GRADE 12 PEER-TUTORS' CONCEPTIONS OF THEIR ROLE AS MOTIVATORS FOR GRADES 8 AND 9 MATHEMATICS LEARNERS

by

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Dissertation

Submitted in partial fulfilment of the requirements for the degree

MAGISTER EDUCATIONIS

in the

MATHEMATICS EDUCATION

in the

FACULTY OF EDUCATION

at the

UNIVERSITY OF JOHANNESBURG

SUPERVISOR: Dr E D Spangenberg

MAY 2019

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ACKNOWLEDGEMENTS

Jesus, thank you so much for being with me through the highs and lows – this dissertation would never have happened without your strength and peace.

Words cannot do justice to the following amazing people in my life who believed in me and encouraged me every step of the way

- Dr Erica Spangenberg, my supervisor. For seeing beyond my first drafts and bringing my ability to the surface, for your patience and 1000s of comments. For being punctual and honest and not giving up on me. I could not have done this without you. I really appreciate your willingness to supervise me.
- All my participants, HOD, principle and fellow mathematics teachers at the school in which this study too place. I really appreciate you believing in me and giving me this opportunity. This journey would not have been possible without you.
- Trudi Lingens for having confidence in me.
- My family; Mom, Dad, Angus, Katy, Lize, Glenda, Kerryn, Grandma and Grandpa and all the others. You were my rock and foundation, my shoulder to cry on, my first port of call when I was overwhelmed.
- My colleagues, Mary-Louise, Roxanne and Michelle for encouraging me to persevere and giving me sound advice.
- My friends who were there in the background, who didn't complain when I brought up my studies in conversations; Liezel, Philippa, Tarryn, Simon, Niki, Lynette, Jaco, my Abs, Rebecca, Josh, Kim and Amy.
- Brydon, Kara, Candice, Trevor, Jacques, Jonique and Jamie for all your prayers and walking the last part of this journey with me.
- Grandpa, thank you for the gift that you have afforded me to study further, I know you would be proud of me.

ABSTRACT

Motivation is a complex concept that has taken many years by numerous researchers in various disciplines to define. For this study, motivation is defined as the compulsion, either intrinsic or extrinsic, that learners have to complete mathematics tasks and to achieve their individual goals.

Trends have shown that motivation is a necessary entity for performance in mathematics. In particular, peer-tutoring was found to be a useful intention strategy to motivate learners in their mathematics learning. Keller's (1987) Attention, Relevance, Confidence and Satisfaction (ARCS) model of motivation provided an effective framework with which to understand how peer-tutors' conceptions of their role as motivators were able to influence learners' mathematics motivation. Therefore, the purpose of this study was to determine how Grade 12 peer-tutors conceive their role as motivators for grades 8 and 9 mathematics learners in terms of Keller's (1987) ARCS model of motivation.

Various theories of motivation were addressed in this study, including the attribution theory, the achievement goal theory and the self-determination theory. Intrinsic and extrinsic motivation, self-regulated learning, as well as the factors of motivation in mathematics education, such as cognitive, psychological, environmental and external factors, were highlighted.

This qualitative research adopted an interpretivist paradigm and utilised a descriptive case study. The population consisted of 175 Grade 12 learners who took core mathematics as a subject. Ten of the top Grade 12 learners from this population were purposively selected to participate in the study. Data were collected through one-on-one pre- and post-interviews, observation sheets and weekly reflection reports. The qualitative data focused on understanding how peer-tutors conceived their role as motivators, the ways they were able to execute their role as motivators and how their conceptions aligned with Keller's (1987) ARCS model of motivation. Data were inductively and deductively analysed according to the four categories of Keller's (1987) ARCS model of motivation, namely *Attention, Relevance, Confidence* and *Satisfaction*.

The main findings of this study revealed that peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners compared closely to Keller's (1987) ARCS model of motivation. This study contributes by establishing peer-tutors' role in motivating learners to learn mathematics, which could eventually assist with development of peer-tutors as an intervention strategy to enhance mathematics performance.

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ARCS	Attention, Relevance, Confidence and Satisfaction
HOD	Head of Department
NSC	National Senior Certificate
SDT	Self-determination theory
TIMSS	Trends in International Mathematics and Science Studies

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CHAPTER 1: INTRODUCTION AND CONTEXTUALISATION

1.1 INTRODUCTION

South African mathematics results are consistently poor in comparison with other developing countries, such as Morocco, Indonesia and Lebanon (Heyd-Metzuyanim & Graven, 2016; Waller & Maxwell, 2016). Although there was an improvement between 2003 and 2015 according to the South African Trends in International Mathematics and Science Studies (TIMSS) results (Reddy et al., 2016), South African mathematics results are still the lowest of 50 countries (Heyd-Metzuyanim & Graven, 2016). In 2015, according to the 2015's World Economic Forum Global Competitiveness report, South Africa's mathematics and science results were among the lowest of 140 countries (Areff, 2015). The TIMSS comprises of four categories of benchmarks: "Scores between 400 and 475 points are classified as achievement at a low level, scores between 475 and 550 points as achievement at an intermediate level, scores from 550 to 625 points as achievement at a high level and scores 625 points as achievement at an advanced level" (Reddy et al., 2016, p. 2). In 2015, South Africa scored 368 points, which was below the lowest benchmark. Despite these low results, there was an 87 point increase for mathematics from 2003 to 2015 which equates to "an improvement in performance of approximately two Grades" (Reddy et al., 2016, p. 6). However, only 34% of mathematics learners, thus a third of South African Grade 9 learners, showed a sufficiently good performance in mathematics which would allow them to choose the subject in Gradess 10-12 (Reddy et al., 2016).

Poor performance in mathematics is not limited to poverty or lack of opportunities. According to the TIMSS reports of the last 15 years, low mathematics results were consistent across the economic spectrum (Heyd-Metzuyanim & Graven, 2016). Although Spaull and Kotze (2015) argue that there is a gap in mathematics performance between learners from rich milieus and those from poor contexts in South Africa, these economic gaps could be bridged as an initial step to address underperformance in South Africa.

Mathematics results are an indication of a learner's ability to achieve academically (Huang, Craig, Xie, Graesser, & Hu, 2016) and affect how the world views a country's adeptness to perform internationally (Bartelet, Ghysels, Groot, Haelermans & van der Brink, 2015).

In 2016, the average pass mark for Grade 12 learners who wrote the National Senior Certificate (NSC) examination in mathematics was 51,1% (Department of Basic Education, 2016). The average pass mark was also much lower in comparison to physical sciences (62%), accounting (69,5%) and life sciences (70,5%) (Department of Basic Education, 2016). The repercussions of poor mathematics results impact not only individual learners, but also the country's performance at an international level (Bartelet, Ghysels, Groot, Haelermans & van der Brink, 2015). Poor mathematics results are a concern, therefore "teaching and learning interventions must focus sharply on what happens inside schools and classrooms" (Reddy et al., 2016, p. 16).

Numerous factors contribute to poor performance. Many teachers are unqualified or under-qualified (Spaull & Kotze, 2015) and do not spend sufficient time in the classroom (Letseka, 2014). Furthermore, some teachers use ill-prepared, outdated, teaching methods and they are often not able to relate to the learners they are teaching (Letseka, 2014). Classrooms are also often overcrowded. Other issues that impact on the poor results in South Africa are inequality and poverty (Graven, 2014). Time management issues, such as tardiness, absenteeism of both teachers and learners, slow pace of lessons, inappropriate lesson focus and inadequate time spent on teaching (Taylor, 2008) also affect performance. Another issue is curriculum challenges, such as access and delivery of textbooks (Taylor, 2008; "Textbook delivery trips," 2017), planning, monitoring and promoting homework and further practice at home (Taylor, 2008). Finally, limited and weak leadership affects performance and is a major concern in South African schools (Taylor, 2008; Van der Berg, 2008).

A key factor influencing learners' mathematical performance is motivation (Karakis, Karamete, & Okcu, 2016). Because some learners, specifically South African learners, have access to certain basic resources – housing, skills development, sanitation,

education training, transport and cultural privilege - and others do not, there is often a discrepancy between satisfactory achievement and poor achievement, which impacts greatly on learners' motivation (Mondada, Bonnet, Davrajh, Johal, & Stopforth, 2016). Research (Kim, Park, Cozart, & Lee, 2015) has shown that motivation is linked to mathematical results. Furthermore, motivation to learn is central to learners' success at school. For this reason, understanding how learners are motivated enables learning to be tailored to learners' needs (Izmirli & Izmirli, 2015).

1.2 BACKGROUND TO THE STUDY

The concept of motivation is complex and for this reason it has taken numerous disciplines many years to begin to arrive at a reasonable understanding of what motivation could be and what it might include (Dornyei, 2009). Over the past 60 years there have been "three major stages of motivational research", namely the social psychological period, the cognitive-situated period and the new approaches period (Dailey, 2009, p. 4). Each period has made its unique contributions to the study of motivation.

The social psychological period was pertinent from 1959 to 1990. This period focused on integrative and instrumental factors of motivation (Dailey, 2009). These factors of motivation refer to the extent to which motivation is an inherent activity and how motivation could be incorporated into lessons. Gardner and Lambert (1985) were the leaders during this period and found that achievement and motivation in language studies were linked. Gardner (1985) defined motivation as "the extent to which the individual works or strives to learn…because of a desire to do so and the satisfaction experienced in this activity" (Gardner, 1985, p. 10). Furthermore, motivation was compared to the objective of joining a family and becoming part of a community of liked-minded people (Gardner, 1985). The idea of motivation was broadened to include aspects of an idea and action by 1) addressing the initial conception of an idea and action 2) the continuation of the idea and action after an interruption or failure 3) the changing of how the action or idea is implemented and 4) the degree of success of the action or idea. All four of these components, needed to be addressed and not simply the success of an action (Tremblay & Gardner, 1995).

During the 1990s, the cognitive-situated period, characterised by “self-determination and self-confidence” (Dailey, 2009, p. 4) came into practise . During this period the ideas of intrinsic and extrinsic motivation were the main focus, which referred back to Atkinson’s conception of motivation in the late 1950s (Dailey, 2009). This concept of motivation focused on motives, incentives that have affects beyond simply pleasure and pain, and incentives based on success (Weiner, 2010). The need for instrumental motivation, where motivation is focused on being propelled to learn because of future prospects or simply to deepen individuals’ understanding, and not only because of the community or family (Dailey, 2009) was identified. Furthermore, new components were added, such as intrinsic and extrinsic motivation, intellectual interest, impacts of past successes and failures, desire to achieve, assurance and aims of the learning environment (Rachvelishvili, 2017).

For many years it was believed that learners who are intrinsically motivated outperform leaners who are extrinsically motivated (Lemos & Veríssimo, 2014). However, in recent years, according to Lemos and Verissimo (2014), there has been a decline in focusing on intrinsic motivation, but this does not mean that an emphasis on achievement has declined at the same pace. Lemos and Verissimo (2014) argue that the relationship between intrinsic and extrinsic motivation should be seen as separate. Each motivation has its own impact on achievement, and should not be seen as one-or-the-other. For this reason learners’ curiosity, welfare and social interactions should be focused on too, in relation to their overall motivation (Lemos & Veríssimo, 2014).

Since the 2000s the idea of “possible selves” (Dornyei, 2009, p. 17) has been introduced. “Possible selves” is the idea that what learners envision themselves to become, what they desire to become, as well as their anxieties of who they do not want to become play into incentive and motive. In short, “possible selves” refers to learners’ motivation and identity (Dornyei, 2009). Focusing on the elements of identity; “ideal self…ought-to self…learning experience” (Dornyei, 2005 in Dailey, 2009, p. 13) individuals are motivated to become the “possible self” they have envisioned. The “ideal self” refers to who an individual would like to become, the “ought-to self” refers to the characteristics an individual

believes s/he should have, and the “learning experiences” refers to the individual’s place of engagement and what learning is occurring there (Dornyei, 2009, p. 16).

Trends that can be seen throughout these stages are the realisation that motivation is a necessary entity for achievement in mathematics and that community, as well as learners’ views of the community, play an integral part in learners’ motivation to do mathematics. Furthermore, leaners’ sense of themselves directly affects their motivation to achieve in mathematics. When a learner is engaged in a mathematical activity and s/he is able to envision his/her “possible self”, the learner’s motivation to solve the mathematics activity is affected.

1.3 RATIONALE FOR THE STUDY

Motivation to achieve is often driven by a desire to be included and to be a part of something (Kim et al., 2015). Learners who achieve are often learners with a high motivation to achieve and therefore they put more effort into their learning (Kim et al., 2015). However, long-term achievement relies on how learners control their learning, how they control their motivation and the environment they find themselves in (Kim et al., 2015).

Motivation is necessary to learn mathematics. If individuals believe that they can increase their intelligence through work and perseverance, they are more likely to try to achieve (Arroyo et al., 2014). Individuals who are applauded for their work, are more likely to persevere with the tasks that are given to them, no matter the amount of work that is needed to complete the task (Arroyo et al., 2014). When individuals are motivated their anxiety level decreases and their confidence increases (Arroyo et al., 2014). Motivated learners are more focused and achieve better results since they are more likely to persevere even when mathematics concepts are challenging (Arroyo et al., 2014). Motivated learners seek solutions, explore patterns and have been shown to draw conclusions, rather than simply completing an exercise in isolation (Schoenfeld, 2016).

Low mathematical performance can be linked to learners’ dependency on the teacher, and their lack of self-regulation (Heyd-Metzuyanim & Graven, 2016) and motivation. Peer-tutoring has the potential to guide learners to become more self-regulated and

motivated, which, in turn, can address poor mathematics performance (Heyd-Metzuyanim & Graven, 2016).

Peer-tutors play an important role in motivating learners to learn mathematics. They are able to create a community of learning (Hoops, Yu, Wang, & Hollyer, 2016; Ticknor, Shaw, & Howard, 2014), address learners' beliefs about themselves and the mathematics to be acquired, and assist learners with the mathematics content to be learnt (Dailey, 2009). Peer-tutors could be role-models to learners as they are persons who have performed well in mathematics, but more importantly have experienced similar circumstances to the leaners (Topping, Campbell, Douglas, & Smith, 2003). Peer-tutors are able to show an awareness about and enthusiasm for mathematics content; address learners' identities; set realistic and achievable goals; and work alongside the learners and help them to achieve mathematically (Kroeger & Kouche, 2006). Finally, peer-tutors could enable learners to move away from external pressures, such as fear of failure or disappointment and encourage independence by providing "strategies, study habits and creat[ive] activities that develop analytical abilities" (Dailey, 2009, p. 19), while assisting learners to develop into self-regulated learners (Hoops et al., 2016).

Peer-tutoring can be linked to increased academic performance in mathematics (Duah, Croft, & Inglis, 2014). When learners are engaged in a task, they have greater awareness of the content being taught. By engaging with other individuals, learners are encouraged to become increasingly mindful of the task and in return are often more motivated to continue with the task at hand (Gardner, 1985; Kim et al., 2015). Peer-tutors can address motivation explicitly or because of availability and access, can inspire learners' motivation to achieve (Grills, 2017).

Peer-tutoring may have several benefits for learners. Peer-tutoring could enhance the response time for feedback that learners need for questions or concerns. Teachers often have to continue with new sections of work and cannot address learners' queries immediately. In this system, learners would not have to wait for a formal lesson by their teachers, but could be assisted by peer-tutors helping at their own pace, in their own time (Kroeger & Kouche, 2006) to build own understanding of the subject content (Karakis et

al., 2016). Peer-tutoring also places importance on one-on-one relationships between learners (Kroeger & Kouche, 2006) that can supersede the traditional one-way tutoring relationship (Kroeger & Kouche, 2006). Peer-tutoring encourages discourse and communication between learners and addresses needs for peer approval (Kim et al., 2015). Furthermore, peer-tutoring can enhance learners' motivation by involving them in the learning process, which can lead to better mathematics performance (Kim et al., 2015).

1.4 THE RESEARCH PROBLEM

Although mathematics results in South Africa have begun to improve since 2011 (Reddy et al., 2016), the country's performance is still low in comparison with other countries (Heyd-Metzuyanim & Graven, 2016; Reddy et al., 2016). Thus, mathematics results in South Africa need to accelerate (Reddy et al., 2016, p. 16) in order for the country to compete globally.

Despite the implementation of numerous intervention strategies, such as extra support in primary schools (Spaull, 2013) and mathematical literacy programmes (Botha & Van Putten, 2018) to improve mathematics performance in South African schools, mathematics results are still poor. Many of these strategies have also not been implemented early enough or have not been implemented effectively (Spaull & Kotze, 2015).

At the school where the researcher of this study is currently teaching, the mathematics department is concerned about the deteriorating mathematics results over the last few years. This trend is evident in many other South African schools too (Taylor, 2008). Although the mathematics teachers at the school under investigation provide extra mathematics lessons twice a week after school hours, this intervention appears not to be sufficient, as results do not improve noticeably. In addition, many learners do not attend the extra mathematics lessons due to inconvenient times, intimidation from other learners, and/or an aversion to the structured environment. Peer-tutoring is an intervention that could address these challenges. Learners may experience less intimidation when approaching fellow learners and the daily contact in an, unstructured environment may motivate learners to join and focus.

According to Schukajlow, Rakoczy and Pekrun (2017) international research into motivation and mathematics largely focuses on affective constructs, such as emotions and motivation. Emotions and motivation influence how learners view mathematics content and their interest in mathematics (Schukajlow et al., 2017). Emotions greatly impact on learners' achievement (Ryan & Deci, 2000b). How learners choose to use mathematics in their everyday lives is determined by their views of mathematics, their emotions towards mathematics and their attitudes about mathematics (Wilkins & Ma, 2003). Wilkins and Ma (2003, p. 59) focused on how to model change by addressing the affective aspects by addressing learners' "attitudes toward mathematics, beliefs about the social importance of mathematics and notions of the nature of mathematics". However, addressing the affective aspects and attempting to change learners' and the community's beliefs about mathematics, are slow practices (Wilkins & Ma, 2003).

The relationship between learners' perceptions of mathematics and the emotions that they exhibit during learning, impacts on their participation in mathematics programmes (Winberg, Hellgren, & Palm, 2014). Winberg, Hellgren and Palm (2014, p. 686) found that learners' emotional experience towards mathematics is impacted "by their type of motivation and their perceived learning". Learners will only engage in mathematical activities, if they perceive the content to be interesting or useful to them (Winberg et al., 2014).

There is a need to provide learners with "effective and engaging learning" (Novak, 2014, p. 73), specifically in mathematics. In order to be effective and engaging, mathematics teaching needs to be more learner-centred (Novak, 2014). Novak (2014) found that learners' attention to their learning environment is a predictor of how they process information. The relevance they place on learning and the confidence they feel during the learning process also impact on their motivation to learn (Novak, 2014), whereas their persistence in learning plays a very small role in their motivation to learn or their mathematics performance (Novak, 2014).

Midgley, Feldlaufer and Eccles (1989) researched the perceptions of learners who transitioned to different teachers and the impact of these changes on their motivation.

They found that high-achieving learners' perceptions of mathematics did not change and their intrinsic motivation was not influenced by the change in relationships with different mathematics teachers. Learners who were high-achievers in mathematics were not influenced negatively by the change in mathematics teachers (Midgley et al., 1989). However, low-achieving mathematics learners were negatively influenced by their beliefs in the "importance and usefulness" of mathematics (Midgley et al., 1989, p. 990). Low-achieving learners simply gave up and lost motivation to try to do mathematics despite of intervention. Therefore, Midgley, Feldlaufer and Eccles (1989, p. 990) advocate focusing on "teacher and classroom variables" in mathematics motivation studies.

Teachers' enthusiasm and self-efficacy impacts greatly on learners' motivation (Lazarides, Buchholz, & Rubach, 2018). Lazarides, Buchholz and Rubach (2018) found that teachers' "own perceptions of mastery goal orientation in the class" impacted on learners' self-efficacy (Lazarides et al., 2018, p. 7). More noticeable was the effect of learners' perceptions of their teachers' enthusiasm and its impact on their "perceptions of mastery goal orientation in class" (Lazarides et al., 2018, p. 7). The results showed that when learners' confidence in their teacher increased, learners' academic development was positively impacted. Both utility value (learners' perceived usefulness of a task) and attainment value (learners' perceived personal importance of a task) are associated with extrinsic motivation, while individual classroom experiences relates to intrinsic motivation (Lazarides et al., 2018).

Recently, Schiefele (2017, p. 115) found that "teacher educational interests " that is teachers' interest in "educational or pedagogical aspects" of teaching, influence teachers' motivation and impact greatly on their classroom management and mastery-orientated instructional practices. Teacher education interests also influence learning practices that affect learners' motivation. Furthermore, classroom management influences both learners' motivation and teachers' mastery-orientated practices. Finally, "subjective and objective aspects of the learning environment are influential" to learners' motivation (Schiefele, 2017, p. 124).

Chue and Nie (2017) researched different learning approach profiles of mathematics learners and how they impacted on achievement and motivation. The findings showed that deep learning was directly influenced by intrinsic motivation, while surface learning was associated with extrinsic motivation. In order to do well academically, therefore, learners should use both surface and deep learning. Extrinsic motivation may be linked to the external pressure of examinations, while learners' intrinsic motivation to achieve depends on learners "compel[ling] themselves to make an effort" (Chue & Nie, 2017, p. 82).

Despite many international studies on motivation in mathematics, as elaborated above, the researcher could only find limited research from South Africa concerning motivation and the impact it may have on local learners' performance in mathematics. Some research studies identified that there is a lack of motivation amongst South African learners (Letseka, 2014; Makonye, 2017). Learners who had chosen mathematics literacy rather than core mathematics at school level, and were entering university for the first time exhibited low motivation in mathematics (Baumgartner, Spangenberg, & Jacobs, 2014). Research focussing on migrant teachers in South Africa, indicated that South African learners' self-motivation was lacking and that implementation of a new mathematics curriculum was insufficient (Makonye, 2017). Further research conducted on mathematics teachers in Johannesburg North, found that teachers need to be self-motivated (Grobler, Moloi, & Thakhordas, 2017). Other studies conducted on learners in rural Kwa-Zulu Natal showed that learners who are motivated and persistent are more likely to have academic success (Maher, 2016; Oswald & Rabie, 2016), and that teacher's motivation is vital to the learners' educational success (Grobler et al., 2017; Maher, 2015). Parents and older siblings also play an important role in South African learners' motivation. If this support is not provided, learners have to depend entirely on their own intrinsic motivation and desire to achieve (Oswald & Rabie, 2016).

