consent.

Confidentiality
The following measures will be taken to safeguard participants' confidentiality:

- Survey data will be through the use of an assigned ID number recorded on the demographic sheet, which means that the data will be de-identified at the point of capture (Feedback to participants will be facilitated through the matching of each participant's unique ID number recorded in the demographic sheet, which is linked to the consent form with the participant's name)
- The data will be initially stored on a learning management system, and later transferred to a non-networked personal computer for data analysis.
- All data will be kept from school staff.

Benefits
Participants will obtain a number of benefits from being a part of this study. They will:

- participate in an innovative program to develop their academic writing skills;
- receive feedback on their level of writing anxiety and self-efficacy after completion of the lessons;
- receive feedback on their writing a few months after the conclusion of both sessions;
- have the opportunity to win an IPad mini; and
- receive a $20 textbook voucher or incentive of equal value and a certificate of completion if they participate in both sessions.

The outcomes of this project will inform the field of online academic writing pedagogy by providing much needed information on the development of academic writing competence and confidence, and how to reduce anxiety in online learning contexts. The results of this project will also highlight the potential of carefully designed online instruction to improve academic writing skills.

At this stage, I welcome any suggestions on how your students may be contacted. Some colleges have offered to contact the students and organise the venues on my behalf which would be highly desirable. However, if this is not possible, I would be happy to contact them myself. I also attach for your information an information letter for prospective participants for your information.

If you have any questions about this project please feel free to contact Shalini Watson (Shaliniwtsn@gmail.com; 93105563) or my main supervisor Tanya McGill (T.Mcgill@murdoch.edu.au; 9360 2798). We are happy to discuss with you any concerns you may have on how this study would be conducted.

Yours sincerely

Shalini Watson

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval 2014/068) subject to my gaining a working with children's check. If you have any reservations or complaints about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office by telephone on 08 9360 6677 (local callers), or +61 8 9360 6677 (overseas callers) or e-mail ethics@murdoch.edu.au). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

CRICOS Provider Code: 00125J
ABN 61 616 369 313

Appendix Q: Participant Information Email

Murdoch UNIVERSITY

www.murdoch.edu.au

Dear student,

Project title: Learning designs incorporating animated pedagogical agents (APAs)

When writing your assignments do you:

- find it challenging, or feel that you could do much better?
- feel very stressed or worried about the process of writing them?
- wish you had more confidence to write?

If you have answered 'yes' to **any** of the questions above, I may be able to help you. My name is Shalini Watson, and I am a PhD student at Murdoch University. Working under the supervision of Associate Professor Tanya McGill and Professor Simone Volet, I am conducting a study to explore the potential for animated pedagogic agents (APAs) (computerized persona that guide the learner through multimedia learning environments by focusing attention and providing instructions) in improving learning outcomes for online academic writing instruction. The outcomes of this project will inform the design of learning environments using APAs to improve learning outcomes for student writing in general, and more specifically students interacting with online academic writing environments.

THE STUDY

Phase 1: You can be involved in this study by participating in a series of two sessions designed to help you to develop your academic writing skills. Each session will help you to develop different but complementary aspects of writing as can be seen below:

Session	Your session details, purpose, content	What you will get out of it	Time
Session 1: Academic writing	**Saturday** 12 March 2016 12.30-2.30 Building 13 Lab 223		
Questions	For us to get information about your: • feelings about completing writing tasks, • confidence in performing some writing tasks • writing proficiency	Once the study concludes, you will be made aware of any changes to your feelings about writing, confidence and proficiency.	60 minutes
Lesson content	Academic style, Introductions, Paragraphing, Cohesion and coherence, Conclusions	This session aims to give you the confidence and skills to structure your writing so that it is logical and easy to follow. This can only improve marks! It should also help you to identify what writing at uni looks like and how to structure it.	60 minutes
Session 2: Referencing	**Saturday 19** March 2016 12.30-2.30 Building 13 Lab 223		
Lesson content	Citing ideas, Quoting, Paraphrasing	This session aims to equip you with the skills that many first year university students struggle with, such as citing in text, quoting, and paraphrasing.	60 minutes
Questions	To get information about whether your: • feelings about writing tasks, • confidence in performing writing tasks, and/or • writing proficiency • have changed over the two sessions.	Now that you have finished this program, you can find out if there are any changes to your feelings about writing and confidence as well as writing proficiency	60 minutes

Murdoch UNIVERSITY

www.murdoch.edu.au

Phase 2: If you agree to it, I would also like to have a short 15 minute interview with you after you have attended both sessions.