None of the research on the role that motivation plays in mathematics performance in South Africa (Grobler et al., 2017; Maher, 2016; Makonye, 2017; Spaull, 2013), as mentioned above, relates to peer-tutoring as an intervention strategy to motivate learners in mathematics. According to Kim et al. (2015) there is a need for an inquiry on how peer-

tutors perceive their role in motivating other learners to participate in the mathematics classroom. More specifically, there is a need to investigate whether a peer-tutoring programme has an influence on learners' motivation to execute mathematics and whether that eventually translates into improved mathematics results. This need has led to this study, which will focus on how Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners

1.5 PURPOSE OF STUDY

The purpose of this study is to determine how Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners in terms of the *Attention*, *Relevance*, *Confidence* and *Satisfaction* (ARCS) model of motivation of Keller (1987). The study envisages highlighting the advantages of peer-tutoring as a successful intervention strategy to motivate learners in their mathematics learning.

1.5.1 Main research question

The following research question will guide the study:

How do Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners as compared with Keller's (1987) ARCS model of motivation?

1.5.2 Sub-questions

The sub-questions that will assist in answering the main research questions are:

1. What are Grade 12 peer-tutors' views of their role as motivators for Grades 8-9 mathematics learners?
2. In what ways do Grade 12 peer-tutors execute their role as motivators for Grades 8-9 mathematics learners?

1.6 AIMS AND OBJECTIVES

The objectives for this study will be to:

1. Establish what Grade 12 peer-tutors' views are pertaining to their role as motivators for Grades 8 and 9 mathematics learners.

2. Ascertain how Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners.

3. Align Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners with Keller's (1987) ARCS model of motivation.

1.7 THEORETICAL FRAMEWORK

1.7.1 Main theoretical underpinnings

Keller's (1987) ARCS model of motivation will be used as a framework to examine Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners. The Keller's (1987) ARCS model of motivation outlines four main categories, namely *Attention, Relevance, Confidence and Satisfaction* (Figure 1:1) (see section 2.7).

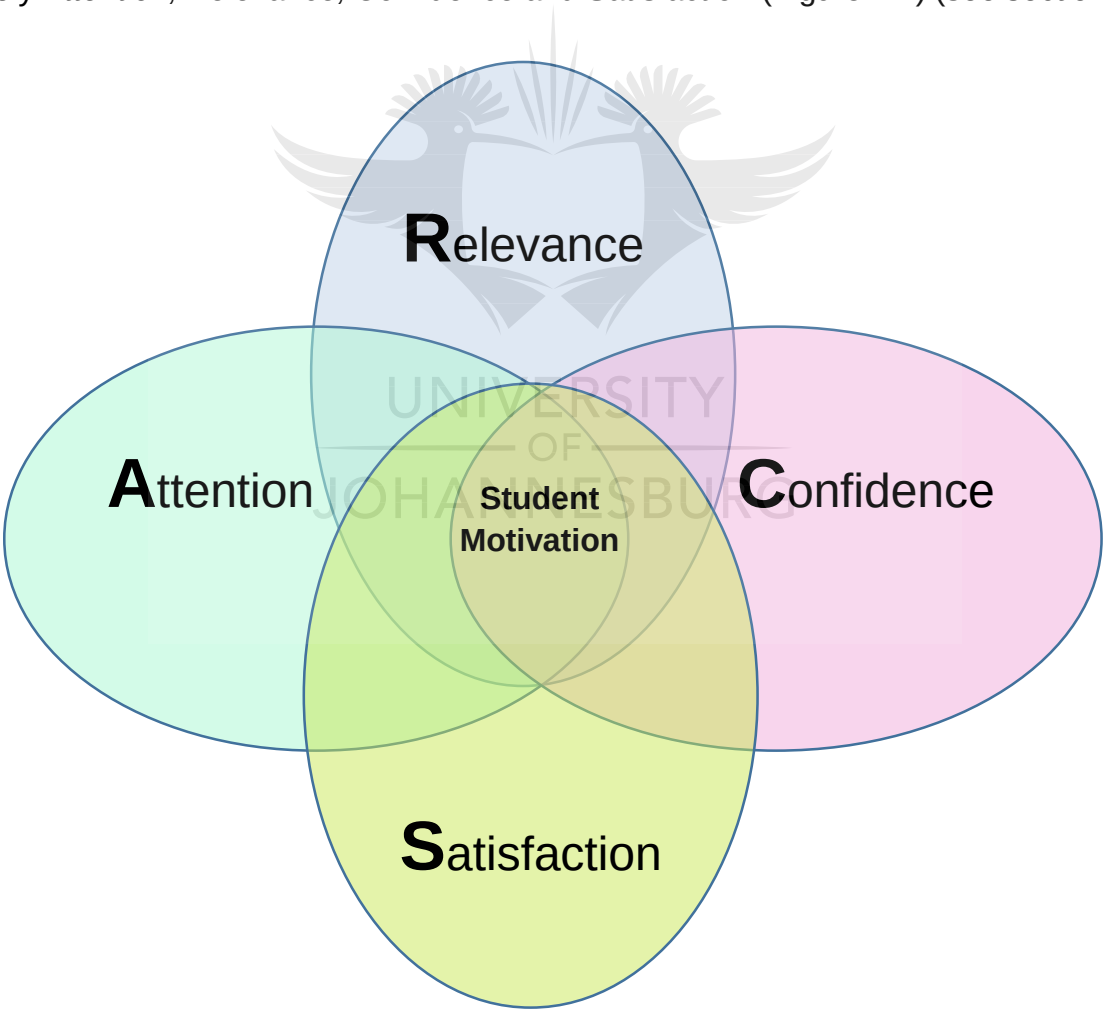

Figure 1.1: Keller's (1987) ARCS model of motivation.

1.7.2 Clarification of concepts: working definitions

The concepts for this study are clarified for the meaning of this study. Many of these concepts are understood to mean the same as the working definition. However, there are concepts that may hold different definitions in other countries.

Conceptions

Conceptions are defined as the process of forming or devising an idea (*The Oxford online dictionary of English grammar*, 2014). Conceptions in learning and teaching involve terms such as understanding, thinking and motivation (Simon, 2017).

Peer-tutors

Fellow learners, who are more knowledgeable than the poor-achieving and/or unmotivated learner and who are willing to help and assist on a voluntary basis.

Grade 12

Learners who are in their final year of study at high school in South Africa.

Grades 8 and 9

Learners who are in their eighth and ninth year of schooling in South Africa. This is equivalent to the first two years of high school.

Motivation

The compulsion, either intrinsic or extrinsic, that learners have to complete a task and to achieve their individual goals

Motivator

Person or thing that can enable motivation to take place.

Attention, Relevance, Confidence, Satisfaction (ARCS model)

Keller (1987)'s ARCS model of instructional design for motivation inspects the factors that impact and guide individuals' motivation during the learning process and "orientates teaching" (Karakis et al., 2016)

1.8 RESEARCH DESIGN AND METHODOLOGY

An interpretivist paradigm will be adopted for this study due to the social context of the study. An interpretivist paradigm seeks to understand the reality of individuals in a social context and to understand the world that they live in (Willis, 2007). An inductive approach following a qualitative single descriptive case study (Given, 2008) will be utilised, describing the conceptions of tutors "as fully and richly as possible" (Fraenkel, Wallen & Hyun, 2012, p. 425). This case study will describe "an intervention and the real-life context in which it occurs" (Baxter & Jack, 2008) (see section 3.3.2.3)

The school in which the research will take place is a large, high-achieving, diverse, ex-model C school. This research will make use of a convenient, purposive sample technique (see section 3.4.3.2). Ten of the top academic achievers in Grade 11 of the previous year (currently in Grade 12) at a school in the North of Johannesburg will be approached to participate in the programme on a voluntary basis (see section 3.3.2.3).

Multiple data sources will be used, namely one-on-one semi-structured interviews, a direct observation using observation sheets designed according to Keller's (1987) ARCS model of motivation, and eight weekly-reflection reports consisting of open- and closed-ended questions.

Two interviews, before and after intervention, conducted at a time suitable for the individual, will be audio recorded on condition that consent is provided (see section 3.4.2.2). Observations will take place on a weekly basis by the researcher during five different tutorials (see section 3.4.3.4). Participants will be asked to complete eight weekly reflection reports focusing on different aspects of Keller's (1987) ARCS model of motivation (see section 3.4.3.4).

1.8.1 Data analysis procedures

The data obtained from the recorded interviews will be transcribed and inductively coded. The codes will be categorised (Creswell, 2013b), reducing the data to themes and allowing analysis via an inductive process (Roulston, 2010) to tell the peer-tutors' stories. The observation sheets and reflection reports will be analysed similarly. Inductive and deductive processes will follow by coding data inductively and then, if possible,

categorising data deductively according to the four categories of Keller (1987)'s ARCS model of motivation. The computer analysis software program, ATLAS.ti, will be used to assist with the coding and categorising of data. This will bring the tutors' stories to the forefront (Creswell, 2013b) and make it possible to interpret the conceptions of the peer-tutors with regard to their role as motivators (see Chapter 3).

1.9 TRUSTWORTHINESS

Trustworthiness of the research process will be established by the following four criteria: "credibility, transferability, dependability and conformability" (Savin-Baden & Major, 2010, p. 30). To ensure credibility, data triangulation will be used to cross check all three data sources; namely interviews, observations and weekly reflections, ensuring "accuracy of interpretation" (Fraenkel et al., 2012, p. 517). Member-checking and peer debriefing (Savin-Baden & Major, 2010) will also be used. For dependability, all collected data will be compared to Keller's (1987) ARCS model of motivation for consistency in results. Confirmability will be addressed using weekly reflections to "check and recheck the data throughout the study" (Trochim, 2006, p. 10) to ensure that the data aligns with Keller's (1987) ARCS model of motivation. The supervisor and other faculty members will read through and give advice on the interview and weekly reflection questions to ensure face validity (Patton, 2003) of the interview questions.

1.10 Possible contributions of the study

This study is important for several reasons. The limited research with regard to peer-tutoring in mathematics and the influence it could have on learners' motivation to learn mathematics have not been sufficiently studied in South Africa. A study on the conceptions of peer-tutors pertaining to their role as motivators to influence learners' execution of mathematics could add to research on intervention strategies in mathematics.

Intervention strategies to improve learners' motivation to learn mathematics could have a vital impact on mathematics performance in South Africa, and as a result on learners' future prospects. This study could highlight the advantages of peer-tutoring as an intervention strategy in mathematics teaching and learning at school level. Peer-tutors'

influence on learners' motivation could also lead to overall learner motivation and achievement in other subjects.

1.11 Demarcation of the field of study

This study will be situated mainly within the discipline of Mathematics Education, but also in Psychology. This study will determine how Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners in terms of Keller (1987)'s ARCS model of instructional design for motivation. Such a study could highlight the advantages of peer-tutoring as an intervention strategy in mathematics teaching at the school level, which could ultimately improve mathematics performance. Furthermore, this study will fit into the field of psychology by contributing to the understanding of how individuals are motivated. What motivates individuals is an important psychological question.

1.12 Structure/outline of the research

This dissertation consists of five chapters.

Chapter 1 consisted of an outline of the study, briefly describing all the aspects of the study. These aspects included the background and rationale of the study, the research problem, purpose of the study as well as the aims and objectives, as well as the theoretical framework and research design. Finally, definitions used in the study were provided and the contributions the study could make to research and practice were offered.

Chapter 2 will provide a detailed analysis and summary of relevant literature: the conceptualisation of motivation and the three periods of research on motivation – social psychological period, cognitive situated period and the new approaches period. Furthermore, it will provide a summary of motivation in mathematics education, an overview of tutoring and the history of tutoring. Finally, Keller's (1987) ARCS model of motivation, will be discussed, which will frame this study.

In Chapter 3 the research design and methodology to be used in this study will be expounded on. The data collection process including instruments, sampling and ethical considerations will be addressed. Finally, the data analysis procedures, namely trustworthiness of the study will be discussed.

Chapter 4 will focus on the data analysis based on the data obtained through interviews, observations and weekly reflections. The interpretation of the findings will be discussed in light of the literature review, the theoretical framework and the research questions.

Chapter 5 will conclude with a summary of the study, the answer(s) to the research question and implications of the study. Finally, limitations of the study, recommendations for further research and a personal reflection on the study will follow.

CHAPTER 2: LITERATURE OVERVIEW AND CONCEPTUAL FRAMEWORK

2.1 INTRODUCTION

Motivation is important in the learning of mathematics (Schukajlow et al., 2017), since it has an impact not only on learners' cognitive development and psychological well-being, but also on their daily environments (Novak, 2014). Therefore, it is essential to ensure that learners are motivated to learn and that they stay motivated (Bernacki, Nokes-Malach, & Aleven, 2015; Schukajlow et al., 2017). A possible strategy to assist in improving learners' mathematics motivation is to provide Grades 8 and 9 mathematics learners with the opportunity to be assisted by peer-tutors (Clarence, 2018; Duah et al., 2014; Kroeger & Kouche, 2006; Ticknor et al., 2014; Topping et al., 2003).

This chapter will start by focusing on the conceptualisation of motivation. It will then look at three periods of research on motivation: the social psychological period, the cognitive situated period and the new approach period of possible selves. Motivational perspectives in mathematics will also be discussed. An overview on tutoring, focusing on the constructs of tutoring and peer-tutoring, as well as the history of tutoring will be addressed. An overview will be provided on Keller's (1987) ARCS model of motivation and the ways that it can be implemented and used to assess motivation. Keller's (1987) ARCS model of motivation will be discussed by focusing on attention, relevance, confidence and satisfaction. Finally, a chapter synthesis will be provided.

2.2 CONCEPTUALISATIONS OF MOTIVATION

The term motivation comes from the Latin verb meaning to move (Pintrich, 2003). Motivation is what gets learners moving and also speaks to activities and tasks that bring about this movement (Pintrich, 2003). Motivation is a central and recurring issue in teaching and learning research (Pintrich, 2003; Schukajlow et al., 2017) and produces positive results (Ryan & Deci, 2000b).

Motivation is not a single aspect to learners' achievement but rather research shows that there are a number of different aspects of learners' lives, actions and emotions, that can affect this achievement (Ryan & Deci, 2000b). For example, if a mathematics learner

is constantly bored (an emotion) while solving mathematical problems, the learner may begin to feel bored, even before he/she knows what the mathematical problem is (Schukajlow et al., 2017). This emotion directly impacts on the learner's performance and motivation to learn. Motivation, the reason behind why a leaner would perform an action, can be both intrinsic and extrinsic to the learner. Ryan and Deci (2000a, p. 55) imply that intrinsic motivation is a preferable over extrinsic motivation since it "results in high-quality learning and creativity". However, even though intrinsic motivation can be encouraged and strengthened in the classroom, it can just as easily be undermined. Motivation is an intricate part of learners' success in executing mathematics. Therefore, it is vital to understand that learners' emotions and motivation can overlap. For example, when learners enjoy performing mathematics, their motivation to persevere increases when they engage in challenging problems (Schukajlow et al., 2017).

The complexity of the concept of motivation has been the focus of much research for more than 60 years (Dornyei, 2009). Although many researchers have attempted to define the term motivation, one single definition has not yet been agreed upon (Heckhausen, 2018; Kleinginna & Kleinginna, 1981; Rheinburg & Engeser, 2018).

Aarts, Chalker and Weiner (*The Oxford online dictionary of English grammar*, 2014) define motivation as " a reason, desire, willingness or enthusiasm … for acting or behaving in a particular way". Rheinberg and Engeser (2018) state that motivation could be defined as the moment when an individual directs his/her life's actions towards a positive goal. They expanded by showing that not every action is necessarily seen as positive, although the individual might recognise a positive outcome for the future. Learners might not enjoy the work in the moment and might not know how mathematics will impact their future; however, they may understand that, by doing well, they are creating opportunities for their future. Heckhausen (2018, p. 15) states that when psychology became more scientific, "motivation was seen to have … value for apparently automated processes such as perception, imagination and thought". However, today motivation is understood to be more than the desire that controls an individual's actions, but is rather the "needs and tendencies that [are] assumed to determine behaviour in accordance with [individuals'] strength" (Heckhausen, 2018, p. 16). Ryan and Deci

(2000b) argue that motivation is involved in causing learners to act and that a learner's motivation is often related to the social settings (the communities) that they find themselves in. For this study, motivation will be understood to be the compulsion, either intrinsic or extrinsic, that learners have to complete a task and to achieve their individual goals.

Learners are naturally inquisitive and willing to learn, "at their best [humans] are agentic and inspired, striving to learn; extend themselves; master new skills; and apply their talents responsibly" (Ryan & Deci, 2000b, p. 68). However, learners do go through changes and circumstances where this innate curiosity is weakened and hindered due to contexts and other factors (Ryan & Deci, 2000b). When learners' motivation is low, their ability to learn is greatly diminished (Bernacki et al., 2015; Ryan & Deci, 2000b). Dornyei (2009) states that motivation is necessary for every learner to reach and obtain long-term goals. Learners' responses to their social environment should thus be investigated in order to better understand what motivates and affects their personal growth, and, in turn, affects the communities that learners are part of (Ryan & Deci, 2000b). It is also important to understand what basic needs learners have, which could influence their goals (Pintrich, 2003). In this way motivation not only addresses learners' needs, but also their innate desires.

2.3 PERIODS OF RESEARCH ON MOTIVATION

Three main periods of research on motivation can be distinguished, namely the social psychological period from 1959 – 1990, the cognitive-situated period throughout the 1990s and more recently new approaches about motivation (Dailey, 2009). The next paragraphs will focus on the development of these three periods and the commonality between them, as well as their relevance to mathematics education.

2.3.1 Social psychological period

During the social psychological period the ideas of integrative motivation and instrumental motivation were termed (Dailey, 2009). Gardner and Lambert's (1959a) work on motivation took the lead during this time and is supported by Rachvelishvili (2017): both claiming that learners' attitudes toward learning impact on their success. Tremblay and Gardner (1995) investigated the role of motivation in language learning contexts and

found “how other elements of motivation [could] be incorporated into [Gardner’s] Socio-Educational Model” (p. 517). Although they stated that there could be ways to improve motivation, they found that the research was “fruitful and conducive to further understanding and research” (Tremblay & Gardner, 1995, p. 517). Dornyei (2009) integrated Gardner’s theory into more recent research on motivation and the individual and found that if an individual believes s/he can, then s/he is more likely to be motivated. Pourhasan and Zoghi’s (2017, p. 60) research was influenced by Gardner’s research on “integrative motivation and instrumental motivation”. They found that their research was able to predict learners’ achievement test scores (Pourhasan & Zoghi, 2017). Gardner’s (1959a) factors of motivation was organised into two categories: integrative and instrumental (Pourhasan & Zoghi, 2017; Rachvelishvili, 2017). Integrative motivation focuses on the learner’s need to interact and relate to the learning community s/he finds him/her-self in. Instrumental motivation is the value that a learner knows his/her learning has for the future (Pourhasan & Zoghi, 2017).

Gardner and Lambert (1959a) argued that the motivation of learners to learn is determined both by their attitudes about the community of learning, as well as the reasons why they perceive the knowledge to be important; thus their learning goals (Dailey, 2009). Learners’ views of their community are impacted by the strength of their desire to be part of the community, which affects their motivation as well at their achievements (Ryan & Deci, 2000b). The more integrated learners are in their communities, the more positively they will view their communities and the more motivated they will be to achieve the communities goals as well as their personal goals (Rachvelishvili, 2017).

There are, however, a number of limitations to Gardner and Lambert’s (1959a) theory. The theory was only tested in one sphere of study, namely with second language learners (Rachvelishvili, 2017). There are also a number of factors, including future success, learning environments, different teaching methods and the teacher, that need to be considered when addressing motivation in foreign language studies or other subjects (Rachvelishvili, 2017). If learners do not feel welcome or cannot relate to a community, it is unlikely that they will integrate into that community or be able to achieve the goals of

the community (Pourhasan & Zoghi, 2017) . Furthermore, due to the advances of the English language and the development of technology and online communities, being part of a community has taken on a different meaning (Harandi, 2015). This community might not be a physical community that the learner attends in person and communicates with face-to-face, but could be a virtual community anywhere in the world. In return, the possibility for such diverse communities can have an effect on learners' integrative and instrumental motivation. If learners do not find a community (physical or virtual) that supports their needs, this may lead learners giving up or removing themselves completely. Although not all learners strive to be integrated into their communities, many of them are motivated to receive the necessary skills and knowledge from those communities to achieve their goals (Dailey, 2009; Harandi, 2015). Despite the limitations to Gardner and Lambert's (1959a) social psychological theory, it is still considered important today.

2.3.1.1 Attribution theory

An important motivational perspective stemming from the social psychological period is attribution and control beliefs (Pintrich, 2003; Skinner et al., 1996; Weiner, 2010). This perspective "refers to beliefs about the causes of success and failure and how much perceived control one has to bring about outcomes and to control ones' behaviour" (Pintrich, 2003, p. 673). How learners attribute their success or failure is where the term attribution theory comes from (Linnenbrink-Garcia, Patall, & Pekrun, 2016).

There are internal and external attributes that contribute to learners' perceived control, namely "ability, effort, task difficulty and luck" (Weiner, 2010, p. 30). Ability and effort are internal attributes, while task difficulty and luck are external attributes (Weiner, 2010) (see figure 2.1). These four attributes also impact on learners' internal motivation.