BENEFITS TO YOU

Aside from getting free writing instruction and feedback about your writing there are a number of other benefits you will receive for your involvement in this study, namely:

- for each session attended, you will be given a token which will go into a draw for you to win an IPad mini, and
- if you attend both sessions, you will receive a bookshop voucher or textbook AND a certificate of completion from Murdoch University at the final session.

The outcomes of this project will help with the future of academic writing, by providing much needed information on the development of academic writing competence, confidence and anxiety in online learning contexts. We will make the results of this study available to you on a password protected website into which you will be invited.

Your participation is entirely voluntary and you can decide not to participate at any time. All data collected is confidential and no names or other information that might identify you will be used in any publication arising from the research.

If you are willing to participate in this study, could you please attend the session (details shown on the first page of this letter) and you will be provided with the relevant forms to complete. If you have any questions about this project please feel free to contact me (Shaliniwtsn@gmail.com; 0421011585) or my main supervisor Tanya McGill (T.Mcgill@murdoch.edu.au; 9360 2798). We are happy to discuss with you any concerns you may have on how this study has been conducted.

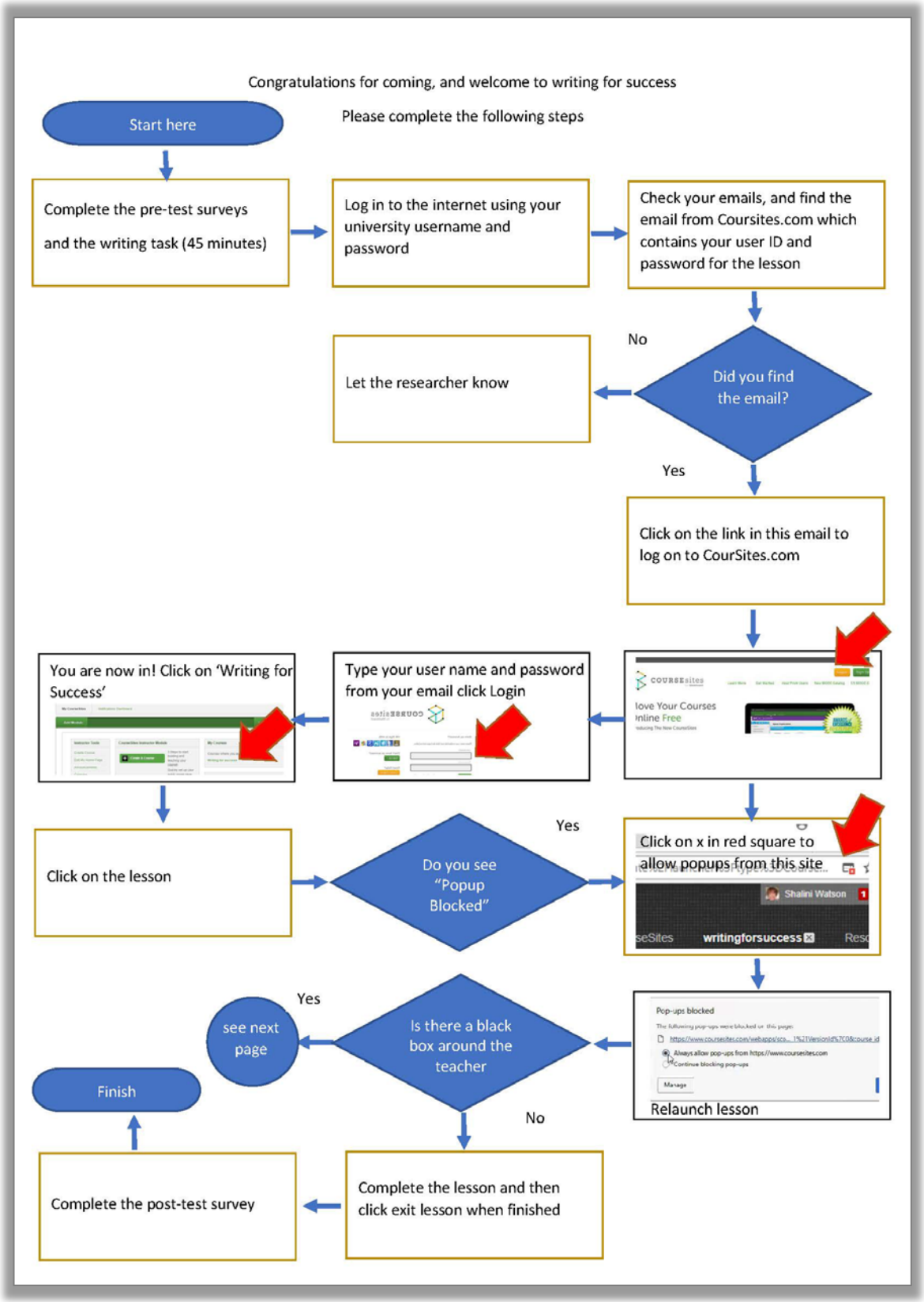
Thank you

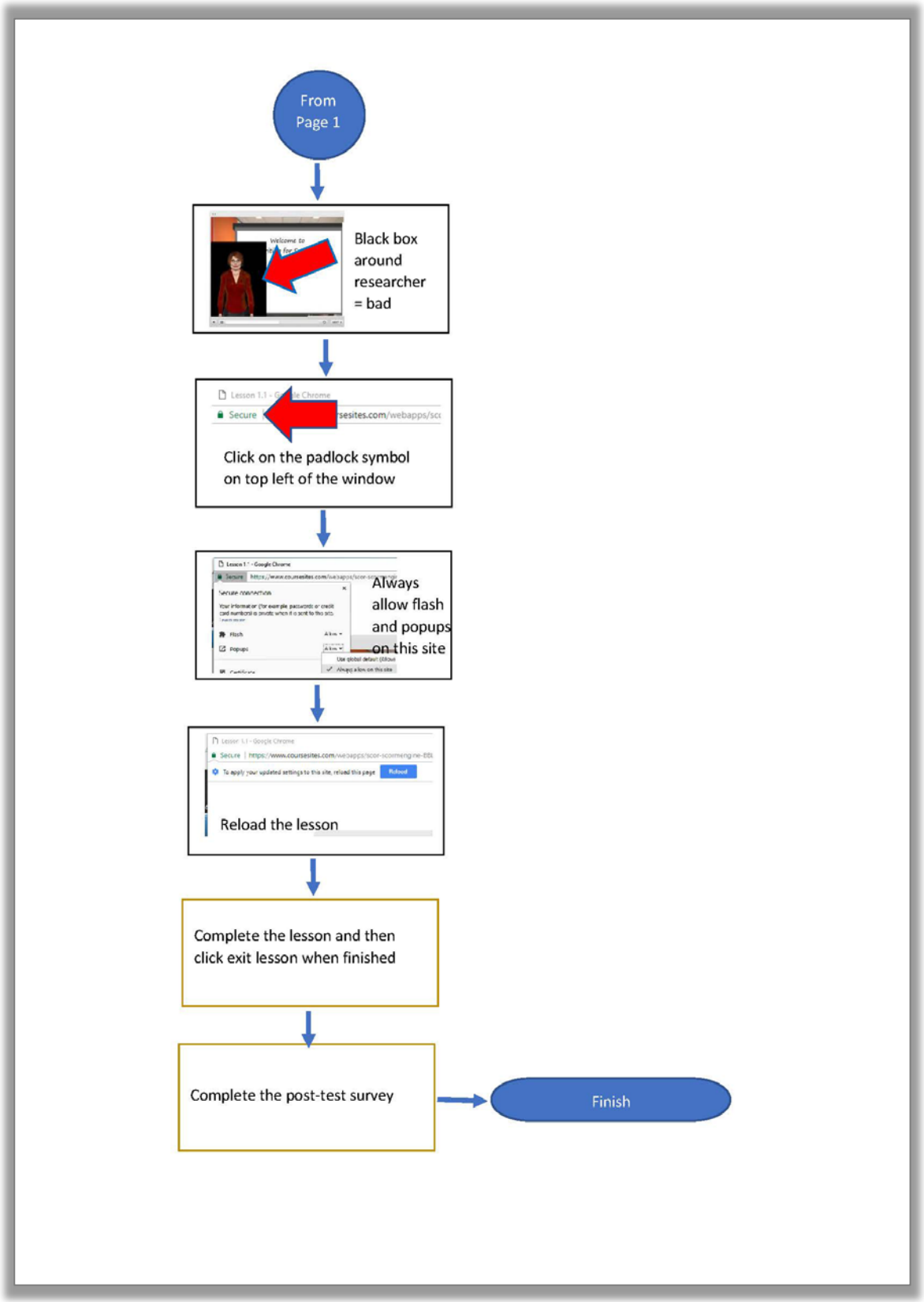
Shalini Watson

Please note that your ID number for this entire study is «ID»