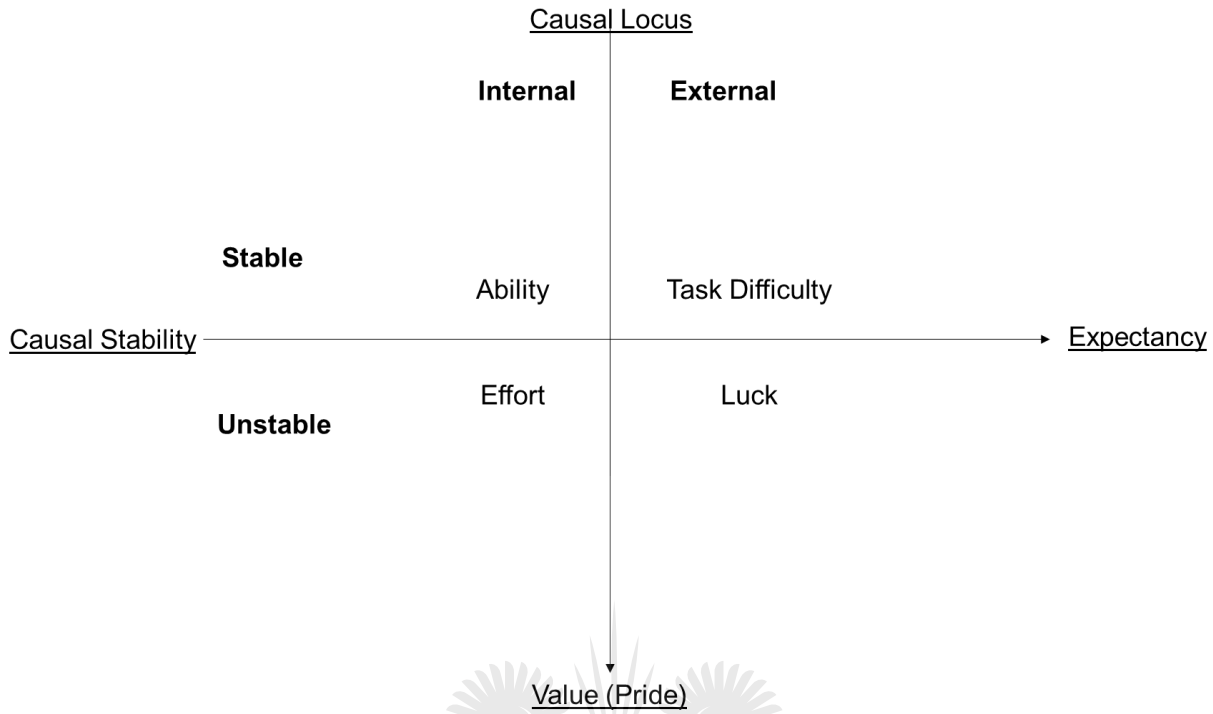

Figure 2.1: Representation of the four main causes of behaviour, their dimensional properties and linkages to affect and expectancy (From Weiner, 2010, p. 32).

Three dimensions categorise these attributes – ability, effort, luck or task difficulty - and stipulate why they matter, namely "locus, stability and controllability" (Linnenbrink-Garcia et al., 2016, p. 230). *Locus* refers to "whether the cause is internal to the individual or external" (Linnenbrink-Garcia et al., 2016, p. 229). If a mathematical task is perceived to be more challenging, there is a greater level of pride if the task is completed successfully and if the task was dependant on the learner's ability or effort (internal to the individual) (Linnenbrink-Garcia et al., 2016). If a mathematical task is viewed as easy or less challenging, there is a lower level of pride if the task is completed successfully (Moodaley, Grobler, & Lens, 2006; Weiner, 2010), if the task was dependant on luck (external to the individual) (Linnenbrink-Garcia et al., 2016). In contrast, if a learner does not achieve at a task and his/her failure can be attributed to an external cause, for example a mathematics test is too difficult, this may cause the learner to believe that s/he is a failure. This failure may affect the learner on an internal level, although the task difficulty is out of the learners control (Linnenbrink-Garcia et al., 2016). However, if a learner attributes his/her failure to an internal cause, ability or effort, "then expectancy of success may not

drop" (Weiner, 2010, p. 31). In this case the learner has acknowledged that his/her failure to achieve was a direct result of his/her lack of studying or completion of homework or similar.

The dimension of *stability* refers to the likelihood that an outcome will reoccur or not. If a learner perceives that in the future there may be changes to the causes - ability, effort, task difficulty and luck - then past failures may not continually impact future outcomes (Weiner, 2010). However, if the cause of the failure is viewed as stable or unchanging "then there would be an expectation of future failure and a state of hopelessness" (Weiner, 2010, p. 31) may settle on the learner. If the learner does not believe that s/he would be able to achieve success in the future, then why continue trying? These perceived changes or lack of changes will impact either positively or negatively on the learner's motivation in the future (Pintrich, 2003; Weiner, 2010). For example, if a learner believes that s/he will not be able to succeed in a specific topic in mathematics, for example geometry, then s/he may not even attempt to complete geometry homework tasks or may leave geometry questions blank in a formal assessment. However, if a learner believes that a certain topic is easy and that s/he understands what needs to be done, despite the level of difficulty, s/he will attempt to complete the homework questions or try the questions in the formal assessments (Mercader, Presentación, Siegenthaler, Molinero, & Miranda, 2017).

Finally, the dimension of *controllability* focuses on "whether the individual can control the cause" (Linnenbrink-Garcia et al., 2016, p. 230). When learners feel that they have little to no perceived control, often due to failure, they may adapt negatively (Pintrich, 2003; Weiner, 2010). When learners believe that they have control of their learning they are more likely to achieve than learners who do not feel that they are in control (Pintrich, 2003). When learners perceive that they are in control, they are also more engaged and have higher levels of achievement (Pintrich, 2003; Weiner, 2010) than those without control. Mercader et al. (2017) have found that learners who have a particular mathematics learning disability often exhibit extrinsic motivational styles. They often attribute their success or failure to causes outside their control, rather than their personal effort.

2.3.1.2 Achievement goal theory

Achievement goal theory is a social cognitive theory of motivation that focuses on the ways in which goals impact on learners' affect (Elliot, 1999; Linnenbrink & Pintrich, 2002), thus their purpose (Elliot, 1999). The achievement goal theory considers affect at a "general level or as it emerges during academic tasks" opposed to the attribution theory, which considers affect once a learner has experienced success or failure (Linnenbrink & Pintrich, 2002, p. 69). The achievement goal theory states that there are two main reasons why learners pursue a goal, namely "mastery goal orientation … [and] performance goal orientation" (Linnenbrink & Pintrich, 2002, p. 69). These reasons link to "different behavioural, cognitive and affective outcomes" (Elliot, 1999; Linnenbrink & Pintrich, 2002, p. 69). Mastery goal orientation is when a learner is focused on learning as well as understanding (Elliot, 1999; Linnenbrink & Pintrich, 2002), while performance goal orientation refers to a learner demonstrating ability and competency (Elliot, 1999; Linnenbrink & Pintrich, 2002). In mathematics, an example of mastery goal orientation would be a learner who desires to understand a concept, while an example of performance goal orientation would be a learner aiming to receive a specific mark, for example 80% for a test (Seaton, Parker, Marsh, Craven, & Yeung, 2014).

Achievement and mastery goals includes both "approach and avoidance dimensions…referred to as a multiple goals perspective" (Linnenbrink & Pintrich, 2002, p. 70). The multiple goals perspectives include a main focus on the goal, but also on how the learner "approaches or avoids the goal" (Linnenbrink & Pintrich, 2002, p. 70). In contrast , Seaton, Parker, Marsh, Craven and Yeung (2014) found that the achievement goal theory does not necessary focus on approaches and avoidances based on stable personality differences, such a motives, but rather on approach or avoidances goals. Also, learners with a mastery goal orientation do not always perform better in mathematics. In fact, achievement and mastery goals are often based on personal preferences or the context in which the learner finds him-/her-self (Linnenbrink & Pintrich, 2002).

Learners who demonstrate mastery goal orientation focus on learning and understanding (Elliot, 1999; Lazarides et al., 2018). Lazaridus, Buchholz and Rubach (2018) found that

learners' perceived mastery of mathematics was impacted by their perception of the importance of mathematics for their future career, as well as the teacher's enthusiasm. Learners who avoid mastery goals simply aim at not falling short of their own goals, which often creates 'gaps' in their learning. Learners who do not exhibit mastery goals in mathematics, do not see the value in mathematics for their future career (Lazarides et al., 2018). Learners who are performance goal orientated focus on outperforming others or they simply attempt to not look foolish in comparison to others who avoid performance goals (Elliot, 1999; Linnenbrink & Pintrich, 2002).

An important aspect of the achievement goal theory is to focus on how learning environments influence learners' motivation. The achievement goal theory suggests that learners' personal goals can differ based on differences in their learning environment (Linnenbrink & Pintrich, 2002). These differences can include instructional practices of teachers or practices of the school. The goal structures that the learners perceive influence the ways they adapt their goals (Linnenbrink & Pintrich, 2002). An enthusiastic mathematics teacher could influence learners' motivation either positively or negatively. Teachers who show interest in the subject and in the teaching of mathematics impact on learners' interest through mastery goal orientation (Lazarides et al., 2018). Therefore, learners' disposition and mood about the environment that they are in will have an impact on their goal structure.

2.3.2 Cognitive situated period

2.3.2.1 Self-determination theory (SDT)

The second major stage in the research of motivation focused on the introduction of the ideas of self-determination and self-confidence. The self-determination theory (SDT) focuses on learners' motivation and personality and how their "personality development and behavioural self-regulation" could advance (Ryan & Deci, 2000b, p. 68). The ideas of intrinsic and extrinsic motivation were introduced by Ryan and Deci (2000b). Intrinsic and extrinsic motivations were introduced in response to the need to determine what causes motivation (Dornyei, 2009). Research shows that there are three essential psychological needs that develop self-motivation and improved mental health: competency, autonomy and relatedness (Ryan & Deci, 2000b).

Competency, also referred to as self-efficacy, occurs when the learner feels that s/he is able to accomplish a task (Ryan & Deci, 2000a). Competency needs to be accompanied by *autonomy*, which is the inner perceived reason for acting (Ryan & Deci, 2000a). *Relatedness* is the psychological need the learner feels for unity and incorporation within his/her environment (Ryan & Powelson, 1991). For example, when a learner perceives that his/her teacher enjoys mathematics and enjoys teaching it, s/he will enhance his/her self-motivation, with the result that s/he finds the subject relatable. Furthermore, when a learner is able to see the value of the mathematical concept and why it is necessary to achieving his/her goals, the psychological need of autonomy is met. When a learner discerns that s/he is able to complete a mathematical task, the learner has the feeling that s/he has control over the task and is competent to execute it. (Winberg et al., 2014).

Competency, autonomy and relatedness are vital for assisting in the innate development of learners' abilities and emotions as well as for the social development of the learners in their communities (Ryan & Deci, 2000b). Learners are generally motivated by the value of the activity, or because of an external pressure (Ryan & Deci, 2000b). For example, learners who demonstrate that they are highly motivated to do mathematics, often have teachers who have laid out clear goals and have provided challenging tasks to learners. These teachers have given learners a sense of autonomy, while still providing support to the learners.

2.3.2.2 Intrinsic motivation

Intrinsic motivation is the innate longing of learners to achieve a desired outcome or simply complete a task for pure pleasure (Dailey, 2009; Pintrich, 2003; Ryan, 1995; Winberg et al., 2014). Intrinsic motivation is seen to be an important factor when examining motivation. Intrinsic motivation is a phenomenon of learners' potential (Dailey, 2009; Ryan & Deci, 2000b), which requires a "high degree of perceived internal control" (Pintrich, 2003, p. 274). Learners are predisposed to search for new and challenging activities that will ensure that there is growth and learning (Ryan & Deci, 2000b). Intrinsic motivation is an important characteristic of motivation as it recognises and builds on learners' innate desire to learn. Furthermore, internally motivated learners have more enthusiasm and self-assurance, and are more inclined to persist when a task becomes

challenging, than learners who are predominantly externally motivated (Ryan & Deci, 2000b). Intrinsic motivation in mathematics is an important predictor of learners' achievements, and what long-term mathematical achievements learners will acquire (Singh, Granville, & Dika, 2002). Furthermore, intrinsic motivation in mathematics has a direct influence on learners' attitudes toward mathematics as well as an emotional impact on learners' "self-concept, confidence in learning mathematics … mathematics interest and motivation, and self-efficacy" (Singh et al., 2002, p. 324). This persistence is necessary for cognitive and social development (Ryan & Deci, 2000b). Learners are motivated to search for themselves for the required knowledge and understanding, which often leads to autonomy and competency as well as the achievement of long-term goals (Dailey, 2009).

Despite the innate inclination for learners wanting to learn and improve themselves, their intrinsic motivation needs to be maintained and enhanced (Ryan & Deci, 2000b). Learners' intrinsic motivation will become disrupted by conditions that challenge them or by the lack of support in tasks. These disruptions can be social or environmental. While learners remain in environments that enrich their tasks, it is easy to remain motivated. It is also possible to encourage internal motivation by encouraging learners' feelings or ability (Ryan & Deci, 2000b). Furthermore, "optimal challenges, effectively-promoting feedback and freedom from demeaning evaluations were all found to facilitate intrinsic motivation" (Ryan & Deci, 2000b, p. 70).

Intrinsic motivation and interest focus on "personal and situational interest" (Pintrich, 2003, p. 673). Personal interest refers to how learners persist with activities in which they are engaged for personal interest. Emotions also influence motivation (Ryan, 1995; Winberg et al., 2014): Winberg, Hellgren and Palm (2014) found that mathematics learners' emotions were impacted positively when they were competent. When their basic needs were met, the learners expressed positive emotions. Intrinsic motivation could stem from an emotional experience that took place in the past. This emotional experience could have stirred up positive emotions regarding the task in the present. Or the learner may have positive emotions in the present which compel the learner to complete or interact with the task, despite what may have taken place in the past (Winberg et al.,

2014). In all cases, however, intrinsic motivation moves beyond being simply compelled to interact and/or complete tasks for external reasons (Ryan, 1995). Instead, intrinsic motivation is "where the regulations or values have been taken in and transformed so they emanate from a sense of self… later lead[ing] to positive prospective emotions in similar situations" (Winberg et al., 2014).

Intrinsic motivation is not developed simply when learners feel that they can achieve. There needs to be a feeling of connectedness. This connectedness requires either immediate support or the internal ability to complete the task (Ryan & Deci, 2000b). Mathematics learners need to feel that they are competent as this impacts on their self-efficacy as well as their interest in the subject and its importance for future careers (Yu & Singh, 2018). Furthermore, because of social pressures and expectations, learners are often pressured into completing tasks that are not interesting, but which are necessary to do in order to become responsible learners and citizens (Ryan & Deci, 2000b). Research has shown that "attitudes toward mathematics are formed by social forces, [such as] attitudes of parents and teaches toward mathematics and specifically their attitudes toward children as learners of mathematics…affect the [leaner's] own perception of their abilities and interest" (Singh et al., 2002, p. 324). Part of SDT is the importance that learners become self-regulated and exhibit traits of self-regulation, even when there is no internal motivation. SDT focuses on determining what motivation is driving learners to act. These motivations have diverse values for learning, achievement, learners' experiences, as well as for the well-being of learners (Ryan & Deci, 2000b).

2.3.2.3 Extrinsic motivation

Extrinsic motivation, or external regulation, is the motivation to achieve a goal, not simply for the joy of it, but to complete another goal, such as praise, reward or avoiding a punishment (Dailey, 2009; Pintrich, 2003; Ryan & Deci, 2000b). In mathematics it is important to provide significant and reasonable motivations as well as "warm, caring and involved" teachers or parents (Pintrich, 2003). In this way learners will be able to relate to what is being taught as well as to others in their learning environment.

Extrinsic motivation is often characterised by short-term goals, meaning that learners are often not driven to continue an activity when the motivation is no longer present, or when

it becomes unnecessary for the learners to continue. In mathematics specifically, despite the strong correlation between completing homework tasks and better Grades (Hagger, Sultan, Hardcastle, & Chatzisarantis, 2015), learners need to be motivated to complete tasks, either through a form of punishment or by rewarding good work. When the sense of punishment or reward is not perceived to be strong enough, some learners choose not to complete tasks (Hagger et al., 2015). According to Dornyei (2009) if learners lose their extrinsic motivation, they can also lose their intrinsic motivation to continue. Furthermore, according to Ryan and Deci (2000b, p. 69), extrinsic factors can often "hinder or undermine self-motivation, social functioning and personal well-being" and prevent basic psychological needs from being met.

There are four types of extrinsic motivational styles: external, introjection, identification and integration (Ryan & Deci, 2000b). These styles "reflect a continuum from most externally controlled to internally controlled or self-determined" (Pintrich, 2003, p. 673). These different styles can lead to positive links between intrinsic motivation, engagement, deep learning, good results and happy learners (Ryan & Deci, 2000b). During the learning process, mathematics learners are involved in "a combination of intrinsic, extrinsic, social and individual factors" (Hannula et al., 2016, p. 18).

First, the external style is measured by others or is bound by rewards. For example, in mathematics this can be seen when "instructional measures ought to ensure that mathematics is presented in an interesting and attractive way" (Ma, 1997, p. 228). Secondly, "introjection" (Pintrich, 2003, p. 673) comes in to play where an activity is seen as something more than a means to an end, but is still measured by some type of external entity. In mathematics this can be seen when learners depend on indications from their teacher, parents or peers and are "constrained by the norms of classroom behaviour, including social goals, general class affect and more specific relationships with other students" (Hannula et al., 2016, p. 20). These associations with others are more highly valued than the subject itself; "such as grades indicating approval" (Hannula et al., 2016, p. 20). Although learners are motivated, the external style of motivation means that learners will always need others or rewards to measure their success.

Thirdly, “identification” (Pintrich, 2003, p. 673) refers to motivation which is internally measured and comprises a belief that the activity will add value and help achieve personal goals. The identification process impacts on the progression of learning as well as the opportunities learners were afforded during the learning process (Hannula et al., 2016). For example, learners move from feeling that mathematics is not needed, to the desire to increase their marks in the subject. This demonstrates “a new awareness of the importance of school success in general, together with a more positive self-efficacy beliefs” (Hannula, 2006, p. 170). When the activity is believed to add value, learners are still extrinsically motivated by the activity, but they are able to justify the time and effort the activity takes.

Finally, “integration … reflects high internal control and congruency between the self and values and goals” (Pintrich, 2003, p. 673). If learners feel that the mathematics environment that they are in will support their learning in the subject, they can relate to others in the environment; and if their teacher enjoys mathematics and enjoys teaching it, they are more likely to exhibit integration.

Another factor of motivation is self-confidence, thus the development of independent motivational practices. Self-confidence is developed through direct contact with a community of learning and through positive attitudes toward the community of learning. This contact and positive attitude encourages communications with members in the learning community (Dailey, 2009). Not only does this contact impact on the self-confidence of the learner, it also impacts on the learners’ attitudes and determination to succeed (Dailey, 2009; Dornyei, 2009). Learners’ self-confidence plays a vital role in their ability to perform in mathematics. However, it is important the learners have “the confidence to pursue … through studying harder” (Hannula, 2006, p. 170). When learners believe that mathematics is too difficult, their self-confidence is low, and this directly affects their motivation (Githua & Mwangi, 2003). Self-confidence is an important factor not only in mathematics and education, but also as a motivation to achieve in life. For this reason, it is important that the learners’ environment is conducive to uplift and develop self-confidence.

2.3.2.4 Self-regulated learning

Learners need to learn to self-regulate their learning. Self-regulation can be defined as thoughts and actions that learners initiate and sustain to achieve their goals (Cleary, Velardi, & Schnaidman, 2017) Self-regulation can be especially difficult when an activity that is being taught is not intrinsically interesting (Ryan, 1995). However, self-regulation is a necessary aspect of socialisation and the integration of individuals into society (Ryan, 1995). Within SDT, internalisation and integration are the terms that have been used to describe how individuals can begin to self-regulate (Ryan & Deci, 2000a); fulfilling "psychological needs for autonomy, competence and relatedness" (Ryan, 1995, p. 397). Psychologists agree that intrinsic inclinations toward integration are vital in social development (Ryan, 1995).

Internalisation is whereby an individual acknowledges the regulation. Integration is when learners start to allow the regulation to transform their sense of self (Ryan & Deci, 2000a). Moving from internalisation towards integration is a process (Ryan, 1995). Learners are expected to move from a place of opposition, to reluctant submission and hopefully towards "active personal commitment" (Ryan & Deci, 2000a, p. 60). As learners move towards integration there is "greater persistence, more positive self-perceptions and better quality of engagement" (Ryan & Deci, 2000a, p. 61). In mathematics this movement towards integration can be done through self-instruction, specifically when it comes to advanced concepts. However, direct instruction is useful for basic skills (Montague, 2008). Furthermore, "self-regulation strategies, such as self-instruction, self-questioning, self-monitoring, self-evaluation and self-reinforcement, help learners gain access to cognitive processes that facilitate learning, guide learners as they apply [mathematical] processes within and across domains and regulate their application [of mathematics] and overall performance of a [mathematical] task" (Montague, 2008, p. 37). Ryan (1995) suggested that teachers need to encourage this move towards integration by encouraging active learning, growing and integration rather than control outcomes or behaviour by using extrinsic means.

Montague (2008) found that introducing learners to problem-solving strategies in mathematics gives learners a tool to refer back to when they are unsure of the next step.

By equipping leaners with a tool to refer back to, learners are motivated to continue and pursue activities when they might otherwise give up. When learners persevered, they were demonstrating the integration of problem-solving skills. They were moving from simply knowing or memorising the problem-solving steps, to integrating them into their leaning. However, the moving from internalisation to integration is not a linear process. Learners can find themselves at any point in the process, often dependent on past experiences and the situation they find themselves in (Ryan, 1995; Ryan & Deci, 2000a). There is no obligatory sequence, but as individuals develop and mature, "behaviours and values can be assimilated" (Ryan & Deci, 2000a, p. 63). For example, learners might be introduced to a concept through some type of external reward and then become intrinsically motivated to continue and pursue the activity. The opposite can also be true. Learners might be intrinsically motivated to pursue an activity, but because of the degree of difficulty of the activity or challenging situations may go backwards (Ryan & Deci, 2000a). Therefore, perseverance is an important characteristic to instil in learners.

2.3.3 New approaches period: Possible selves

Possible selves is a recent approach whereby learners can imagine who they will be in the future, therefore motivating them to achieve in the present. The idea of possible selves includes "what they might become, what they would like to become and what they are afraid of becoming" (Dailey, 2009, p. 13). The idea of possible selves impacts on learners' motivation by encouraging learners to envision their future in the learning community and by allowing the external pressures placed on them to influence them to engage in the community (Brophy, 1999; Dailey, 2009; Dornyei, 2009).

The theory behind the idea of possible selves links motivation to learners' self-concept (Pourhasan & Zoghi, 2017), thus how they view themselves and what kind of future they envision for themselves (Dornyei, 2009). When learners are motivated to complete a task or activity, because they are able to envision it being useful to their future, they are able to create an image of their future selves (Dornyei, 2009). Possible selves is more than simply having an idea of what the learner would like to achieve in the future. Possible selves are the dreams and visions learners have for their future, a tangible idea and understanding of what they will achieve and become (Dornyei, 2009).

There are three essentials of possible selves, namely the ideal self, the ought-to-self and the learning experience (Dornyei, 2009; Pourhasan & Zoghi, 2017). First, the ideal-self is who learners would ideally like to be, the characteristic that learners would like to possess and allow to govern their choices (Pourhasan & Zoghi, 2017). Early on in learners' lives they begin to conceptualise their mathematical identity (Lutovac & Kaasila, 2014). This conceptualisation is a reflection and self-evaluation of what has happened in the past, the present and what could happen in their future, in regards to mathematics. A learner "enters into a dialog that leads to one's awareness of a tension or gap between the actual and the ideal state of mathematical identity" (Lutovac & Kaasila, 2014, p. 131) Learners' ideal-self "can act as a potent self-guide, with considerable motivational power". Ideal-self learners are people who society would consider "living up to their dreams" (Dornyei, 2009, p. 17).

Secondly, the ought-to-self is the attribute learners believe they need to possess to be who they want to be, such as living up to a family name, a social-status, one's class or any other preconceived individual or social idea (Dornyei, 2009; Pourhasan & Zoghi, 2017). In mathematics learners' ought-to-self is often influenced by gender (Lips, 2004). This has an impact on what learners believe they are capable of within the field of mathematics (L. A. Mills, 2016), as well as what they decide they are able to handle in a traditionally male-dominated field (Lips, 2004).

Thirdly, the learning experience is the motive the learner has for joining or being a part of the specific community of learning (Dornyei, 2009; Pourhasan & Zoghi, 2017). In mathematics learners might have had a negative past experience in a mathematics community. However, because they can envision their future-self needing mathematics, they may determine to join a mathematics community so as to enhance their future self (Lutovac & Kaasila, 2014). Moreover, the learning experience in the past may dictate how the learner makes decisions regarding future mathematics and science career choices. Specifically with female learners, the mathematics learning community may not be a choice, since they have not been able to envision themselves in the mathematical community (Lips, 2004). This may be linked to the perception that mathematical fields, such as engineering, are and should be, a male dominated community (Lips, 2004).

Possible-selves do not always automatically take place. Learners have to want a future for themselves. They need to imagine a self that is reasonable and in line with the expectations others have for them (Dornyei, 2009). These possible selves need to be modelled for learners, thus a life that is seen to be possible (Brophy, 1999; Dornyei, 2009) must be longed-for, and learners need to see the consequences or side-effects of not achieving their ideal-self (Dailey, 2009). For this reason, the learning experiences that learners are involved in needs to be positive and encouraged (Dornyei, 2009) and to focus on "understanding, appreciation and life application" (Brophy, 1999, p. 80). Possible-selves need to be modelled by the teachers and even encouraged by teachers.

2.4 MOTIVATION IN MATHEMATICS EDUCATION

Learners' views, emotions and attitudes toward mathematics are as important as the content that is being taught (Wilkins & Ma, 2003; Winberg et al., 2014). For example, how an individual feels about the teacher, as well as the social importance of mathematics and its role in the learner's future will impact on leaners' motivation (Wilkins & Ma, 2003) Thus, learners' attitudes towards mathematics and what compels them to participate or not participate with the content, influences their mathematics ability (Winberg et al., 2014). Learners' motivation to learn mathematics can be directly influenced by their emotions and attitudes towards the subject.

There are a number of factors that can impact on learners' motivation, including, cognitive, psychological, environmental or external issues (Novak, 2014).

2.4.1 Cognitive strategies

Cognitive strategies are the information provided in a social context (Olafsen, Deci, & Halvari, 2018) and how "quantitatively literate" learners are (Wilkins & Ma, 2003, p. 52). "A quantitatively literate person possesses a functional knowledge of mathematical content, an ability to reason mathematically, a recognition of the societal impact and utility of mathematics, an understanding of the nature and historical development of mathematics [and] a positive disposition towards mathematics" (Wilkins, 2000, p. 406). By introducing different motivational strategies in mathematics, teachers should be able to "exert positive effects on [learner] behaviour and academic outcomes" (Cleary et al., 2017, p. 29). These strategies could include ideas that are found in achievement goal

theory and attribution theory (Cleary et al., 2017). Learners are able to view themselves as being able to achieve a goal by mastery and performance, as well as attribute ways of overcoming failure.

Furthermore, it is important for teachers to introduce metacognition strategies, such as reflection, into the classroom to create a more authentic learning practice (Cleary et al., 2017). Reflection empowers learners to assess what tasks they were successful in and which they need to improve or change so as to be better prepared for related tasks in the future (Hannula et al., 2016).

Research (Beswick, 2011; Schukajlow et al., 2012) shows that the type of mathematical problem influences motivation, not necessarily the difficulty of the problem. Schukajlow et al. (2017) argue that mathematical problems that address the real world and connect the learners' reality to the problem, influence learners' motivation. Therefore, research focusing on mathematical content knowledge and learners' motivation to complete mathematics tasks is important.

2.4.2 Psychological factors

Psychological factors focus on leaners' attitudes towards mathematics as well as their mathematical anxiety (Novak, 2014). Psychological factors can include, learners' self-concept (Hannula, 2006; Novak, 2014), test anxiety (Hannula et al., 2016; Novak, 2014), interest in schooling (Hannula et al., 2016), attitude towards mathematics (Hannula, 2006; Novak, 2014), motivation (Hannula, 2006; Linnenbrink-Garcia et al., 2016) and locus of control (Linnenbrink-Garcia et al., 2016). Research in mathematics education indicated that attitudes, such as "curiosity, frustration, anxiety, surprise and elation" (Hannula et al., 2016, p. 2), have an impact on mathematics learning (Hannula, 2006). Learners' motivation toward mathematics can also be linked to their enjoyment and boredom (Linnenbrink-Garcia et al., 2016; Schukajlow et al., 2017; Winberg et al., 2014) in executing mathematics activities. Furthermore, learners' motivation can impact on their mathematical misconceptions. Misconceptions could occur when learners apply a rule incorrectly or generalise a concept in the wrong context (Luneta, 2015). When learners lack motivation, misconceptions can compound, which means learners are at risk of constantly having a low self-concept or negative attitude towards mathematics.

Teachers could influence learners' motivation to execute mathematical activities. Learners being taught by teachers who are themselves enthusiastic and have high self-efficacy, are also very motivated (Lazarides et al., 2018; Midgley et al., 1989). Learners view their teachers' enthusiasm "as enjoyment, excitement and pleasure" for their subject and their profession (Lazarides et al., 2018, p. 2), which, in turn, also changes their views pertaining to the subject (Lazarides et al., 2018). Furthermore, teachers can influence learners' motivation positively by ensuring that misconceptions in mathematics are addressed and opportunities for learners to address misconceptions are provided (Luneta, 2015).

2.4.3 Environmental factors

Environmental factors include "teacher engagement and attitude, clarity of instruction and performance expectations, social values … [and] can influence learning outcome and learner satisfaction" (Novak, 2014, p. 74). The learning environment impacts on learners' motivation which has a direct influence on learners' leaning outcomes and their learning enjoyment (Hannula et al., 2016; Novak, 2014). Additionally, the learning environment, specifically the mathematics classroom, is impacted by learners' needs. If a learner believes that mathematics is necessary, he will view the mathematics classroom more positively, resulting in greater motivational levels in the classroom (Hannula, 2006). The learning environment also impacts on learners' identities: "findings… showed that [learners] studying in different learning environments…developed different mathematical identities" (Hannula et al., 2016, p. 15).

Motivation can also be influenced by a lack of preparedness for how the learning environment works (Cleary et al., 2017). When learners are not mathematically prepared they may find it difficult to work independently and adjust to different learning styles (Grehan, Mac an Bhaird, & O'Shea, 2016). "Students will struggle…because of maladaptive motivational profiles…deficient metacognitive and strategic skills or inadequate feedback provided by others" (Cleary et al., 2017, p. 29). For learners who have not learnt how to motivate themselves, or how to adapt to varying motivational styles of teachers, others or the environment, struggle to stay motivated. A lack of these factors

can result in learners finding it difficult to overcome their lack of preparedness (Cleary et al., 2017).

2.4.4 External factors

External factors, such as, parents, or guardians, can also influence learners' motivation. The belief of parents or guardians, mostly though their support, could shape the perceptions of learners pertaining to mathematics (Lazarides et al., 2018; Midgley et al., 1989). The belief that parents or guardians have towards mathematics influences how the learners perceive mathematics. Because of this parents and guardians, as external entities, impact on learners' motivation.

The task value as well as the enjoyment or perceived value that learners place on mathematics can also influences learners' motivation, especially regarding the importance placed on the task at hand. This value is subjective to the learner and is often influenced by learners' chosen career path (Lazarides et al., 2018). For example, if a learner chooses a career in engineering, the stipulations indicated by the tertiary institution will influence learners' motivation to achieve.

2.5 AN OVERVIEW ON TUTORING

Historically, tutoring has been understood to be a specific pedagogy complementing learners' education. Tutoring focuses on the enhancement of learners' educational development, over longer periods of time and usually outside classroom contact time (Gabdulhakov, 2014). Tutoring can be seen as a formal structure that assist learners, either one-on-one or in a group setting, to enhance their understanding of a specific course (Duah et al., 2014). For the purpose of this study, tutoring is defined as formal assistance, given to learners, regarding mathematics content, knowledge and appropriate skills in a learning environment, in order to enhance learners' understanding of the subject.

The term 'tutor' derives from the Old French word *tutour* or the Latin *tutor*, from *tueri* meaning to watch or guard (*The Oxford online dictionary of English grammar*, 2014). A tutor is known today as a private, voluntary teacher who usually teaches individual learners or small groups of learners (*The Oxford online dictionary of English grammar*,

2014). A tutor can be seen as a specific type of teacher, who is engaged with the learner's holistic educational development (Gabdulhakov, 2014). Furthermore, the word can be linked to terms such as defender, protector or guard. However, a tutor is not a teacher, thus "it is not his/her job to convey information" (Palfreyman, 2002, p. 9). It is the learners' responsibility to find the information themselves.

Furthermore, tutoring is seen as an attempt to bridge the gap between what the teacher has taught and what the learners know, in order to get the learners to the level of what the teacher expects them to know. Tutoring assists learners when and where teachers are unable to, often due to high enrolment and busy teaching schedules (Clarence, 2018; Joubert & Snyman, 2017). A tutorial is a space where content is addressed and "put into a meaningful and practical context" (Joubert & Snyman, 2017, p. 129). Tutorials can create a fair environment where all learner's, irrespective of their academic background, have an opportunity to learn and improve (Layton & McKenna, 2016).

A peer-tutor is a tutor who has a place of influence in a learner's life; a fellow learner who they can relate to (Duah et al., 2014). A peer-tutor is someone who is able to elaborate and come alongside the learner in order to motivate, develop and strengthen the learner's content knowledge (Clarence, 2016). Peer-tutoring has been associated with improved academic performance in mathematics (Duah et al., 2014), as well as a positive attitude towards mathematics (Kroeger & Kouche, 2006). Furthermore, peer-tutoring has been shown to encourage learners to continue with mathematics even when they find the content difficult (Topping et al., 2003), and subsequently to improve their mathematics results (Clarence, 2018; Duah et al., 2014; Kroeger & Kouche, 2006; Topping et al., 2003). Limited literature was found addressing the disadvantages of peer-tutoring in South Africa or internationally. De Backer, Van Keer and Valcke (2015) suggests that further research needs to be done on "negative socio-emotional peer-interactions" since there is the opportunity that they might have a negative influence on the learners.

Tutoring also provides support to employees wishing to learn and progress in their work, for example "managers in industry, services sphere, medicine [or teachers]" (Gabdulhakov, 2014, p. 127). Furthermore, tutoring enables a number of social skills to be developed, such as a positive attitude toward specific content, engagement among

learners and aiding in accepted social skills in the learning environment (Kroeger & Kouche, 2006). Peer-tutors are most often used to give feedback on learners' performance and to provide extra academic support (Clarence, 2018). A tutor's role is to "create a sense of satisfaction, belonging and fulfilment with the learning environment" (Joubert & Snyman, 2017, p. 128). This academic support is specifically important in South Africa due to the inequalities in education resulting from socio-economic differences (Layton & McKenna, 2016).

Tutoring can be structured and can be conducted by qualified teachers or professionals. However, more commonly, tutors do not have any specific qualification or experience (Clarence, 2018; Joubert & Snyman, 2017; Layton & McKenna, 2016). Rather, they are learners who are capable and willing to tutor and/or simply assist learners (Clarence, 2018). They often need some guidance from teachers or other professionals (Clarence, 2018; Gabdulhakov, 2014). Tutorials or tutoring sessions are important since a teacher or professor tends to a distinctive way of thinking, while an array of ideas, learning styles and perspectives can be discussed in tutorials (Clarence, 2018; Joubert & Snyman, 2017). Tutoring, therefore, can limit learners' bias and strengthen learners' understanding and comprehension of topics or ideas (Underhill & Mcdonald, 2010). Thus, it is important for a tutor to encourage independent thinking and discussions between learners (Clarence, 2018; Underhill & Mcdonald, 2010).

2.6 HISTORY OF TUTORING

Tutoring, as an intervention strategy, can be traced back to the sixth century where it was used in medieval European universities in Oxford and Cambridge (Palfreyman, 2002). As the number of learners in a single class increased, so did tutoring, specifically peer-tutoring, until it became an accepted practice in universities around the world. Early in the 1990s South Africa also saw an increase in tutoring (Clarence, 2018) rather more noticeable at university than at school level.

In ancient Sparta during the six century, children as young as seven attended camps where mentors trained them to be warriors (Johnson, 1961). These camps were called *agoges* (Johnson, 1961) and focused on fighting skills as well as skills such as music, writing and reasoning. In Europe and America in the early 19th century, tutoring was

viewed as the collaboration of learners who had a common learning goal, namely "the principle of peer [tutoring] was based on the teaching of gifted boys to pass their knowledge to groups of their peers" (Alesksandrovna et al., 2015, p. 493).

Tutoring as a formal form of assistance first appeared in the 12th and 13th century at two British universities, namely Oxford and Cambridge (Ashwin, 2005; Korsakova & Korsakov, 2017), with the main focus on educating the clergy who would be "participating in cultural reproduction" (Alesksandrovna et al., 2015, p. 493). Since Christian leaders were the literate class at the time, monasteries were the learning communities. However, as the culture shifted from monasteries to cities, there was a need for the establishment of colleges. With the introduction of colleges and universities, there was a need for peer-tutoring, which greatly impacted on how teaching and learning has progressed (Ashwin, 2005).

By the 14th century, tutoring became an official part of the university system in Europe with the focus on three specific features. Firstly, the growth of a student's education had to be addressed by working with a lecturer and one or two other students. Secondly, tutoring needed to be done in collaboration with lecturers, whose functions were to supervise, guide and assist in the moral development of the student and finally to act as an academic tutor (Alesksandrovna et al., 2015). Slowly, tutoring became the foundation of university systems in Europe (Alesksandrovna et al., 2015; Ashwin, 2005; Korsakova & Korsakov, 2017; Palfreyman, 2002).

Tutors interacted with students as friends and the "main features of tutor lessons were informality…performing the functions of spiritual fathers and mentors" (Alesksandrovna et al., 2015, p. 493). Furthermore, students were responsible for discovering the means that they felt would be best to guide them to gain the necessary knowledge to complete their studies. Tutors were not conveyers of knowledge, but were to be "constructive critics who help sort out information, verify it, study possible ways of work and choose one approach over others" (Alesksandrovna et al., 2015, p. 494). Tutors attempted to create an environment, in most cases an informal environment (Palfreyman, 2002), where students were able to come up with their own interpretations of texts (Palfreyman, 2002). Practical teaching, where-by learners were able to develop skills of interpretation and

thinking, linked content with the learners' own experiences (Gabdulhakov, 2014; Palfreyman, 2002).

By the 17th century tutors guided students by looking at content and providing the means for students to make connections (Alesksandrovna et al., 2015). Tutors also provided skills for studying and ensured that students' worked diligently in order to be ready for their examinations, thus, tutors acted as counsellors and assistants (Ashwin, 2005; Gabdulhakov, 2014; Palfreyman, 2002).

Currently, tutors at British universities oversee class organisation, instruct - giving everyday classes, consult on subject matter, arrange subject content for students, administer research and organise intern programmes (Alesksandrovna et al., 2015). Tutorials do not replace other methods of instruction, but have become necessary weekly meetings for students and tutors (Palfreyman, 2002). Tutoring programmes produce students who are able to think for themselves and enter the world of work with the necessary skills to become effective citizens (Alesksandrovna et al., 2015).

In the South African context tutoring, especially at university level, is utilised as an important "pedagogical intervention to improve student retention" (Layton & McKenna, 2016, p. 296). Due to South Africa's past history of inequality, specifically during Apartheid, but even in the decades that have followed, "[learners] need to have a fair chance…to make sense of powerful disciplinary knowledge and generate new knowledge" (Layton & McKenna, 2016, p. 297). Tutorial systems, at university level, have become an intervention strategy to enable students an opportunity to gain the necessary knowledge to pass (Clarence, 2018; Layton & McKenna, 2016).

After-school private tutoring, also called supplementary tutoring or shadow education, are often expensive sessions that parents pay for (Kim, Gough, & Jung, 2018). There are also tutors, in the form of assistant teachers in the classroom, who are often paid by the school governing body (Grant, 2005).

Unfortunately, the option of tutoring only benefits the minority of South African learners whose parents can afford to pay for their children to attend private tutoring. Many learners from poor families are denied resources, such as access to a computer and internet

connection, or denied attendance at schools where governing bodies have a surplus income to employ additional assistant teachers to act as tutors.

2.7 ARCS MODEL OF MOTIVATION

Keller's (1987) ARCS model of motivation provides an effective framework to understand what influences learners' motivation to learn. The ARCS model was developed in a response to a need for an ordered and more logical way of recognising and solving problems in learners' motivation (Keller, 1987). Motivation should not simply be left to learners in the hope that they will take advantage of the "opportunity to learn" (Keller, 1987, p. 2). Motivation needs to be seen as a holistic endeavour, affecting the learner's education as a whole, rather than a casual idea, in the hopes that the learner will achieve something. The ARCS Model (Keller, 1987) results from the belief that people will engage in an activity if they recognise it to be beneficial to themselves and if the activity will meet their needs (Keller, 1987). Keller's (1987) ARCS model endeavours to stimulate and encourage learners' desire to achieve (Karakis et al., 2016).

Keller's (1987) ARCS model is based on the macro theory of motivation, namely self-determination theory (Milman & Wessmiller, 2016). A macro theory of motivation focuses on the learner as a whole (Deci & Ryan, 2008). Macro theory of motivation is interested in the development of personality, how learning is self-regulated, the psychological needs of the learner, the learner's hopes for the future, "energy and vitality, non-conscious processes, the relations of culture to motivation and the impact of social environments on motivation, affect, behaviour and well-being" (Deci & Ryan, 2008, p. 182). Macro-theory is interested in what motivates the learner to act (Gilal, Zhang, Gilal, & Gilal, 2018; Olafsen et al., 2018).

Keller's (1987) ARCS model of motivation attempts to focus on four aspects of a learners' motivation, namely attention, relevance, confidence and satisfaction (Keller, 1987). Keller's (1987) ARCS motivation model is a useful guide to understanding how learners are motivated. This model is designed to create healthy learning environments, while ensuring learners' motivation is addressed (Izmirli & Izmirli, 2015; Karakis et al., 2016) (see table 2.1).

Table 2.1: Modified subcategories of ARCS model of motivation (adapted from Keller (1987, pp. 4-5) and Keller (2000, pp. 4).

CATEGORY	SUB-CATEGORY	CODE
ATTENTION	Capture interest	*Incongruity* *Conflict* *Concreteness* *Variability* *Humour*
	Stimulate inquiry	*Inquiry*
	Maintain attention	*Participation*
RELEVANCE	Relate to Goals	*Experience* *Present Worth*
	Match Interests	*Future Usefulness* *Need Matching*
	Tie to Experiences	*Modelling* *Choice*
CONFIDENCE	Success Expectations	*Learning Requirements* *Difficulty*
	Success Opportunities	*Expectations*
	Personal Responsibility	*Attributions* *Self-Confidence*
SATISFACTION	Intrinsic Satisfaction	*Natural Consequences*
	Rewarding Outcomes	*Unexpected Rewards* *Positive Outcomes*
		Negative Influences
	Fair Treatment	*Scheduling*

2.7.1 Attention

The first category of Keller's (1987) ARCS model of motivation, *attention* (see table 2.1), aims to gain the learners' attention though varying "instructional design strategies or applications" (Izmirli & Izmirli, 2015, p. 57) but more importantly to keep the learners' attention (Milman & Wessmiller, 2016). Attention involves capturing the learner's interest, the first sub-category (Keller, 2000). Getting and keeping learners' attention can be achieved by using activities that involve numerous forms of collaboration, visual elements, mock-ups, varying forms of instruction, debate, inconsistency, inquiry and humour (Milman & Wessmiller, 2016). This can take place through introducing seemingly contradicting facts or experiences that the learner previously thought were true; "introducing two equally plausible facts or principles, only one of which can be true…playing devil's advocate" (Keller, 1987, p. 4), which is the *incongruity, conflict*

aspect. Providing different and varied ways of presenting mathematics content, such as using computer programmes, videos or group activities can keep learners attention and keep learners motivated (Novak, 2014). Demonstrating to the learners through visual examples or through "content-related anecdotes" (Keller, 1987, p. 4) would result in *concreteness.* Likewise, *variability or humour* might be achieved by changing the way the content was presented (Keller, 1987). These approaches are all aimed at stimulating inquiry and maintaining the attention of the participants.

Keller (1987) suggested teachers should address learners' emotions, rather than only gain their attention with excitement and noise. Teachers should focus on tangible ideas or specific examples that are part of the learners' everyday lives (Milman & Wessmiller, 2016). Keeping the learners' attention in the mathematics classroom could be done by using real-life examples of mathematical concepts to create a sense of wonder, amazement and interest (Milman & Wessmiller, 2016). For example, in mathematics, teachers could show learners videos of how mathematical functions can be used in everyday life (Novak, 2014), or use word questions, which include real-life examples, to grab the learners' attention. Another method, to create attention, could be to use storytelling to introduce an idea, however this should not detract from the lesson (Milman & Wessmiller, 2016). Storytelling in mathematics can empower learners, by giving them a voice and enabling them to actively construct their knowledge (Starčič, Cotic, Solomonides, & Volk, 2016). Invoking a sense of inquiry could also encourage interest in learners to help arouse attention. For example, mathematics teachers could include strategies, which encourage a sense of inquiry that could compel learners to pay attention, and could hold the learners' attention (Hodges & Kim, 2013). Ways to gain learners' attention may include 1) varying styles of presentation, such as text change, voices or presentation methods (Milman & Wessmiller, 2016); 2) presenting mathematical topics by encouraging learners to participate; 3) addressing topics in such a way that learners are interested (Hodges & Kim, 2013); or 4) using novel or graphically attractive (Novak, 2014) methods. Attention can be divided into three sub-categories – capturing interest, stimulating inquiry and maintain attention. These sub-categories can be further divided into codes in the analysis process (see column three in table 2.1).