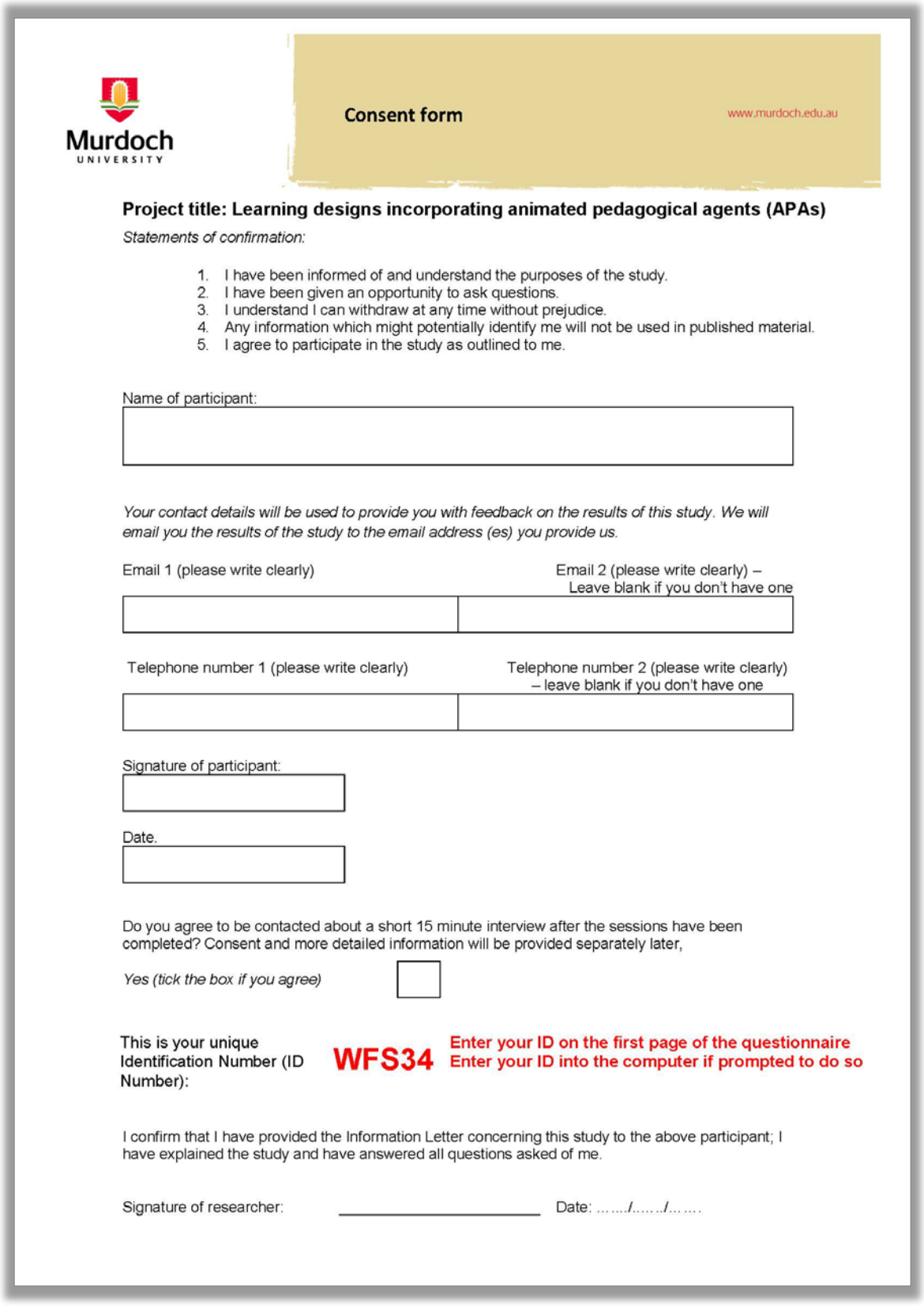
This study has been approved by the Murdoch University Human Research Ethics Committee (Approval 2014/068). If you have any reservations or complaints about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office by telephone on 08 9360 6677 (local callers), or +61 8 9360 6677 (overseas callers) or e-mail ethics@murdoch.edu.au). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix R: Lesson Procedures