2.7.2 Relevance

Relevance is the second category of Keller's (1987) ARCS model of motivation (see table 2.1) that ensures that learning fulfils the requirements for future study, or a chosen career (Izmirli & Izmirli, 2015; Milman & Wessmiller, 2016). The instructor, whether a teacher or a tutor, links content to familiar events or current happenings (Milman & Wessmiller, 2016). Furthermore, it is useful for the learner to be able to link learning, where possible, to multiple situations. Teachers should also link mathematics lessons to their future usefulness (Izmirli & Izmirli, 2015). Some strategies could include 1) relating the mathematics curriculum to real world issues; 2) addressing learners' educational needs; 3) linking present content to future needs; 4) clearly laying out objectives: 5) encouraging group work; and 6) addressing learners one-on-one (Milman & Wessmiller, 2016). Showing the relevance of mathematics increases motivation, as learners are able to see how mathematics content links to other subjects and to develop a greater understanding of why mathematics learning is necessary for them. The category of relevance is divided into three sub-categories – relate to goals, match interests and tie to experiences. These sub-categories can be further divided into codes when analysing the data (see column three in table 2.1).

Relevance can be addressed by integrating present day events and by linking content to other subject areas. The linking of subject areas can create an awareness that learning happens across subjects and not in a vacuum. For example, links between subjects can be seen in mathematical procedures, technology, as well as in the use of language when calculating unknown values in science formula (Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013; Novak, 2014). Milman and Wessmiller (2016, p. 96) state that "by placing the [learners] in roles, as opposed to worked models or examples, [learners] might be more likely to visualise the application of the material, as well as relate to it, and therefore be more motivated to learn from it". In addition, learners might be able to grasp the relevance of the content better if teachers explain the "goals, objectives and rationale" behind the learning, (Milman & Wessmiller, 2016, p. 70).

2.7.3 Confidence

Thirdly, Keller's (1987) ARCS model addresses the category of *confidence*. Once learners are aware of the relevance of the work to be completed, learners need to believe that they are capable of completing tasks. Confidence includes "people's self-confidence and their feelings of control over their lives and environment" (Keller, 1987, p. 3). When learners believe that they can achieve, their chances of successfully completing a task are increased (Keller, 1987). A learner's confidence places a vital role in his/her perseverance and achievement (Keller, 1987).

When learners feel confident to begin - and possibly complete - a task, their self-efficacy is addressed (Hodges & Kim, 2013). Focusing on what learners are able to do, enhances confidence in learners. By allowing learners to apply work and showcase what they have done, they are afforded the chance of feeling good about their work (Milman & Wessmiller, 2016). Confidence, according to Keller (2000), has three sub-categories – success expectations, success opportunities and personal responsibilities. These sub-categories can be further divided into coded for analysis (see column three in table 2.1).

Various strategies could be implemented to improve learners' confidence. Learners can be motivated by being encouraged to attend mathematics lessons to improve their knowledge of the subject. Teachers could organise mathematics content by sequencing it from easier to more complex (Izmirli & Izmirli, 2015), which could help learners feeling that they are able to complete tasks successfully, while ensuring that knowledge is deepened; and more challenging aspects to mathematical processes could be added. Other strategies could include establishing realistic opportunities given what is required to achieve mathematically; identifying areas that are challenging, and allowing learners to clarify where their strengths and weaknesses lie (Milman & Wessmiller, 2016). Furthermore, teachers can allow learners to control the pace of the lessons (Milman & Wessmiller, 2016).

2.7.4 Satisfaction

Satisfaction focuses on how learners feel about tasks they have accomplished. Personal satisfaction refers to the pride a learner feels when a task is completed (Izmirli & Izmirli, 2015; Keller, 2000). Although intrinsic motivation is important, it can be difficult to

influence. Intrinsic satisfaction occurs when learners receive the “recognition and evidence” (Keller, 2000, p. 2) that agrees with their intrinsic feeling about their accomplishments and when they feel “that they have been treated fairly” (Keller, 2000, p. 3). External motivation, through awards or praise, is easier to influence. Extrinsic rewards can be either functional or representative such as the receiving of “grades, privileges, promotions, certificates… [or other] tokens of achievement” (Keller, 2000, p. 3). It is important that learners feel that they have been treated fairly, the work load was reasonable and , consistent, and that there was no discrimination (Keller, 2000). The category of satisfaction can be divided into three sub-categories – intrinsic satisfaction, rewarding outcomes and fair treatment. The sub-categories can be further coded for analysis (see column three in table 2.1).

Strategies for satisfaction could include providing feedback and support to learners by means of praise and hands-on activities (Milman & Wessmiller, 2016). These strategies are effective if feedback is fair, aligned with given objectives and timeous. In a mathematics classroom learners’ satisfaction is influenced by learner anxiety, teachers’ attitudes towards teaching, the perceived usefulness of the subject, level of difficulty, different forms of assessments as well as the flexibility and quality of instruction (Novak, 2014).

2.8 CHAPTER SYNTHESIS

This chapter focused on the conceptualisation of motivation. Motivation is what gets learners moving and acting. In mathematics, motivation is important to get learners to see the significance of mathematics, not only to achieve good results in the subject, but also to begin to understand the impact it will have on their future.

There have been three distinct periods in research on motivation, namely social, cognitive and, more recently, new approaches focusing on possible selves. During the social psychological period, the attribution theory and the achievement goal theory emerged. Cognitive research addressed the self-determination theory, intrinsic and extrinsic motivation and self-regulation. Finally, the new approaches to motivation focus on the possible selves – how learners feel about themselves and how this impacts on their motivation in mathematics.

The history of tutoring and its development since the 11th century was discussed as well as how it now seems to be a necessary part of British and American university experiences. Peer-tutoring was considered as was the role it plays in the tutoring system.

Lastly, Keller's, (1987) ARCS Model of Motivation was outlined focusing on the self-determination theory. Attention, Relevance, Confidence and Satisfaction were addressed in his model were elaborated on here.

Chapter 3 will address the research design and methodology used in this study. The research design will focus on the research question, design paradigm and methodological assumptions. The research methodology section will elaborate on the data collection processes and, the data analysis procedures.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

Chapter 3 will focus on the research design and the methodology used in this study. A research design is the

> …way in which a research idea is transformed into a research project. … decisions about how the research itself is conceptualized, the subsequent conduct of a specific research project and ultimately the type of contribution the research is intended to make to the development of knowledge in a particular area. (Given, 2008, p. 761)

The research design is a type of plan or map that shows the rational planning behind moving from a study-thought, to collecting and analysing data, drawing up findings and, finally, making conclusions (Given, 2008; Merriam & Tisdell, 2016). Research methodology is "the tools or techniques with which researchers collect their data" (Given, 2008, p. 516). These tools or techniques need to be chosen carefully from the goals and aims of the study.

> Decisions about qualitative research methodology include a) selection of guiding paradigm; b) identification of research questions; c) development of a formative conceptual model; d) site selection, study population and study sample; e) topics, procedures and tools for data collection; f) and procedures for data analysis and interpretation. (Given, 2008, p. 517)

According to Given (2008, p. 761) there are three components that are loosely associated or linked in a research study, namely "theoretical, methodological and ethical considerations". Theoretical considerations entail the "theoretical understandings and assumptions" (Given, 2008, p. 761) that the researcher has. These assumptions are derived from theory, as well as the experiences brought to the study by the researcher. These theoretical considerations inform the research design throughout the whole study (Given, 2008). The methodological considerations include the actions taken during the study to test existing theories or create new theories (Given, 2008). Ethical considerations ensure that the researcher's conduct is appropriate and honest (Given, 2008).

The chapter will begin by explaining what brought about the specific research question for this study. Then, the researcher's assumptions which were considered for the study will be interrogated, followed by an outline on the data collection process. Finally, the data analysis procedures will be discussed.

3.2 THE RESEARCH QUESTION

Research, specifically qualitative research, starts with an intellectual curiosity which leads to a question (Denzin & Lincoln, 2000). This curiosity involves real people that the researcher wants to spend time with in a social setting. By spending time with people in a setting that satisfies the researcher's curiosity, the researcher starts to "understand the meaning of participants' lives in the participants' own terms" (Denzin & Lincoln, 2000, p. 382). This curiosity and questioning informs the researcher's observations and directs the research design (Denzin & Lincoln, 2000). Furthermore, questions offer an opportunity to understand and predict what will come next (Creswell, 2013a).

This inquiry was brought about by the curiosity of how peer-tutors conceive their role as motivators. Keller's model of motivation (1987) that addresses *Attention*, *Relevance*, *Confidence* and *Satisfaction* (ARCS), was considered. In this regard, Keller's (1987) questions and strategies for promoting and accessing learners' motivation led this inquiry. The approach for this study was to focus on the extent to which Grade 12 peer-tutors conceived their role as motivators. These conceptions were gauged through interviews, observation and reflection.

This curiosity and questioning led to the main question and sub-questions presented in sub-section 1.5.2. For ease of reference, the questions are repeated here.

Main question: How do the conceptions of Grade 12 peer-tutors, of their role as motivators for Grades 8 and 9 mathematics learners, compare with Keller's (1987) ARCS model of motivation?

Sub-questions:

- What are Grade 12 peer-tutors' views of their role as motivators for Grades 8 and 9 mathematics learners?

- In what ways do Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners?

3.3 RESEARCH DESIGN

3.3.1 Defining a paradigm

A paradigm can be defined as a "basic set of beliefs that guide action … dealing with first principles or ultimate's" (Denzin & Lincoln, 2008, p. 245). Paradigms are human constructs that define how the researcher views and interprets the world (Denzin & Lincoln, 2008; Thanh, Thi, & Thanh, 2015). A paradigm incorporates four assumptions: "ethics (axiology), epistemology, ontology and methodology" (Denzin & Lincoln, 2008, p. 245). Ethics focuses on answering questions about morality. Epistemology focuses on questions dealing with knowing the world and the researcher's place in it. Ontology focuses on raising questions about what reality is and what man's purpose in the world is. Methodology focuses on the best means of collecting knowledge (Denzin & Lincoln, 2008).

3.3.2 Assumptions

3.3.2.1 Philosophic assumptions

Axiology is "the branch of philosophy dealing with ethics, aesthetics and religion" (Denzin & Lincoln, 2008, p. 265). Using a broad view of axiology helps interpretivist inquiry models attain better flow. The researcher's beliefs will influence

> the choice of the problem, choice of paradigm to guide the problem, choice of theoretical framework, choice of major data-gathering and data-analytic methods, choice of context, treatment of values already resident within the context and choice of formats for presenting findings. (Denzin & Lincoln, 2008, pp. 264–265)

Axiological assumptions need to be indicated in the study, especially how the researcher positions him/herself in the study in order to address biases that will arise (Creswell, 2013a). Due to the proximity of the researcher to the participants in an interpretivist paradigm (see section 3.3.2.2) and because of observation bias, during observations, there will be a degree of researcher bias in this study. Interpretive inquiry focuses on "understanding the meanings, purposes and intentions people give to their own actions and interactions with others" (Given, 2008, p. 459). For this reason, "objectivity,

subjectivity and relativism [are understood to be less] scientific… meaning that the knowledge claims made by researchers cannot be seen as automatically and inevitably superior to the knowledge claims made by no researchers" (Given, 2008, p. 459). This study, will therefore assume "that the outcome of the research will reflect the values of the researcher, trying to present a balanced report of the findings" (Kivunja & Kuyini, 2017, p. 34). For this study, encouragement by peer-tutors will be valued, specifically that peer-tutors should create a fair environment (Layton & McKenna, 2016) to encourage learners (Topping et al., 2003) to develop mathematics proficiency. It will be valued if peer-tutors could provide extra academic support to learners (Clarence, 2018).

In this study, because of the researcher bias that will arise, both from the proximity of the researcher and observation bias that will take place, the researcher will ensure that full ethical considerations, will be adhered to (see section 3.4.4). For this research it is important that the researcher values the participants' privacy (Kivunja & Kuyini, 2017). Accuracy of the findings will also be valued in the study (Kivunja & Kuyini, 2017). The researcher will ensure the trustworthiness of the findings (see section 3.4.3). Finally, during observations the researcher will not inject herself into the tutoring, unless approached.

Epistemology is "the sub-discipline of philosophy concerned with the truth status of knowledge that can be achieved either by observation or by interference" (Bellamy, 2011, p. 61). Epistemological assumptions in qualitative studies refer to researchers getting to know the participants in the study well. In this study an interpretivist paradigm was used; this focuses on the implications of observations and supposes that "reality is always something we make or construct" (Given, 2008, p. 460). The interpretivist paradigm infers that there is no one way that knowledge is created, rather knowledge is created by certain groups' insights and practices (Thanh et al., 2015). Furthermore, no one can judge an interpretation or belief as simply right or wrong. In this study, as the researcher gets to know the participants, knowledge will be created which will be linked to the participant and the researcher's view. The epistemology of this study is based on the theories of motivation and specifically on Keller's (1987) ARCS model of motivation. It is important in this report for the researcher to be submerged in the field with the participants to better

understand their insights and practices. It is important for the researcher to limit the separation between the researcher and participant (Creswell, 2013a).

Ontology is “the sub-discipline of philosophy which is concerned with the question of what exists and what status we are ascribing [to things]” (Bellamy, 2011, p. 60). Ontological issues “relate to the nature of reality and its characteristics” (Creswell, 2013a, p. 20). In qualitative research, researchers, participants and readers are accepting that there are multiple realities. For this reason, in this study it is important for the researcher to report the multiple realities. “Evidence of multiple realities includes the use of multiple forms of evidence in themes using the actual words of different individuals and presenting different perspectives” (Creswell, 2013a, p. 20). An important reality in this study is that the participants are new to peer-tutoring and they have no formal training, other than their academic ability to achieve, in mathematics. Furthermore, the participants are fellow learners themselves; they do not have any formal knowledge of motivation or the theories behind motivation.

3.3.2.2 Meta-theoretical position and assumptions

For this study, an interpretivist paradigm was adopted. An interpretivist paradigm focuses on how individuals experience their world (Creswell, 2013a; Thanh et al., 2015), and describes reality from the participant’s point of view and understanding (Creswell, 2013b). For this study, the peer-tutors’ conceptions of Grades 8 and 9’s motivation were important. The researcher chose to focus on how the peer-tutors experienced the world of peer-tutoring to identify their views on what their role as motivators were. Interpretivist researchers make discoveries of reality by focusing on the participants’ views and their own context and practices (Thanh et al., 2015). The researcher makes his/her own interpretation of the data gathered, allowing for different perspectives of what is true. Therefore, it is important that the researcher has an understanding of the context in which the data is collected (Thanh et al., 2015). In this study, the peer-tutors were learners themselves and the researcher was a teacher at the school. This meant that the researcher had a good understanding of the context and of the participants who were all familiar with the researcher.

Since the focus of an interpretivist paradigm is on the lived experiences of the individuals, subjectivity is going to arise. An individual's subjectivity, as well as the researcher's subjectivity, is a part of an interpretivist paradigm. (Willis, Jost, & Nilakanta, 2007). It is important for researchers to understand how their beliefs and views impact on the choices they make in the study (Creswell, 2013a). Again, since the researcher was a teacher at the school where this study was conducted and the peer-tutors were current learners at the time the study was taking place, it was important for the researcher to be aware of the subjectivity, and to acknowledge it.

3.3.2.3 Methodological assumptions

"Research methodology consists of the assumptions, postulates, rules and methods – the blueprint or roadmap – that researchers employ to render their work open to analysis, critique, replication, repetition and/or adaptation and to choose research methods" (Given, 2008, p. 516). Methodology is not only the method of how research is conducted but also "the sense of using appropriate techniques in the correct way" (Bellamy, 2011, p. 11). According to Bellamy (2011) methodology is understood to be the process of moving from findings in empirical research, to making extrapolations about the truth. These methods differ when conducting qualitative and quantitative research.

For qualitative research there are three interconnected aspects: research approaches, who is being studied and the topics being studied (Lichtman, 2006) (see Figure 3.1). Although it is advisable to start with a research question and topic, the research process does not always follow a linear progression. The research approach enables the researcher to plan the research, it gives the researcher steps to follow, and grounds the research on a conceptual and philosophical level (Lichtman, 2006). Qualitative research also focuses on who the researcher wants to focus on. The researcher chooses the type of individual that will best meet the requirements for the study and from there will select a sample (Given, 2008; Lichtman, 2006). The third aspect that makes up a qualitative research study is the topic that the researcher chooses. The topic drives the study as well as the research question (Lichtman, 2006).

Figure 3.1: Intermingling of research ideas (From Lichtman, 2006, p. 26).

a) Research approach

It is important, when distinguishing different research approaches, to "assess the central purpose or focus of each approach" (Creswell, 2013a, p. 121). Creswell (2013a) suggests that when choosing an approach the researcher should start with the desired outcome – "what the approach is attempting to accomplish" (Creswell, 2013a, p. 124). Moreover, other factors should be considered: what approaches are used by experts in the field, what knowledge the researcher has of the various approaches, what is required in a particular research field, and finally what approach the researcher is most comfortable with (Creswell, 2013a).

An inductive and deductive approach will be used for this research. Often researchers change between the two approaches in order to ensure that the data is completely interrogated. A deductive approach works "from the general to the specific" (Lichtman, 2006, p. 11). This approach is appropriate because it was believed, before the study was conducted, that a tutor programme with peer-tutors could influence Grades 8 and 9 learners' motivation (Bellamy, 2011; Lichtman, 2006). "The aim of deductive research is to test a statement that is formulated before [data is created or collected]" (Bellamy, 2011, p. 76). An inductive approach "deals with specifics and moves to the general…moves

from concrete to the abstract" (Lichtman, 2006, p. 11). Researchers begin the study with data and then the data are used to begin to understand the phenomena and interactions that are studied (Lichtman, 2006).

There are five phases to an inductive analysis. Firstly, the researcher needs to engage in the setting where the research will take place. Secondly, thoughtful reflection is necessary in "becoming aware of nuance and meaning in the setting and capturing intuitive insights, to achieve understanding" (Denzin & Lincoln, 2000, p. 391). Thirdly, a time of meditation should be set aside, which could allow the researcher's awareness to be expanded. Fourthly, a time of clarification should be prioritised where the researcher describes and explains the experience of the individuals in the study. Finally, the researcher should be able to give meaning to the lived experience by bringing the story together (Denzin & Lincoln, 2000). The purpose of this is to "describe and to explain the essence of experience and meaning in participant's lives" (Denzin & Lincoln, 2000, p. 391).

Since inductive conclusions are likely to be true (Given, 2008), for this study it is believed that the peer-tutor's conceptions of motivation will align with the four aspects of Keller's (1987) ARCS model of motivation, which addresses *Attention*, *Relevance*, *Confidence* and *Satisfaction*. Themes are constantly "checked against the data" (Creswell, 2013a, p. 45). For this study the four themes will be *Attention*, *Relevance*, *Confidence* and *Satisfaction* as defined by Keller (1987). A shortfall with a deductive approach is that it is "rigid" (Bellamy, 2011, p. 77). The research is limited by the statement that is put forth. Furthermore, the research might not be conclusive. However, deductive research enables the researcher to build on previous research. "It is explicitly designed to be cumulative in relation to existing knowledge" (Bellamy, 2011, p. 77). This study builds on Keller's (1987) research on motivation, which addresses ways to recognise and solve problems in leaners' motivation (see 1.7.1 and 2.7).

b) Research strategy

This study used a descriptive case study to determine the individuals' ideas (Given, 2008) and to describe the mediation of a "real-life context" (Baxter & Jack, 2008, p. 548). A descriptive case study focuses on detailed assumptions and questions regarding a

phenomenon (Tobin, 2012). The assumptions and questions are “carefully scrutinised and articulated at the outset” (Tobin, 2012, p. 289) A case study approach was used to “inquire and highlight specific differences in the analysis and representation of the data” (Creswell, 2013a, p. 189). A descriptive theory was used in order to articulate “what is already known about the phenomenon” (Tobin, 2012, p. 289). A case study allowed the researcher to conduct an in-depth inquiry of a particular aspect of the mentoring programme at the selected school, namely ten Grade 12 peer-tutors’ conceptions of their role as motivators.

The advantages of using a case study is that the researcher is able to relate and compare “specific goals and contexts” (Given, 2008, p. 68). Case studies allow the researcher to have descriptive goals which permits the researcher to determine “specific mechanisms and pathways between causes and effects” (Given, 2008, p. 69). The researcher is able to work closely with the participants, in order to tell their stories (Baxter & Jack, 2008). Furthermore, case studies allow the researcher to make strong comparisons that allow for deep analysis – “conceptual richness and theoretical consistency” (Given, 2008, p. 69).

In this study, each peer-tutor was asked the same questions in the pre- and post-interviews, they were each required to answer the same weekly reflections and all the peer-tutors were observed by the researcher. However, the questions asked and discussed by the learners were not necessarily the same. The content that the peer-tutors tutored was not necessarily the same. Because of these differences, a case study was a good choice as it allowed the researcher understand the variations between the cases (Baxter & Jack, 2008).

c) Research choice

A qualitative research method was used for this research, describing the conceptions of the peer-tutors “as fully and richly as possible” (Fraenkel, Wallen, & Hyun, 2012, p. 425). Qualitative research begins with a research question, instead of an objective or hypotheses. The research question can be further broken down into sub-sections (see section 3.2) (Creswell, 2014). The research question and sub-sections for this research were best addressed using qualitative research. In addition to starting with the research

question, qualitative research has a number of differing ideas as to what it is and what it entails (Given, 2008; Lichtman, 2006). “Qualitative research is a situated activity that locates the observer in the world” (Denzin & Lincoln, 2000, p. 3). In this research the ‘world’ is understood to be the tutorials.

Qualitative research is understood to be an over-arching term, a way of “knowing that assumes that the researcher gathers, organises and interprets information with his or her eyes and ears as filters” (Lichtman, 2006, p. 22). Qualitative research method is understood to be the approach the researcher takes in collecting, analysing and reporting findings. This approach enables the researcher to better understand social or human problems (Creswell, 2013a). Qualitative research focuses on in-depth interviews and observations of humans active in their natural settings, as well as in their social settings (Lichtman, 2006). For this reason, data were collected through interviews and reflections - the researcher’s ears - as well as observations - the researcher’s eyes. The qualitative research method was the most suitable method for this research since it allowed the researcher to better understand the social problem of motivation amongst learners in their social settings.

d) Time Horizon

The time frame for collecting data for this study was nine months. The researcher began with the pre-interviews in late February and continued with observations from May to August. After completing all the observations, post-interviews were conducted from August to October and weekly reflections were submitted. Once all the data were collected, interviews were transcribed and the data analysis process began.

3.4 DATA COLLECTION PROCESS

This section discusses the data collection processes. Information relating to the data collection instruments is also discussed (see section 1.8). The instruments used to collect data - interviews, weekly reflections and observations – were selected to answer the research question and sub-questions. Then, the sampling procedures are deliberated (see section 1.8). The trustworthiness of the processes is described (see section 1.9) and an outline of the data collection process is presented.

3.4.1 Data collection instruments

3.4.1.1 Aim of data-collection instruments

For this study, it was anticipated that the research question and two sub-questions (see section 1.5) would be addressed using qualitative questioning. The sub-questions aimed at determining the views peer-tutors held of their role as motivators how they felt that they executed their role as motivators and how their conceptions of their views aligned with Keller's (1987) model of motivation (compare sub-section 1.5.2). The collection of the answers to these questions, would address the main research question (compare sub-section 1.5.1).

The research question determined the choices of the instruments for the study and the literature supported these choices. The instruments were chosen to provide the researcher with an in-depth understanding of the participants' stories as well as their conceptions of learners' motivation for the case study. Furthermore, three different instruments were used in order for trustworthiness of the study to be established. First, one-on-one semi-structured interviews with peer-tutors were conducted at the beginning and end of the research period. Secondly, observations of the peer-tutors were made during the tutorials. Lastly, weekly reflection reports obtained from the peer-tutors, consisting of open-ended and closed questions, were used as data collection instruments.

3.4.1.2 One-on-one semi-structured interviews

One-on-one semi-structured interviews were conducted before the peer-tutors began tutoring and then again at the end of eight weeks of tutoring (see tables 3.1 and 3.2). Interviewing is a conversation between the "interviewer and an interviewee … the conversation is carried out to serve the researcher's ends, which are external to the conversation itself" (Given, 2008, p. 470). Semi-structured interviews allow the researcher to have an agenda, while still allowing for the "spontaneous descriptions and narratives"(Given, 2008, p. 470) The interviews aimed to give insight into the conceptions of the peer-tutors (Creswell, 2013b) and to answer the research question (Roulston, 2010). The interviews were used as a starting point to understand and to identify how the peer-tutors understood their roles as peer-tutors. Moreover, the interviews allowed the peer-tutors an opportunity to verbalise their thoughts and give further explanations to what they would do and had done during the tutorials. The interview questions were

conceptualised around the aims of the study (see section 1.5.2), as well as the four categories of Keller's (1987) ARCS model of motivation, namely *Attention, Relevance, Confidence* and *Satisfaction.* In the pre-interview schedule there were 11 open-ended questions (see Appendix A). In the post-interview schedule there were ten open-ended questions (see Appendix B).

3.4.1.3 Observation sheets

Direct observation was done using observation sheets (see Appendix C). Direct observation is how a researcher collects impressions of the world through one's senses, but mainly observing and listening (Given, 2008). Qualitative observation focuses on capturing the lived experience of participants (Given, 2008).

The observation sheet focused on the four categories of Keller's (1987) ARCS model of motivation, namely *Attention*, *Relevance*, *Confidence* and *Satisfaction*. Each category was further divided into the sub-categories that Keller (2000) used in more recent research. The researcher noted her observations based on these categories and sub-categories. Although an observation sheet was used, the researcher noted the behaviour of the peer-tutors as it occurred naturally.

3.4.1.4 Reflection reports

Eight weekly reflection reports were handed out to the tutors to complete once a week for eight weeks after they had completed the pre-interview and were collected after the post-interview. These reports had questionnaire type questions, comprising between five and eight open- and closed-ended questions (see Appendix D). All the questions aligned with Keller's (1987) ARCS model of motivation categories and sub-categories. Weeks one and five addressed *Attention*. Weeks two and six addressed *Relevance*. Weeks three and seven addressed *Confidence* and weeks four and eight addressed *Satisfaction*.

Questionnaire-type questions encouraged the peer-tutors to reflect on the tutoring process. These questions added value to the study and "added depth and richness to the data set" (Given, 2008, p. 846). Open-ended questions provided more freedom to the researcher "in terms of how to frame the questions" and also more freedom to the peer-

tutors to respond in a way that they believe best (Given, 2008, p. 846). All closed-ended questions were followed with an opportunity to explain the peer-tutors answer.

3.4.2 Sampling procedures

3.4.2.1 Research context

The public high school, with an active school governing body, at which this study took place, is a large, high-achieving, diverse, ex-model C school (see section 1.8). The researcher chose this school as she is a teacher at the school. Additionally, the school has a peer-tutor programme utilising peer-tutors to assist Grades 8 and 9 mathematics learners, who have difficulty with the learning of mathematics or underperform in the subject (see section 1.4). The peer-tutor programme runs on four afternoons a week. The peer-tutoring programme is based on the belief, held by teachers at the school, that learners feel more comfortable asking for assistance from fellow learners and that they relate better to older peers than to their mathematics teachers, due to power imbalances.

3.4.2.2 Population and sample

A convenient and purposive sample technique was used to select participants. A purposive sample is a nonprobability sample where the sample is chosen based on a particular criteria (Given, 2008). For a purposive sample the population needs to be defined before the sample can be selected (Given, 2008). Data obtained from purposive sampling is information-rich (Suri, 2011). The use of a purposive sample allowed the researcher to choose participants who met the objectives of determining how Grade 12 learners conceived their role as peer-tutors for Grades 8 and 9 learners. The sample was convenient as the participants attended the school where the researcher was a teacher. Criteria used to select participants were as follows: a) a Grade 12 learner; b) takes mathematics as a subject; c) was a top achiever (average greater than 80% for mathematics in Grade 11); and d) was willing to participate in the study.

For this study, the population consisted of 175 Grade 12 learners who took core mathematics as a subject. Of these 175 learners, the top 15 Grade 12 mathematics learners from Grade 11 were approached by the researcher and the HOD of mathematics at the school to enquire whether they would be willing to assist in the peer-tutor programme. From these 15 learners, ten learners voluntarily agreed to participate in this

study. They participated in pre- and post-interviews, completed weekly reflections and were willing to be observed during the tutorials.

3.4.2.3 BIOGRAPHICAL DATA OF PEER-TUTORS

The peer-tutors (PT) chosen for this study were ten learners selected from the top fifteen mathematics learners identified by the school to act as tutors. These learners were all in Grade 12, obtained 85% or higher for their Grade 11 final mathematics mark, and agreed to participate voluntarily in the study. The peer-tutors' ages were all between 16 and 18. Four of the ten learners were female (40%) and six were male learners (60%) as illustrated in Figure 3.2.

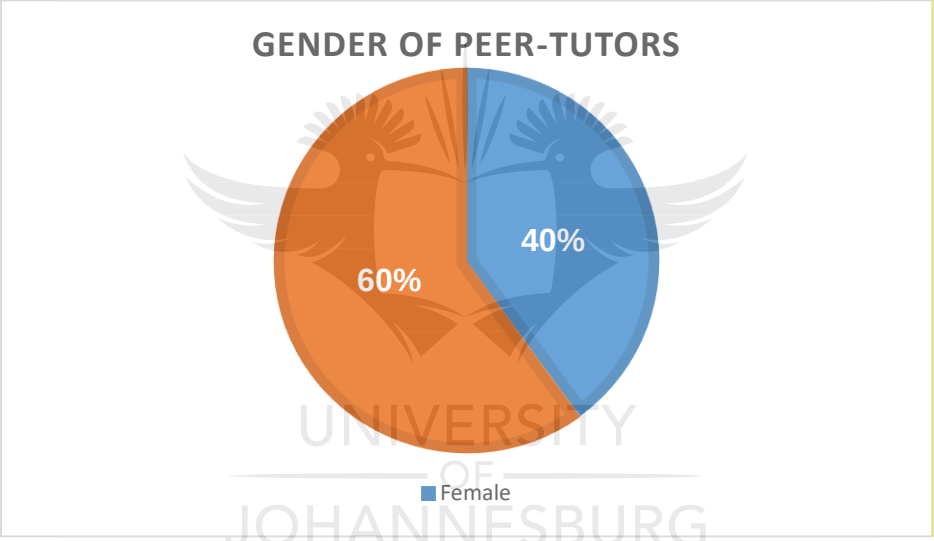

Figure 3.2: Gender of peer-tutors

Eight of the ten peer-tutors were white (80%), one peer-tutor was black and one peer-tutor was Indian as presented in Figure 3.3.

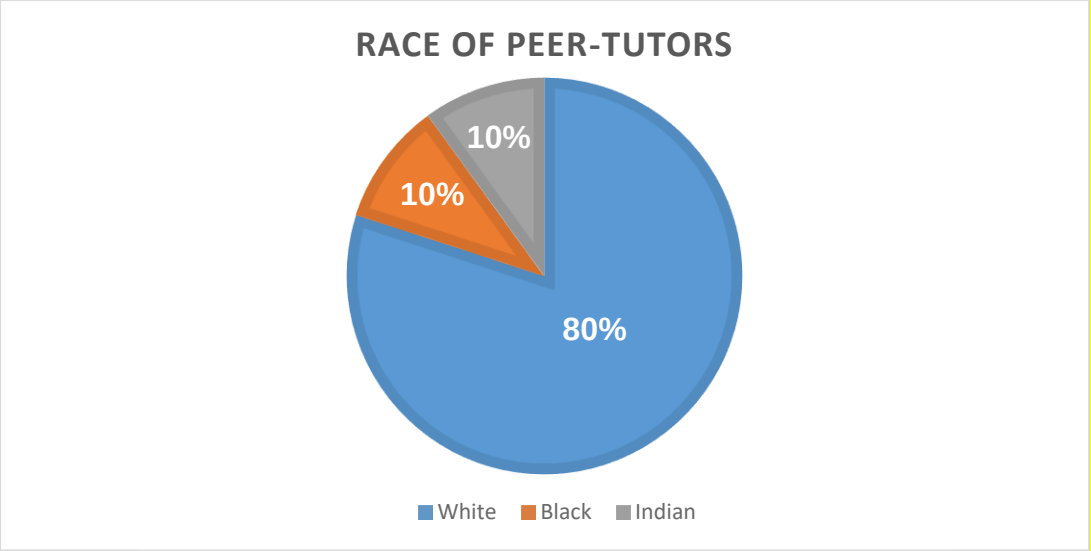

Figure 3.3: Race of peer-tutors

3.4.2.4 Data collection processes

Data collection commenced in the last week of February 2018 and concluded in September 2018 when the Grade 12 learners began writing their final examinations, thus a period of seven months. The interviews were conducted after school in a classroom, on the school property.

First, pre-interviews were conducted at the peer-tutors' convenience from late February to early March of 2018. Table 3.1 displays the pre-interview schedule (see Appendix A for interview questions). These provided a basis for determining how the peer-tutors understood their role as motivators in order to answer the sub-questions:

- What are Grade 12 peer-tutors' views of their role as motivators for Grades 8 and 9 mathematics learners?
- In what ways do Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners?

Table 3.1: Pre- interview schedule.

Peer-tutor	Date	Time	Location	Comment
PT1	27 February 2018	14:16 – 14:23	P4	
PT2	6 March 2018	14:25 – 14:30	P4	Changed interview day because of a leader commitment
PT3	26 February 2018	14:11 - 14:14	P4	
PT4	21 February 2018	13:10 – 13:15	P4	
PT5	28 February 2018	13:15 – 14:21	P4	
PT6	28 February 2018	13:25 – 13:29	P4	Wanted to come with a friend so came earlier
PT7	6 March 2018	14:32 – 14:37	P4	
PT8	14 March 2018	14:16 – 14:21	P4	
PT9	14 March 2018	14:25 – 14:31	P4	
PT10	20 February 2018	14:20 – 14:28	P4	Decided to come on this date since he was available

During the eight weeks that the peer-tutors were completing the weekly reflection reports, May 2018 through to late August 2018, Table 3.2 presents the observation schedule, the researcher also conducted observations. Each peer-tutor was observed at least once. The data obtained from these observations were recorded on the observation sheets comprised of the four categories, as well as the sub-categories laid out by Keller (1987) (see Appendix C). The observations enabled the researcher to view the peer-tutors while they actively engaged with the learners.

Table 3.2: Observation Schedule.

Peer-tutor	Date	Time	Location	Comment
PT1	7 May 2018	14:10 – 15:00	P4	
PT2	23 May 2018	13:04 – 13:30	P4	Only two learners came for tutoring
PT3	24 July 2018	14:15 - 14:30	P4	Peer-tutors arrived late
PT4	26 July 2018	14:10 – 14:35	P4	
PT5	26 July 2018	14:10 – 14:35	P4	
PT6	24 July 2018	14:15 – 14:30	P4	Peer-tutors arrived late
PT7	7 August 2018	14:10 – 15:00	P4	
PT8	23 August 2018	14:11 – 14:50	P4	
PT9	23 August 2018	14:11 – 14:50	P4	
PT10	31 May 2018	14:10 – 14:45	P4	

Also, the peer-tutors were given eight weekly reflections to complete During the weeks after the pre-interviews, the peer-tutors submitted eight weekly-reflection reports, from May 2018 till September 2018. Table 3.3 illustrates the schedule for the weekly reflections, which also assisted the researcher in answering the sub-questions (see section 1.5.2). Data were obtained from the weekly reflection reports completed by the peer-tutors on the provided forms (see Appendix D).

Table 3.3: Weekly reflections reports.

Peer-tutor	Distribution Date	Submission Date	Comment
PT1	27 February 2018	7 August 2018	
PT2	6 March 2018	14 August 2018	
PT3	26 February 2018	17 October 2018	
PT4	21 February 2018	17 October 2018	
PT5	28 February 2018	15 October 2018	
PT6	28 February 2018		Did not hand back weekly reflections
PT7	6 March 2018		Did not hand back weekly reflections
PT8	14 March 2018	17 October 2018	
PT9	14 March 2018	17 October 2018	
PT10	20 February 2018	15 August 2018	

Finally, at the end of the tutoring season, post-interviews were conducted, August 2018 to October 2018 at the peer-tutor's convenience, Table 3.4 indicates the post-interview schedule using an interview schedule (see Appendix B). Table 3.4 indicates the post-interview schedule. The post-interviews provided the researcher with the opportunity to determine how the peer-tutors viewed their role as motivators after tutoring and whether there was a change in their views before and after and tutoring. The data from the interviews enabled the researcher to answer the main research question, namely: How do the conceptions of Grade 12 peer-tutors of their role as motivators for Grades 8 and 9 mathematics learners compare with Keller's (1987) ARCS model?

Table 3.4: Post-interview schedule.

Peer-tutor	Date	Time	Location
PT1	7 August 2018	14:32 – 14:39	P4
PT2	14 August 2018	14:20 – 14:26	P4
PT3	17 October 2018	13:10 – 13:15	P4
PT4	17 October 2018	13:17 – 13:21	P4
PT5	15 October 2018	14: 15 – 14:21	P4
PT6	8 October 2018	14:20 – 14:25	P4
PT7	15 October 2018	14:15 – 14:20	P4
PT8	17 October 2018	13:15 – 13:20	P4
PT9	17 October 2018	13:22 – 13:28	P4
PT10	15 August 2018	13:10 – 13:18	P4

3.4.3 Trustworthiness

Trustworthiness of the research process was established using the following four criteria: "credibility, transferability, dependability and conformability" (Savin-Baden & Major, 2010, p. 30). It was important for the researcher to ensure that these criteria were evident in the investigation/study/inquiry (Given, 2008).

Credibility is the confidence that researchers and readers have "in the data and their interpretations … the trust that can be placed in the accuracy of data and the process by which it was acquired" (Savin-Baden & Major, 2010, p. 172). One way that credibility was established was through the "triangulation of data sources, methods and investigators" (Creswell, 2013a, p. 246). Triangulation is the use of different methods to ensure that the credibility of the study is maximized (Savin-Baden & Major, 2010). Triangulation helped the researcher to cross check all three data sources, namely interviews, weekly reflections and observations to ensure "accuracy of interpretation" (Fraenkel et al., 2012, p. 517). In this way the researcher was able to determine whether she had "successfully measured what [she] sought to measure" (Given, 2008, p. 895).

Transferability refers to the need for a study to be applicable in a wider context (Given, 2008). If a study can be determined to be transferable to broader contexts by others, the study is believed to fulfil the criteria of transferability. For this study, a "general theory" was developed by taking a number of previous studies and using them to "adapt and apply [their] conclusions" to the South African context (Given, 2008, p. 878). Due to the

contextualised nature of this study and the small sample, it cannot be generalised to other contests. However, an in-depth literature review on previous studies was done (see chapter 2).

For *dependability*, all collected data were compared for consistency in results. Dependability ensures that the findings are reproducible when the "same content and procedures" are used again (Given, 2008, p. 896). It is important that the procedures and research instruments are presented so that other researchers can use them in similar conditions. In this study, content and necessary procedures were included as appendices, and cross-references were used to signify the relevant content. Furthermore, previous research done by Keller (1987) was used as a guide to develop the interview questions and weekly reflections (see appendix X), in order to strengthen the dependability of this study.

Confirmability ensures that "the interpretations and the findings match the data" (Given, 2008, p. 895). Confirmability enables the researcher to accurately verify the data from the participants' point of views and to "understand the meaning people give to their experiences" (Given, 2008, p. 112). All claims and findings in this study were supported by data. Weekly reflections were used to "check and recheck the data throughout the study" (Trochim, 2006, p. 10). The supervisor and other faculty members read through and gave advice on the questions to ensure face validity (Given, 2008; Patton, 2003) of the interview schedule.

3.4.4 Ethical considerations

Ethical considerations were taken into consideration throughout the study and not only during data collection. Ethical measures were taken from the start of the study, during the study, during data collection and data analysis, until the reporting on the data and in the publication of the study.

All ethical considerations were adhered to as stipulated by the University Of Johannesburg's Faculty of Education's Research Committee (see Appendix E), as well as the Gauteng Department of Education (see Appendix F), and the school (see Appendix G) – which included the governing body and the principle as well as the Mathematics

Head of Department. Finally, permission was obtained from the peer-tutors themselves and their parents/guardians (see Appendix H). In order to get permission from the Gauteng Department of Education the researcher completed forms provided by the Department and submitted all interview, observation and reflection schedules as well as the ethical clearance certificate from the University of Johannesburg. In order to obtain clearance from the school the researcher approached the Mathematics Head of Department and the principal who then agreed to the research taking place. The peer-tutors were then approached and after they had agreed to take part in the study the researcher gave them a consent form for their parents/guardians to sign and to be returned.

Ethical considerations were implemented to protect the participants and the researcher (Creswell, 2013a). The researcher was continually aware of "the needs of participants, sites, stakeholders and publishers of research" (Creswell, 2013a, p. 56) and how her role as researcher impacted these needs. The researcher was aware of what was researched and ensured that the research processes and instruments did not make the participants feel fearful or uncomfortable. The researcher created an environment where the participants felt supported and respected (Creswell, 2013a). An important part of creating this environment was to consider my use of language as a researcher. The researcher endeavoured to use language that was appropriate, understandable and acceptable to all the participants (Creswell, 2013a). Furthermore, the researcher was "sensitive to vulnerable populations, imbalanced power relations and placing participants at risk" (Creswell, 2013a, p. 56).

Table 3.5 indicates the ethical considerations that were considered in this study.

Table 3.5: Ethical issues in qualitative research (adapted from Creswell, 2013a, pp.58-59).

When in the process of research the ethical issue occurred	Ethical considerations
Prior to conducting the study	- Sought university approval (see Appendix E). - Gained local permission from site (School in Johannesburg North (see Appendix G) and Gauteng Department of Education (see Appendix F) as well as permission from parents/guardians and learners (see Appendix H).
Commencement of the study	- Informed participants about the purpose of the study. - Did not pressurize participants to sign consent forms.
Collection of data	- Showed respect for the site and did not disrupt the site. - Did not deceive participants. - Was aware of, and respected, power imbalances.
Data Analysis	- Did not side with participants. - Did not reveal only positive results. - Respected the privacy of participants.
Reporting data	- Was honest; did not plagiarise. Did not fabricate evidence, data, findings and conclusions. - Did not share information that would be detrimental to the participants. - Used appropriate language for the readers.
Publishing study	- Shared data with participants, stakeholders and other relevant parties. - Did not use the same material for further publication. - Indicated who would profit from the research.

Data collection took place at a time that was convenient for the participants and in a comfortable setting. It was important to ensure that the participants remained anonymous, especially because they were minors (Given, 2008). The nature of the questions was considered so that participants did not feel uncomfortable or exposed during the research process. For this reason, the participants were given numbers during the data collection and data analysis processes.

3.4.5 Data analysis procedures

Data analysis is the process of creating meaning from the data collected through classification and interpretation both “implicit and explicit” (Merriam & Tisdell, 2016, p. 194). Data analysis is an essential part of qualitative research and is important in both gathering data and using the findings to impact on the field of study. The data analysis, which was used in this study, is illustrated in Figure 3.2.

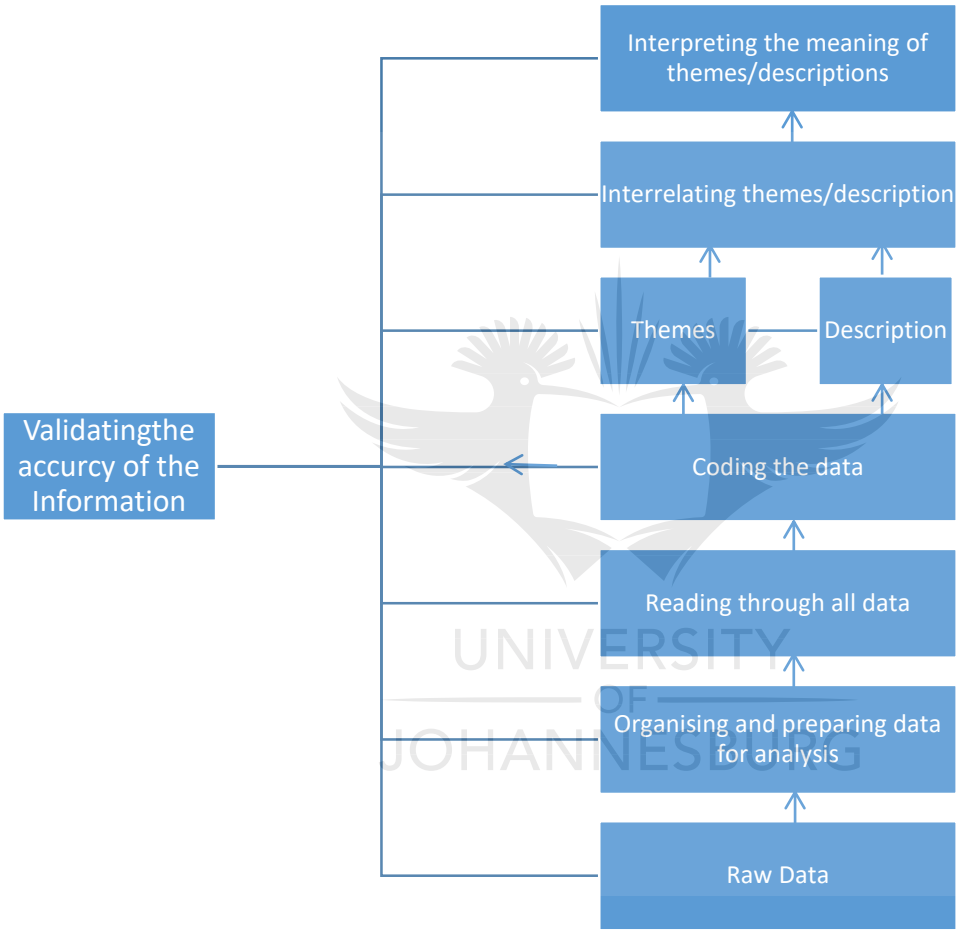

Figure 3. 4: Data analysis in qualitative research (From Creswell, 2014, p. 197).