From Page 1
Black box around researcher = bad
Click on the padlock symbol on top left of the window
Always allow flash and popups on this site
Reload the lesson
Complete the lesson and then click exit lesson when finished
Complete the post-test survey
Finish

Appendix S: Consent Form (Phase 1)



Murdoch UNIVERSITY

Consent form

www.murdoch.edu.au

Project title: Learning designs incorporating animated pedagogical agents (APAs)

Statements of confirmation:

1. I have been informed of and understand the purposes of the study.
2. I have been given an opportunity to ask questions.
3. I understand I can withdraw at any time without prejudice.
4. Any information which might potentially identify me will not be used in published material.
5. I agree to participate in the study as outlined to me.

Name of participant:

Your contact details will be used to provide you with feedback on the results of this study. We will email you the results of the study to the email address (es) you provide us.

Email 1 (please write clearly)

Email 2 (please write clearly) – Leave blank if you don't have one

Telephone number 1 (please write clearly)

Telephone number 2 (please write clearly) – leave blank if you don't have one

Signature of participant:

Date.

Do you agree to be contacted about a short 15 minute interview after the sessions have been completed? Consent and more detailed information will be provided separately later,

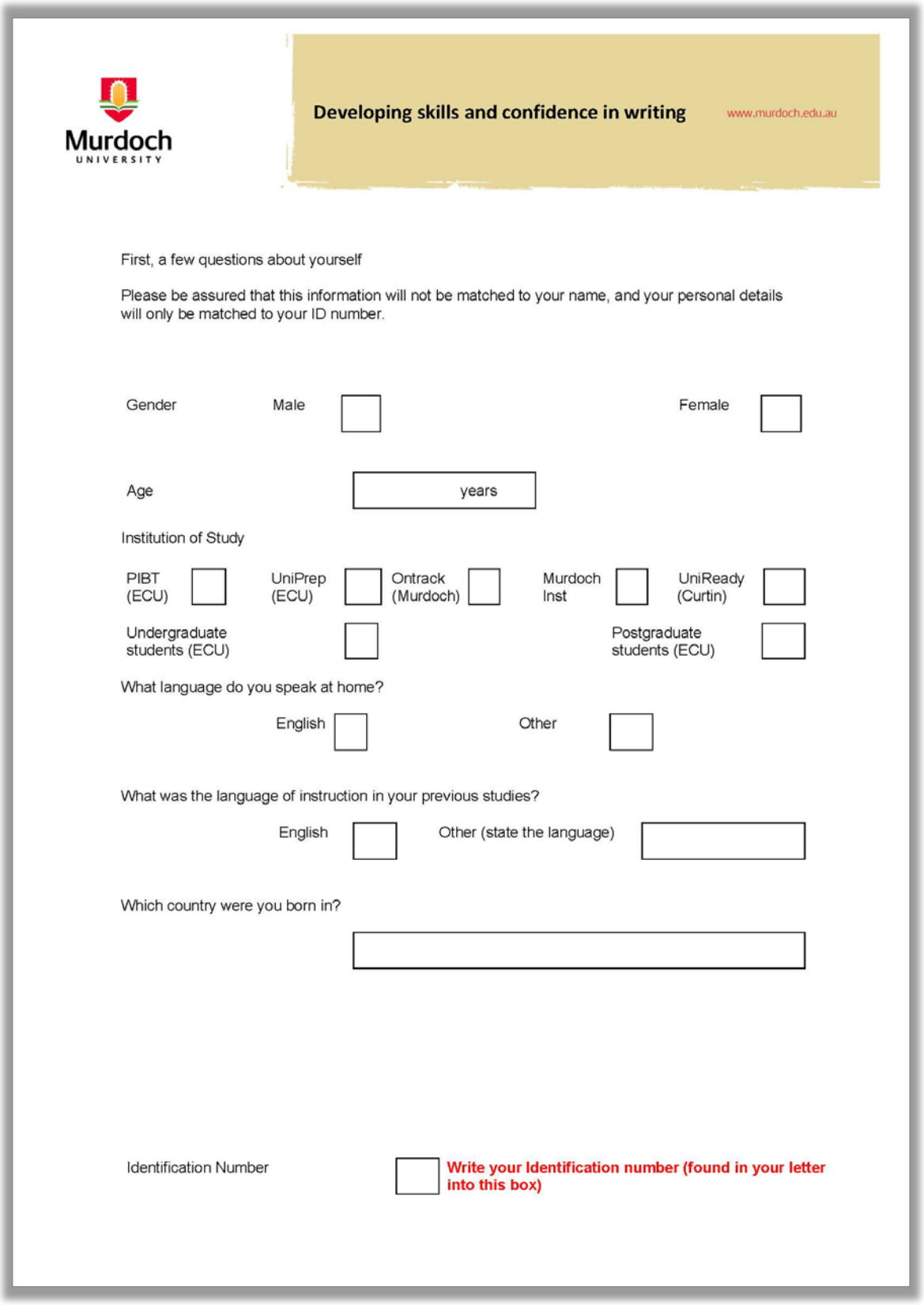
Yes (tick the box if you agree)