Once the researcher had collected the raw data, the data analysis began with the researcher organising the data on a computer. For this study ATLAS.ti, a data analysis programme, was used to manage the collected data, and to assist with the coding and categorising of data. Data management is “divided into three phases: data preparation, data identification and data manipulation” (Merriam & Tisdell, 2016, p. 222).

Firstly, for *data preparation,* the raw data were prepared and organised for analysis. All interviews, weekly reflections and observation notes were typed up, transcribed and entered into ATLAS.ti. This created a "clean record from which to work" (Merriam & Tisdell, 2016, p. 222).

Once data were organised, the researcher read and re-read the transcripts. The researcher engaged with the details by writing notes and observing what was said in the interviews (Creswell, 2013a). Reading and memoing includes, reflecting and looking for "multiple perspectives" (Creswell, 2013a, p. 184).

The next phase of the data analysis was to describe, classify and interpret the data by creating codes. *Data identification* was thus done by developing codes to sections of the interviews, weekly reports and observation notes. Coding involves assigning labels to words, phrases or passages of the data in alignment with what the researcher has identified to be relevant, in relation to the problem statement (Merriam & Tisdell, 2016). The researcher determined and assigned the codes to the information (Merriam & Tisdell, 2016). For this study there was a number of pre-determined codes used, which aligned closely with Keller's (1987) ARCS model of motivation, namely *Attention* (see section 2.7.1), *Relevance (see section 2.7.2)*, *Confidence (see section 2.7.3)* and *Satisfaction (see section 2.7.4)*, as well as synonyms or similar terms.

Finally, *data management* refers to giving meaning to the codes that have been identified in relation to what the research has shown to be relevant. When retrieving the meaning from the codes the researcher is able to "code at multiple levels" (Merriam & Tisdell, 2016, p. 223). Retrieving meaning from the codes was done by sorting codes into categories and further breaking the categories into subcategories. ATLAS.ti was a useful tool to create categories and to identify any links that assisted in understanding logical relationships between the codes and the developing theories (Merriam & Tisdell, 2016).

The interpretation of the data went beyond simply focusing on the codes and themes, by also interpreting the larger meaning of the codes and themes" (Creswell, 2013a, p. 187). The researcher used text and/or figures to help envisage and comprehend what was found (Creswell, 2013a).

All the interviews were transcribed word-for-word and loaded onto ATLAS.ti. The interviews were coded according to Keller's (2000) updated categories and original sub-categories (1987) (see section 2.7) (also see sections 4.5.1.1, 4.5.2.1, 4.5.3.1 and 4.5.4.1). The researcher was able to do this since the peer-tutors gave more in-depth answers in the interviews than in the observations and weekly reflections.

Observation notes were typed up and then coded using ATLAS.ti (4.5.1.2, 4.5.2.2, 4.5.3.2 and 4.5.4.2). The codes were formulated in line with the four categories of Keller's (2000) recent ARCS model of motivation.

The weekly reflection responses were also typed out and loaded onto ATLAS.ti. Again, the codes were aligned with the updated categories of Keller's (1987) ARCS model of motivation (see sections 4.5.1.3, 4.5.2.3, 4.5.3.3 and 4.5.4.3).

3.5 CHAPTER SYNTHESIS

Chapter 3 started by returning to the research question in order to contextualise the philosophical, theoretical and methodological assumptions. The research problem for this study was based on the research question, namely: How do the conceptions of Grade 12 peer-tutors of their role as motivators for Grades 8 and 9 mathematics learners compare with the ARCS model of motivation of Keller (1987)? An interpretivist paradigm was adopted for this descriptive case study. The methodological assumptions were taken from an inductive to a deductive approach; working from the general to the specific. The research methodology used in this study was qualitative, enabling the researcher to describe the conceptions of the peer-tutors regarding their role as motivators as fully and richly as possible. The data collection instruments used were one-on-one semi-structured interviews, weekly reflections and observations. Multiple data sources were used in order to ensure that the data were consistent (Given, 2008). A convenient and purposeful sample was used to select ten Grade 12 learners who were willing to become peer-tutors and to voluntarily participate in the study. Trustworthiness of the study was ensured by focusing on credibility, transferability, dependability, and confirmability. All research done was ethically sound and complied with the Department of Education and the University of Johannesburg's requirements. Lastly, the data analysis procedures by means of qualitative inductive and deductive coding were discussed.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

4.1 INTRODUCTION

Chapter 4 presents the data presentation, analysis and interpretation of the findings of the study. Data were collected through the three data sources related to the research question presented in chapter 1 (see section 1.5.1). The chapter begins with a short summary of the data collection process as discussed in detail in Chapter 3. Then, the model of analysis used in examining the data will be described. Once the model has been described, the data is analysed for each peer-tutor in terms of age, gender and race and the findings presented. Moreover, the data analysed according to the four categories presented by Keller (1987) – *Attention, Relevance, Confidence and Satisfaction* – will be discussed. Finally, the commonalities, contradictions and idiosyncrasies found across the data will be addressed.

Table 4.1 illustrates Keller's (1987) four categories together with the respective data collection instruments used in the data analysis.

Table 4.1: Data collection for the four categories.

Attention	Relevance	Confidence	Satisfaction
- Interviews - Observations - Weekly Reflection Reports	- Interviews - Observations - Weekly Reflection Reports	- Interviews - Observations - Weekly Reflections Reports	- Interviews - Observations - Weekly Reflections Reports
- Commonalities - Contradictions - Idiosyncrasies			

4.2 ANALYTICAL MODEL FOR DATA ANALYSES

A vertical model (Given, 2008) was the data analysis model used to examine the data. A vertical model begins with a category, for example in this study, *Attention*, and then the researcher works though all the data gathered that relates to this category – "category-to-phenomenon relationships" (Given, 2008, p. 72). Vertical analysis enables the researcher to compare claims made by different participants (Vavrus & Bartlett, 2006) "in-

depth" (Smeyers, 2008, p. 695). For this study the following steps were taken in the data analysis:

1. Analysis of Keller's (1987) category of *Attention* from interviews, observations and weekly reflection reports.
2. Analysis of Keller's (1987) category of *Reflection* from interviews, observations and weekly reflection reports.
3. Analysis of Keller's (1987) category of *Confidence* from interviews, observations and weekly reflections reports.
4. Analysis of Keller's (1987) category of *Satisfaction* from interviews, observations and weekly reflection reports.
5. Commonalities, contradictions and idiosyncrasies of the overarching findings were noted and explored.

4.3 ANALYSES OF DATA ACCORDING TO KELLER'S (1987) CATEGORIES

The data from the interviews and group observations were inductively analysed and the weekly reflection reports were deductively analysed according to Keller's (1987) four categories, namely *Attention*, *Relevance*, *Confide*nce and *Satisfaction*. The frequency (f) and percentage of responses to each category, sub-category and code of the sub-category as indicated by Keller (1987) in his/her ARCS model of motivation, were calculated. The number (n) of peer-tutors who responded to the codes was also determined. It is important to note that for the weekly reflection reports only eight peer-tutors submitted their weekly reflection reports.

4.3.1 Attention

Table 4.3 shows the sub-categories and codes transpired from each data collection instrument for the Keller's (1987) category of *Attention*. *Attention* is concerned with leading the learners' curiosity to an suitable stimuli (Keller, 1987). The symbol *f* indicates the frequency of responses per code, while n refers to the number of peer-tutors who addressed a specific code.

Table 4.2: Data analysis of Keller's (1987) category of *Attention*.

Data collection instruments	Category	Sub categories	Codes	f	$n = 10$
INTERVIEWS	Attention 57 (58.2%)	Capture Interest 38 (66.7%)	Incongruity	0 (0%)	0 (0%)
			Concreteness	16 (42%)	8 (80%)
			Variability	22 (57.9%)	9 (90%)
			Humour	0 (0%)	0 (0%)
		Stimulate inquiry 8 (14%)	Inquiry	8 (100%)	6 (60%)
		Maintain attention 11 (19.3%)	Participation	11 (100%)	6 (60%)
OBSERVATIONS	Attention 20 (20.4%)	Capture Interest 15 (75%)	Incongruity	0 (0%)	0 (0%)
			Concreteness	6 (40%)	5 (50%)
			Variability	7 (46.6%)	3 (30%)
			Humour	2 (13.3%)	2 (20%)
		Stimulate inquiry 0 (0%)	Inquiry	0 (0%)	0 (0%)
		Maintain attention 5 (25%)	Participation	5 (100%)	4 (40%)
WEEKLY REFLECTION REPORTS	Attention 21 (21.4%)	Capture Interest		7 (33.3%)	5 (62.5%)
		Stimulate inquiry		4 (19%)	4 (50%)
		Maintain attention		10 (47.6%)	6 (75%)

The category *Attention* was addressed by a total of 98 out of 258 responses (38%) across all three data sources. *Attention* was also the category addressed by most by the peer-tutors, namely eight out of ten participants (80%).

4.3.1.1 Interviews

In the pre- and post- interviews, the peer-tutors addressed the concept of *Attention* in 57 out of a total of 98 responses (58.2%) across the three data collection sources. All ten peer-tutors addressed *Attention* during the interviews.

4.3.1.1.1 Capturing interest

In his modified subcategories of the model of motivation, Keller (2000) talks about capturing the learners' interest in order to get their attention. The four ways that Keller (1987) suggests this could take place are though incongruity, concreteness, variability or humour. More than half of the instances where attention was addressed, were under the sub-category of capturing learners' interest (38 out of 57 which equates to 66.7%). This sub-category was further coded according to incongruity, concreteness, variability and humour. None of the peer-tutors stipulated that they used incongruity or humour (as a way to get learners' attention).

(a) Concreteness

Concreteness was addressed by eight of the ten peer-tutors (80%). Five of the ten peer-tutors (50%) discussed how they allowed learners to use different methods to the ones taught in class by the teacher, to complete a task. PT6 mentioned: "I gave them more modern examples… to give them insight…. [I also] gave them some tricks to make it easier for them" (male, pre-interview, 28 February). Schukajlow, Rakoczy, and Pekrun (2017) agree that mathematical problems that address the learners' world and that attempt to connect what is real for the learner to the problem, positively impact on learners' motivation Relating the mathematics in a tangible and specific way is important in getting learners' attention (Milman & Wessmiller, 2016; Novak, 2014). It appears that the peer-tutors believed that for the learners to increase their' mathematics motivation it was important that they understood the mathematics in terms of their lived reality.

Three of the ten peer-tutors (30%) discussed how they preferred working with worksheets with specific questions and methods. PT1 said that worksheets worked well because it meant that the learners "actually had something to ask about" (female, post-interview, 7 August). There are numerous methods for getting learners attention, but worksheets, in this case, appeared to be a useful method. Milman and Wessmiller (2016) suggest that

to get and keep learners' attention, teachers can use activities that involve numerous forms of collaboration, visual elements, mock-ups, varying forms of instruction, debate, inconsistency, inquiry and humour. Although the peer-tutors did not use all these methods, the worksheets appeared to go a long way towards getting and keeping the learners' attention.

(b) Variability

Variability is another way that Keller (1987) discusses as a way of capturing learners' interest. Variability was addressed by nine of the ten peer-tutors (90%), as the central way of capturing learners' attention. Twenty-two out of 38 remarks (57.9%) were made in this regard. Variability is achieved by changing the way that the content is presented (Keller, 1987). One of the ways that the peer-tutors got learner's attention was through variety: by refocusing the learners in different ways. PT8 found that it was important to try to:

> …make it more interesting, not just [your] standard teaching way of doing [the lesson], so for example with geometry, I would try and explain different ways of seeing the picture and things like FUNKYX and different ways of looking at it. (Male, post-interview, 17 October).

Five of the ten peer-tutors (50%) noted using a variety of teaching methods and styles to keep the learners' attention. PT4 spoke about how he would see what the learners wanted to do "some [learners] preferred just to see it written down for them, or some [learners] preferred to do examples. They didn't just all learn in the same way". He went on to say that this was something that he had learnt to do,

> I obviously tried just one learning style, but it didn't work. You can't teach everyone the same way. Because everyone doesn't learn in the same way. So I taught in the way that they learn [best] … we used the [white] board, especially me, to draw for geometry, triangles and things like that. [For] perimeter and area I would draw on the [white] board and tell them to solve it based on [what was illustrated]. (Male, post-interview, 17 October).

Several researchers agree that varying methods of engagement are important to improve learners' attention, which in turn impact on their motivation (Izmirli & Izmirli, 2015; Milman & Wessmiller, 2016). This finding could indicate that the peer-tutors were aware of the learners' needs and were conscious of getting and keeping their attention. These methods of variability, although elementary, appeared to be important in getting and keeping the learners' attention and significantly impacted on the learners' motivation. These strategies provided varied and stimulating activities, which may have been different to what the learners had experienced in the past.

4.3.1.1.2 Stimulate inquiry

Stimulating inquiry, under *Attention*, was addressed by eight out of 57 responses (14%) by six of the ten peer-tutors (60%). The peer-tutors stressed the importance of asking questions and engaging with the learners. Five of the ten peer-tutors (50%) specifically and routinely asked learners questions. PT8 stated, "… I would ask them questions so they can see for themselves where they are going wrong, so I [was continually] interacting with [the learners]" (male, post-interview, 17 October). Three of the ten peer-tutors (30%) spoke about how they encourage the learners to come prepared to ask questions, especially questions that the learners did not want to ask the teacher during class. PT2 said she encouraged the learners to have questions for the peer-tutors "[I let them ask] questions that they might be too scared to ask a teacher, that they [wanted to] ask us instead … [the learners] ask a lot of questions" (female, post-interview, 14 August). Hodge and Kim (2013) concur that mathematics teachers should encourage a sense of inquiry in order for learners to be more attentive. The peer-tutors appeared to have the learners' attention, and were engaged with them in such a way that the learners felt comfortable enough to engage openly and candidly with the peer-tutors.

4.3.1.1.3 Maintain attention through participation

Maintaining learners' attention through *participation* was address by eleven out of 57 responses (19.3%) on *Attention* by six of the ten peer-tutors (60%). Most of the peer-tutors worked alongside the learners. PT3 interacted with the learners one-on-one until they had completed the question and noted: "I never just did something on my own and made them watch. I kept communicating with them to see if they were following" (male, post-interview, 17 October). Encouraging learners to participate is an important aspect of

maintaining attention. Encouraging learners to participate with the content is important in keeping the learners' attention. Winberg, Hellgrem and Palm (2014) also found that the learners' attitudes towards mathematics influence how they participate with the content, which can have a direct influence on their motivation to learn. By encouraging learners to participate not only with other leaners, but with the peer-tutor and the content being presented, peer-tutors gave the impression that they were able to keep learners attention on the mathematics being completed.

4.3.1.2 Group observations

The researcher conducted eight group observations over a four-month period (see section 3.4.3.3). In that time the category of *Attention* was noted by 20 out of 98 responses (20.4%) across the three data collection sources.

4.3.1.2.1 Capture interest

During the observations capturing interest was the factor addressed the most (15 out of 20; 75%) by all ten peer-tutors. Interest was captured mainly through concrete examples, using a variability of methods, and humour. Incongruity was not observed during the observations.

(a) Concreteness

During the observations seven out of 21 instances (33.3%) were noted where five of the ten peer-tutors (50%) actively attempted to capture the learners' attention through giving *concrete* representations. The researcher noted on the observation sheet (Appendix C):

> Once the peer-tutor had introduced him-/herself and the one-on-one tutorial began, learners appeared to be comfortable to interact with the peer-tutor and to initiate a discussion, regarding the content. Peer-tutors made use of the white board, objects in the classroom, paper and coloured pens as well as various textbooks provided by the researcher.

During three of the eight observations, however, the researcher noted that the peer-tutors did not capture learners' attention initially.

> I'm concerned about the fact that the peer-tutors didn't greet and engage with the learners as soon as they walked in the door. Peer-tutors seemed to wait for the leaners to settle

> and then approach them. Two learners came into the classroom and walked out after a few seconds. I am unsure if they were looking for a friend or felt hesitant about attending a tutorial. (See Appendix C)

Milman and Wessmiller (2016) and Novak (2014) agree that it is important for the teacher (or in this case the peer-tutor) to get the learners' attention (see 4.5.1.1.1).

(b) Variability

Seven out of 15 times (46.6%) the researcher observed peer-tutors using variability to get learners' attention, two of these instances (28.6%) were noted where the peer-tutors used various methods to capture learners' attention, for example "I liked how PT1 cheerfully explained to the learner how important geometry was, using a classroom window" (female, 7 May) (see Appendix C). Five instances (71.4%) were noted of peer-tutoring using various methods to address factorising. The researcher noted:

> The peer-tutors first enquired what method the learner had been taught and then used that method, as well as at least one other method, to explain factorisation. As a teacher I like seeing the peer-tutors encouraging various methods of factorising and writing out steps for the learners. Peer-tutors got the learners' attention through concrete and various, relevant representations regarding mathematics. This appeared to encourage the leaners to see examples and topics from a different perspective. " (see Appendix C)

As indicated above (see section 4.4.1.1.1) offering different and varied forms of instruction helps get and keep learners' attention and helps motivate learners to get and stay motivated (Keller, 2000; Milman & Wessmiller, 2016). The peer-tutors were more than prepared to get the learners' attention through variety. The learners appeared to have responded well to the peer-tutors' methods and appeared comfortable to attempt what they had been taught.

(c) Humour

Humour was observed twice during eight group observations (25%) on capturing interest. One observation noted in this regard is as follows:

> A learner came into the tutorial with a question regarding solving equations. PT5 was very helpful in helping the learner understand the steps and told the learner a humorous story

> to explain, how to remember when to change signs when taking a term over the equal sign. PT4 wasn't afraid to look a little silly, she drew on the board with coloured markers and was very animated, and the learner laughed at the silliness and seemed to feel relaxed and ready to participate. (see Appendix C)

PT4 (male, 26 July) and PT5 (male, 26 July) got the learners' attention by encouraging them through humour and inquiry. They used appropriate presentations and creative techniques to address problem solving (Keller, 1987). The learners appeared to respond well to humorous examples or explanations during the tutorials. The stories and actions certainly appeared to help keep learners' attention on the task at hand.

4.3.1.2.2 Stimulate inquiry

The researcher did not observe any instances where peer-tutors stimulated inquiry as laid out by Keller (1987).

4.3.1.2.3 Maintain attention

During the eight group observations the researcher noted that in five out of 20 instances (25%) the learners were willing to ask questions and to participate with the peer-tutor and the content. Peer-tutors seemed to expect learners to have questions to ask, and learners appeared to come prepared with questions to ask the peer-tutors. One observation which noted the learners' willingness to ask questions is as follows:

> Today when the peer-tutor asked the learner if she had any questions, the learner opened her diary. She had prepared a list of questions she wanted to ask the peer-tutor… I didn't see any learners who didn't participate with the content or engage with the peer-tutor. (see Appendix C)

Encouraging learners to participate in the content, as well as with another person, is important in keeping the learners' attention. Hodges and Kim (2013) also state that when learners are encouraged to participate with the content, it helps maintain their attention. From this finding, it can be deduced that peer-tutors ensured that the content they presented was simulating and that the learners were participating by asking questions and engaging with the content.

4.3.1.3 Weekly reflection reports

Only eight of the ten peer-tutors (80%) submitted their weekly reflection reports. All of these eight peer-tutors addressed attention as being important during the weekly reflection reports. The category of *Attention* was addressed 21 out of 98 times (21.4%) during the weekly reflection reports.

4.3.1.3.1 Capture interest

A third of the instances (7 out of 21; 33.3%) where *Attention* was addressed relates to the peer-tutors' attempts to capture the interest of the learners. This was addressed by over half of the peer-tutors (5 out of 8; 62.5%). These peer-tutors captured learners' attention by showing the learners different ways of solving problems and using visual representations. PT8 showed learners "how to break down the problem and how to identify what [the questions was asking]" (male, reflection report 1, 18 April). PT1 commented that "using the white board [and using] different colours helped leaners visualise [what was being asked]" (female, reflection report 1, 5 March). Others ways of capturing learners' attention, mentioned by three of the eight peer-tutors (37.5%) were through group work, constantly engaging with learners and ensuring that they knew all the work that was required of them. PT9 noted: "[I] watched the leaners do examples on their own while assisting them, as opposed to doing examples for them" (female, reflection report 5, 15 May). Novak (2014) agrees that by providing varied presentations of mathematical content, teachers (or peer-tutors) are able to keep leaners' attention and keep them motivated. Learners' mathematical motivation may have been influenced positively because the peer-tutors were able and willing to use varied techniques to capture and keep leaners' attention.

4.3.1.3.2 Stimulate inquiry

Four of the eight peer-tutors (50%) addressed stimulating inquiry. The peer-tutors challenged the learners to practice the work that they had been taught during the tutorial. The peer-tutors believed that this would help the learners maintain their attention when completing similar work in the future. PT10 said he "assured [the learners] that [mathematics] would benefit them" (male, reflection report 1, 26 February). Novak (2014) noted that it was important that the learners heard from a fellow learner (the peer-tutor) that what had been taught was worthwhile.