This is your unique Identification Number (ID Number): **WFS34** Enter your ID on the first page of the questionnaire Enter your ID into the computer if prompted to do so

I confirm that I have provided the Information Letter concerning this study to the above participant; I have explained the study and have answered all questions asked of me.

Signature of researcher: _____ Date: ...../...../.....

Appendix T: Demographic Sheet



Murdoch UNIVERSITY

Developing skills and confidence in writing www.murdoch.edu.au

First, a few questions about yourself

Please be assured that this information will not be matched to your name, and your personal details will only be matched to your ID number.

Gender Male ☐ Female ☐

Age ☐ years

Institution of Study

PIBT (ECU) ☐ UniPrep (ECU) ☐ Ontrack (Murdoch) ☐ Murdoch Inst ☐ UniReady (Curtin) ☐

Undergraduate students (ECU) ☐ Postgraduate students (ECU) ☐

What language do you speak at home?

English ☐ Other ☐

What was the language of instruction in your previous studies?

English ☐ Other (state the language) ☐

Which country were you born in?

☐

Identification Number ☐ **Write your Identification number (found in your letter into this box)**

Appendix U: Sample Questions, 15 Minute Interviews (Phase 2)

To what extent has the learning environment helped you to improve your academic writing competence? Please explain how it helped or why you think it didn't help.

What about improving your confidence in academic writing? Did the learning environment have any impact? Please explain how it helped to improve your confidence or why you think it didn't help.

And what about negative feelings towards academic writing? Did the learning environment have any impact?

To what extent do you think the presence of the APA(s) helped you to improve your writing competence? Please explain why you think it played a role, or didn't.

Appendix V: Participant Information Letter (Phase 2)

Murdoch UNIVERSITY

Student Information Letter

www.murdoch.edu.au

Project title: Learning designs incorporating animated pedagogical agents (APAs)

Dear Student

The purpose of this interview is to find out about your experiences in interacting with the learning environment, as part of the larger project exploring the potential for animated pedagogic agents (APAs) in improving learning outcomes for online academic writing instruction.

The interview will take place on your college premises and last about 15 minutes. In it we would like to ask you a few questions about the learning environment and how it may have helped you. You can choose not to answer any of the questions.

We would like to record your responses to our questions, to help us when we need to analyse your answers. Your answers to the questions will be recorded against the ID number that was assigned to you earlier, so we do not need to store your name or otherwise identify you. The transcriptions will also be stored under your allocated number, not your name. These recordings will be deleted after we have transcribed them.

You can decide at any time to withdraw your consent to participate in this research up until the data has been analysed. If you decide to withdraw before then, any material you have given us will be destroyed.

If you have any questions about this research please feel free to contact either of us: (Shaliniwtsn@gmail.com; 0421011585) or my main supervisor Tanya McGill (T.Mcgill@murdoch.edu.au; 9360 2798).

Thank you

Shalini Watson

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval 2014/068) If you have any reservations or complaints about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office by telephone on 08 9360 6677 (local callers), or +61 8 9360 6677 (overseas callers) or e-mail ethics@murdoch.edu.au). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix W: Consent Form (Phase 2)

Murdoch UNIVERSITY

Consent form

www.murdoch.edu.au

Project title: Learning designs incorporating animated pedagogical agents (APAs)

This phase of the study will involve your participation in a short 15 minute telephone or face to face interview where you will be asked a few general questions about your experience in using the APA learning environment.

Statements of confirmation:

- I have attended both sessions of the above study.
- I have been fully informed about the study.
- I have been given an opportunity to ask questions.
- I agree to be interviewed for this phase of the study.
- I understand that I can choose not to answer any particular question.
- I understand I can withdraw at any time without prejudice.
- I understand that my interview will be recorded
- I understand that my interview will be transcribed and stored electronically.
- I understand that my words may be used in academic publications.
- I understand that any information which might potentially identify me will not be used in published material.

Name of participant:

Signature of participant:

Date.

I confirm that I have provided the Information Letter concerning this study to the above participant; I have explained the study and have answered all questions asked of me.

Signature of researcher: ..... Date: ..../...../....

Appendix X: Ethics Approval

Murdoch
UNIVERSITY

Division of Research & Development
Research Ethics and Integrity Office

Chancellery Building
South Street
MURDOCH WA 6150
Telephone: (08) 9360 6677
Facsimile: (08) 9360 6686
human.ethics@murdoch.edu.au

www.murdoch.edu.au

Thursday, 03 July 2014

A/Prof Tanya McGill
School of Engineering and Information Technology
Murdoch University

Dear Tanya,

Project No. 2014/068
Project Title Learning designs incorporating animated pedagogical agents (APAs): Their potential for improving academic writing competence and writing self-efficacy, and reducing writing anxiety

Thank you for addressing the conditions placed on the above application to the Murdoch University Human Research Ethics Committee. On behalf of the Committee, I am pleased to advise the application now has:

OUTRIGHT APPROVAL

Approval is granted on the understanding that research will be conducted according the standards of the ***National Statement on Ethical Conduct in Human Research*** **(2007), the *Australian Code for the Responsible Conduct of Research*** **(2007)** and **Murdoch University policies** at all times. You must also abide by the **Human Research Ethics Committee's standard conditions of approval (see attached).** All reporting forms are available on the Research Ethics and Integrity web-site.

I wish you every success for your research.

Please quote your ethics project number in all correspondence.

Kind Regards,

Dr. Erich von Dietze
Manager
Research Ethics and Integrity

cc: Prof Simone Volet and Shalini Watson

CRICOS Provider Code: 00125J
ABN 61 616 369 313

Human Research Ethics Committee: Standard Conditions of Approval

a) The project must be conducted in accordance with the approved application, including any conditions and amendments that have been approved. You must comply with all of the conditions imposed by the HREC, and any subsequent conditions that the HREC may require.

b) You must report immediately anything, which might affect ethical acceptance of your project, including:
   - *Adverse effects on participants*
   - *Significant unforeseen events*
   - *Other matters that might affect continued ethical acceptability of the project.*

c) Proposed changes or amendments to the research must be applied for, using an Amendment Application form, and approved by the HREC before these may be implemented.

d) An Annual Report for the project must be provided by the due date specified each year (usually the anniversary of approval).

e) A Closure Report must be provided at the conclusion of the project (once all contact with participants has been completed).

f) If, for any reason, the project does not proceed or is discontinued, you must advise the committee in writing, using a Closure Report form.

g) If an extension is required beyond the end date of the approved project, an Extension Application should be made allowing sufficient time for its consideration by the committee. Extensions of approval cannot be granted retrospectively.

h) You must advise the HREC immediately, in writing, if any complaint is made about the conduct of the project.

i) Other Murdoch approvals (e.g. fieldwork approval) or approval form other institutions may also be necessary before the research can commence.

j) Any equipment used must meet current safety standards. Purpose built or modified equipment must be tested and certified by independent experts for compliance with safety standards.

k) Graduate research degree candidates must normally have their Program of Study approved prior to commencing the research. Exceptions to this must be approved by the HREC.

l) You must notify Research Ethics & Integrity of any changes in contact details including address, phone number and email address.

m) Researchers should be aware that the HREC may conduct random audits and / or require additional reports concerning the research project.

Failure to comply with the *National Statement on Ethical Conduct in Human Research* (2007) and with the conditions of approval may result in the suspension or withdrawal of approval for the project.

The HREC seeks to support researchers in achieving strong results and positive outcomes.

The HREC promotes a research culture in which ethics is considered and discussed at all stages of the research.

If you have any issues you wish to raise, please contact the Research Ethics Office in the first instance.

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