Gardner and Lambert's (1959) social psychological research on motivation (see section 2.3.1) is relevant here as it addresses integrative motivation and instrumental motivation. Integrative motivation relates to the learners' need for learning communities and the need to be able to relate to these learning communities. Instrumental motivation focuses on the value that the learners' learning has for their future (Pourhasan & Zoghi, 2017). Since the learners were able to discuss issues with the peer-tutors and to see that mathematics was going to be useful in their future endeavours, learners might have been more inclined to both question the peer-tutors and also heed their advice.

4.3.1.3.3 Maintain attention

Nearly half of the instances, where *Attention* was addressed, had to do with maintaining attention (10 out of 21 remarks; 47.6%). Six out of eight peer-tutors (75%) commented that the learners did not concentrate immediately and were distracted. PT8 said, "The learners need to focus so that they can remember everything I showed them" (male, reflection report 1, 16-19 April). However, he did go on to say "the learners were interacting with me well, they just forgot information I explained to them earlier" (male, reflection report 1, 16-19 April). PT5 said, "Some [learners] were not willing to work" (male, reflection report 5, 3 May). Cleary, Velardi, and Schnaidman (2017) concur that when a learner is not prepared for how a working environment works, motivation to work can be impacted.

A reason why learners found it difficult to maintain attention may have been because they were unsure of how the tutoring programme worked, and what was expected from them. Furthermore, they might have found it difficult to adjust to a different teaching style. Two of eight peer-tutors (25%) spoke about learners working together to complete tasks. PT5 said that she had had a positive experience when "the whole group struggled with the same concept and helped each other…group explanations on the same topic helped keep learners' attention" (male, reflection report 5, 3 May) . Grehan, Mac an Bhaird, and O'Shea (2016) agree that when learners are not equipped mathematically, working independently is a struggle. Cleary et al. (2017) also acknowledge that "students will struggle…because of maladaptive motivational profiles…deficient metacognitive and strategic skills or inadequate feedback provided by others" (p. 29). By allowing learners

to work in groups or together they might have found that it was easier to become motivated and stay motivated in the task that they needed to complete.

4.3.2 Relevance

The second category of Keller's (1987) model of motivation is *Relevance*. Keller (1987) notes that "relevance can come from the way something is taught; it does not have to come from the content itself" (p. 3). As with *Attention*, Keller (2000) divided *Relevance* into three subcategories, namely 1) relate to the goals; 2) match interests; and 3) tie to experiences. Table 4.4 illustrates the analysis of the category *Relevance*. The symbol *f* indicates the frequency of responses per code, while n refers to the number of peer-tutors who addressed a specific code.

Table 4.3: Analysis of Keller's (1987) category of *Relevance*.

	Category	Sub-category	Code	f	$n = 10$
INTERVIEWS	Relevance 18 (29%)	Relate to goals 0 (0%)	Experience	0	0 (0%)
			Present worth	0	0 (0%)
		Match Interests 15 (83.3%)	Future Usefulness	10 (66.7%)	4 (40%)
			Need Matching	5 (33.3%)	5 (50%)
		Tie to Experiences 3 (16.7%)	Modelling	3 (100%)	3 (30%)
			Choice	0 (0%)	
OBSERVATIONS	Relevance 32 (51.6%)	Relate to goals		13 (40.6%)	10 100%
		Match interests		4 (12.5%)	3 30%
		Tie to experiences		15 (46.9%)	10 100%
WEEKLY REFLECTION REPORTS	Relevance 12 (19.4%)	Relate to goals		6 (50%)	5 (62.5%)
		Match Interests		6 (50%)	6 (75%)
		Tie to Experiences		0 (0%)	0 (0%)

The category of *Relevance* was evident in a total of 62 out of 258 times (24%) during all three of the data sources (see Table 4.4). The analysis of the category of *Relevance* will next be discussed according to each of these data sources.

4.3.2.1 Interviews

Relevance was addressed 18 out of 62 times (29%) by seven out of the ten peer-tutors (70%) during the interviews. There were three out of the ten (30%) peer-tutors who felt that they didn't explicitly address the relevance of mathematics with the learners. PT5 unequivocally stated: "I didn't" (Male, pre-interview, 15 October) when asked how he ensured that learners understood the relevance of mathematics. PT10 said that the learners already understood that mathematics was relevant, "I think that the learners who actually showed up believe that maths is already relevant so I don't have to do much to ensure that they know" (male, pre-interview, 20 February).

The fact that three of the ten peer-tutors (30%) did not specifically address *Relevance*, may demonstrate that the rest of the peer-tutors believed that the learners, who attended the tutorial sessions voluntarily, already knew that mathematics was relevant to their lives. PT8 said that he believed that the learners were already motivated, not because a parent or guardian or teacher forced them to attend, but because they knew receiving good marks was important, claiming for example "I definitely think that they showed the initiative to come so that already shows that it is important to get good marks" (male, post-interview, 17 October). Chue and Nie (2017, p. 82) concur that learners need to "compel themselves to make an effort" and that different learning approaches, such as tutorials, can impact on achievement and motivation. Deep learning has been found to influence mathematics learners' intrinsic motivation directly, however, both deep and surface learning (primarily associated with extrinsic motivation) can motivate the learners to achieve academically (Chue & Nie, 2017). Thus, the learners' who attended the tutorials could have been both intrinsically and extrinsically motivated to attend the tutorials. By attending the tutorials learners might have felt that they were able to receive help that would benefit them in the future. This finding could be interpreted as the learners who attended the tutorials were demonstrating a degree of self-regulation by acknowledging that attending the tutorials could help them achieve their goals. Research on self-

regulated learning also reveals that self-regulated learners' actions demonstrate a desire to achieve (Cleary et al., 2017; Ryan, 1995; Ryan & Deci, 2000a) (see 2.3.2.4).

Four of the ten (40%) peer-tutors commented on the absenteeism of learners, despite the positive results that took place during the tutorials. Taylor (2008) also briefly notes absenteeism among learners as a concern regarding performance in South African schools. However, learners that do not attend tutorials does not infer that the learner does not attend school. PT7 stated that she "…hoped [more learners] would come". She continued raising the issue that when learners attended a tutorial they "don't come again" (female, post-interview, 15 October). Some learners could have felt that by attending simply once would be sufficient to help them improve their mathematics knowledge. Duah, Croft and Inglis (2014) agree that peer-tutoring can be associated with improved mathematics results. Concerns regarding attendance and absenteeism could also be linked to learners' motivation. When leaners are involved in a task, they have a greater awareness of the content being taught. When learners engage with other learners, they are encouraged to become more mindful of the content, which often leads to high levels of motivation to continue with the task at hand (Gardner, 1985; Kim et al., 2015). The peer-tutors are able to address learners' motivation due to availability, access and engagement with learners during tutorials (Grills, 2017). However, if learners are not attending the tutorials on a regular basis, it could have a negative impact on learners' motivation. Lips (2004) acknowledges that when a learner has had a negative mathematics experiences in that past, this could dictate how the learner will make future decisions - often by choosing not to become part of a community .

4.3.2.1.1 Relate to goals

None of the ten peer-tutors discussed how they related the learners' mathematics goals to show the relevance of mathematics. Instead, they focused on how mathematics would impact the learners' future.

4.3.2.1.2 Match interest

(a) Future usefulness

Predominantly, four of the ten peer-tutors (40%) addressed matching interest of mathematics by referring 10 out of 15 times (66.7%) to the future usefulness of mathematics. PT7 said

> … [I tried to] make them understand how much they should understand maths right now, like the basics of it. [I] make them see how important it is in life…so I tried to tell them they should understand it right now, so [the learner] doesn't have to struggle all through his high school…[it's a good] foundation" (female, post-interview, 15 October).

Dailey (2009) notes that one of the ideas of possible selves (see 2.3.3) includes the learner looking to the future to see what they might become. Dornyei (2009) concurs that when learners are motivated to complete a task (or in this case, attend a tutorial) they are envisioning its usefulness to their future, they are creating an image of who they would like to be one day, or what they are hoping to achieve. The learning experience addressed in the possible-self theory focuses on the community of learning (Dornyei, 2009; Pourhasan & Zoghi, 2017). Despite the previous, possibly negative, learning experience a learner may have had with mathematics, they may still choose to engage in a learning community; in this case the tutorials. When learners are able to envision their future-self, specifically a future-self that needs to achieve in mathematics, attending a mathematics tutorial may become an easy choice so as to enhance their future self (Lutovac & Kaasila, 2014). When the peer-tutors address and demonstrate the future relevance of what the learner could achieve, they could further enable the learner to envision what the future may hold.

(b) Need matching

Need-matching was mentioned five out of 15 times (33.3%) by five of the ten peer-tutors (50%). Need-matching occurs when the teacher or peer-tutor enhances learners' achievement by providing opportunities for the learners to achieve where there is moderate risk. Also, need-matching ensues when peer-tutors provide opportunities for the learners to demonstrate "responsibility, authority and interpersonal influence" or create opportunities where there is a level of trust and no risk in collaboration (Keller,

1987, p. 3). According to PT1, she provided opportunities for the learners to "…compare [their answers] to [other learners] who [demonstrated a level of understanding] and see how they answered differently" (female, post-interview, 7 August). Pourhasan and Zoghi (2017) acknowledge that when learners feel welcome in their learning community and they can relate to the community, they are able to integrate into the community and achieve the goals of that community. Even if the learner does not have a desire to be integrated into a community, the learner is still able to demonstrate motivation to receive the knowledge that he/she believes he can receive from the community (Dailey, 2009; Harandi, 2015).

4.3.2.1.3 Tie to experiences

Linking mathematics to experiences in order to demonstrate the relevance of mathematics and influencing the motivation to pursue mathematics, is the third sub-category that Keller (1987) discusses. Keller (2000) divided this sub-category further into modelling and choice.

None of the ten peer-tutors referred to choice during the interviews. However, modelling was addressed three out of the eighteen times (16.7%) by four of the ten peer-tutors (40%). The peer-tutors themselves, were very practically modelling their enthusiasm for mathematics. PT9 said, "They obviously know that we are doing well in mathematics" (female, post-interview, 17 October). PT1 commented on how she believed that the learners could understand the importance of mathematics since there were peer-tutors who apparently enjoyed the subject. "[Tutoring has] got a lot of people who like maths in one room … [the learners] can't really find the reasons to disagree [with] why math is discouraging" (female, post-interview, 7 August). In order for learners to have an awareness that they are able to achieve, the possibilities need to be modelled for them (Brophy, 1999; Dornyei, 2009). Modelling is an important aspect of peer-tutoring (see 1.3). Peer-tutors are able to guide learners to become increasingly self-regulated (Heyd-Metzuyanim & Graven, 2016; Hoops et al., 2016). Dailey, (2009) agrees that peer-tutors are role-models to learners, in the sense that they can showcase what learners are able to achieve and they can assist learners with mathematics content. The peer-tutors represent what they were able to achieve mathematically and they went through similar

circumstances as the learners at an earlier stage. Furthermore, peer-tutors appeared to be able to demonstrate an awareness and enthusiasm about mathematics.

4.3.2.1.4 Group observations

During the observations the researcher noted in more than half of instances (32 out of 62; 51.6%) where the category of *Relevance* was evident. Next, *Relevance* will again be discussed in terms of its three subcategories, namely 1) relate to the goals; 2) match interests; and 3) tie to experiences.

4.3.2.1.5 Relate to goals

During the group observations all ten peer-tutors addressed *Relevance* by relating to goals in 13 out of 32 instances (40.6%). The researcher noted, "I enjoyed seeing how the peer-tutors showed the learners that mathematics builds on previous work that they had done… [and] how it [mathematical concept] was relevant to what they were doing presently in mathematics" (Appendix C). According to Goetz, Bieg, Lüdtke, Pekrun, and Hall (2013), one way that the *Relevance* of the content can be demonstrated and help increase learners' motivation is to demonstrate its usefulness. During the observations it was apparent that the peer-tutors did relate content to the learners' goals by discussing its present worth and how it ties in with what learners had learnt in the past.

4.3.2.1.6 Match interests

There were only four out of the 32 (12.5%) instances where the researcher noted that three of the ten peer-tutors (30%) spoke to the learners on how they would be able to apply the mathematics in the future. The following observation was made: "PT10 explained a number of reasons why achieving in mathematics was important to become a paramedic. I felt that the learner was more motivated to continue after the discussion" (male, 31 May) (Appendix C). According to several scholars (Izmirli & Izmirli, 2015; Keller, 1987; Milman & Wessmiller, 2016), linking present content to future needs and addressing real world issues helps to promote the relevance of what learners are doing currently. Although it was observed that not all the peer-tutors matched the learners' interests with the content being taught, they did address the future application of mathematics.

4.3.2.1.7 Tie to experiences

All ten peer-tutors were observed showing interest in the learners and wanting to assist in helping learners improve their mathematics. In particular, 15 out of 32 instances (46.9%) were observed that tie to learners' experiences. The researcher demonstrated that she believed the peer-tutors were good models for the learners to learn from as the peer-tutors showed enthusiasm for mathematics.

> When I approached the peer-tutors to tutor the Grades 8 and 9 learners I was aware that the learners were really excited to help their fellow learners… it did not appear that the peer-tutors were doing this only for merits or an extra activity… I feel they are genuinely interested in helping the learners. (Appendix C)

The peer-tutors were able to bring their own experiences into the tutoring and to help learners get and stay motivated (Clarence, 2016). Peer-tutoring in mathematics is linked with improved mathematics results (Duah et al., 2014) and, according to Topping, Campbell, Douglas, and Smith (2003), peer-tutors encourage learners to stay positive, especially when the content is challenging The peer-tutors were able to influence learners' mathematics motivation and knowledge progressively and they were able to "provide meaningful alternative methods for accomplishing a goal" (Keller, 1987, p. 4).

4.3.2.2 Weekly reflection reports

4.3.2.2.1 Relate to goals

Five of the eight peer-tutors (62.5%), who submitted weekly reflection reports, focused on relating learners' goals (6 out of 12; 50%) to the mathematics that learners were currently working on. PT5 said he found that it was important to "display relevant situations that happen outside of school, for example, the programming of their favourite game or the speed of cars". He went on to say that learners had positive experiences when "they realised the involvement of mathematics in scenarios they weren't aware of" (male, weekly reflection report 6, 10 May). Schukajlow, Rakoczy and Pekrun (2017) argue that in order to influence learners' motivation it is important to link the learners' reality to the real world. From the weekly reflection reports the majority of the peer-tutors showed evidence that they understood that relating learners' mathematics to real life situations was an important aspect of making mathematics relevant to the learners.

4.3.2.2.2 Match interests

Another way, according to Keller (1987), of showing learners the relevance of mathematics, is to match it with learners future interests. Two of the eight peer-tutors (25%) addressed the future usefulness of mathematics in the learners' life. PT3 demonstrated this to the learners by bringing in his mathematics books from Grade 11 and showing the learners where he was using similar work. "I showed the learner my Grade 11 book so he could see how his work forms a foundation for Grade 11… I was able to show the learner how important the work is for higher Grades" (male, weekly reflection report 6, 24 April). PT8 noted, "I explained to them how important these foundations are for higher Grades in mathematics… learners should realise how maths teaches them valuable life-skills that they can use in the future" (male, weekly reflection report 2, 23 April).

Two of the eight peer-tutors (25%) mentioned that they believed that teachers could do more to addresses the relevance of mathematics in the real world. PT9 commented that "educators should show how the content is relevant in the real world as opposed to just high school exams" (female, weekly reflection report 6, 22 May). Two of the eight peer-tutors (25%) also addressed the unwillingness of some learners to see the relevance of mathematics. PT1 commented, "Pessimistic learners who prefer focusing on a life without mathematics were discouraging" (female, weekly reflection 2, 5 February). PT5 commented that there were "learners who believed that there are better things to focus on, which are irrelevant to mathematics" (male, reflection report 6, 9 May).

It is important that learners understand the importance of mathematics for their future if they want to succeed. Weiner (2010) discusses, under the attribution theory (see 2.3.1.1), that when learners perceive that, in the future, they might be able to achieve, they may be motivated to continue and pursue an activity. In achievement goal theory (see 2.3.1.2), Lazaridus, Buchholz and Rubach (2018) also found that the ways in which learners perceived the likelihood that they would succeed in mathematics, were impacted by their perceptions of the importance of mathematics to their future career. Furthermore, Dailey (2009), when discussing the possible selves theory (see 2.3.3), states that learners need to imagine what they want to do in the future for themselves. Lutovac and Kaasila (2014,

p. 131) acknowledge that when a learner “enters into a dialog that leads to one’s awareness of a tension or gap between the actual and the ideal state of mathematical identity”, s/he is able to reflect on what s/he wants to become.

From the weekly reflection reports, it is evident that learners have successfully discussed and addressed the importance of mathematics in their lives as the peer-tutors have demonstrated the importance of mathematics to them in various ways. These demonstrations and discussions may have helped the learners to understand the relevance of mathematics in their school careers.

4.3.2.2.3 Tie to experience

None of the eight peer-tutors addressed the relevance of mathematics by linking it to mathematics experiences.

4.3.3 Confidence

The third category in Keller’s (1987) model of motivation is *Confidence. Confidence,* assists in promoting learners’ determination to complete a task (Keller, 1987). Keller (2000) identified three sub-categories under *Confidence*, namely 1) success expectations; 2) success opportunities; and 3) personal responsibilities. Table 4.5 displays the analysis of the category *Confidence*. The symbol *f* indicates the frequency of responses per code, while n refers to the number of peer-tutors who addressed a specific code.

Table 4.4: Analysis of Keller's (1987) category of *Confidence*.

	Category	Sub-category	Code	f	$n = 10$
INTERVIEWS	Confidence 17 (25%)	Success expectations 0 (0%)	Learning requirements	0 (0%)	0 (0%)
		Success opportunities 5 (29.4%)	Difficulty	3 (60%)	3 (30%)
			Expectations	2 (40%)	1 (10%)
		Personal Responsibility 12 (70.6%)	Attributions	7 (58.3%)	7 (70%)
			Self-confidence	5 (41.7%)	6 (60%)
OBSERVATIONS	Confidence 25 (36.8%)	Success expectations		6 (24%)	5 (50%)
		Success opportunities		12 (48%)	7 (70%)
		Personal responsibility		7 (28%)	6 (60%)
WEEKLY REFLECTION REPORTS	Confidence 26 (38.2%)	Success expectations		10 (38.4%)	3 (37.5%)
		Success opportunities		8 (30.8%)	5 (62.8%)
		Personal Responsibility		8 (30.8%)	7 (87.5%)

Confidence was addressed in 68 of the 258 times (26.4%) across all three data sources as indicated in table 4.5. The category of *Confidence* had almost the same number of responses in each data source, namely interviews (17 of 68; 25%), observations (25 of 68; 36.8%) and weekly reflection reports (26 of 68; 38.2%) (see table 4.5).

4.3.3.1 Interviews

Confidence was addressed 17 of 68 times (25%) by all ten peer-tutors during the interviews. Next, the three sub-categories under *Confidence* will be discussed, namely 1) success expectations; 2) success opportunities; and 3) personal responsibilities.

4.3.3.1.1 Success expectations

Learning requirements are categorised under the sub-category success expectations. None of the ten peer-tutors indicated that they explicitly laid out learning requirements to the learners (Keller, 1987).

4.3.3.1.2 Success Opportunities

(a) Difficulty

Under the sub-category of success opportunities, three of the ten peer-tutors (30%) spoke about organising questions in increasing levels of difficultly. PT10 said that he let the learners start with simple questions and then let them work towards more challenging questions, because he didn't want them getting confused with lots of working out. He noted "Give them sums that would be easier for them to solve, so [the learners] don't [have as much to] write [otherwise the sums] look confusing and that is intimidating" (male, pre-interview, 20 February). In the attribution theory (see section 2.3.1.1) task difficulty is understood to be external to the learner (Linnenbrink-Garcia et al., 2016; Moodaley et al., 2006; Weiner, 2010). When a task is perceived as too difficult learners can be led to believe that they are failures and this negatively impacts on their motivation (Linnenbrink-Garcia et al., 2016). When learners are presented with strategies which enable them to persevere with challenging tasks, and when they believe that they are prepared for the tasks, learners' motivation increases (Pintrich, 2003). When the peer-tutors address learners' confidence to complete difficult tasks, it can be assumed that they are more likely to persevere because their motivation has increased.

(b) Expectations

Under the sub-category of success opportunities, expectations were noted by only one peer-tutor who referred to it two out of five times (40%). PT1 claimed she felt that it was important that learners knew what was expected of them, but also that there was not only one way to get to the answer. According to Ryan and Deci, (2000a), when a learner possess self-efficacy and possesses the competency to complete a task, the learner's self-confidence increases (see 2.3.2.1 for self-determination theory). Hannula (2006) concurs that for learners to believe that they can complete a task, they need "the confidence to pursue … through studying harder" (p. 170). From this finding of the study,

it could be deduced that the peer-tutors addressed learners' abilities to persevere when questions got difficult, which improved learners' self-confidence and motivation.

4.3.3.1.3 Personal responsibility

(a) Attributions

There were 12 of the 17 responses (70.6%) on the third sub-category, personal responsibility, which addresses attribution and self-confidence. Seven of the ten peer-tutors (70%) stated that primarily they helped improve learners' confidence by verbally attributing the learners' success to the effort that the learners were putting in. PT2 spoke about how important it was that she was patient when learners got an answer wrong and that it was important that the learners knew they could do the work for themselves, by reflecting, "I think it's a big thing [us] just being patient…letting them know they can do it and letting them know that we are here for them" (female, pre-interview, 6 March).

(b) Self-confidence

Although not explicitly addressed, four of the ten peer-tutors (40%) implied that they helped learners' mathematics self-confidence by allowing learners to "become increasingly independent in their work" (Keller, 1987, p. 3). PT7 said that she ensured that the learners knew she was there to assist but "eventually they would just do it themselves" (female, post-interview, 15 October). Peer-tutors allowed learners to practice and repeat under low risk conditions (Keller, 1987). PT8 stated that he would remain close to the learner but allow them to figure the sum out for themselves. "…they [were] still able to figure it out for themselves. Then when they do they feel more confident in their abilities" (male, post-interview, 17 October). Two of the ten peer-tutors (20%) believed that they helped learners' self-confidence by creating a safe space where the learners knew they did not have to be perfect (Keller, 1987) . PT9 said she encouraged them even when learners made mistakes. ""It's okay, try again"" (female, post-interview, 17 October).

The self-determination theory (see 2.3.2.1) focuses on the learner's self-confidence. Ryan and Deci's (2000b) state that there are three essential psychological needs that are addressed in self-determination theory – competency, autonomy and relatedness (Ryan & Deci, 2000b). Ryan and Deci (2000b) continue noting that competency, autonomy and

relatedness are vitally important in a learner's development with his/her community of learning. When learners are highly motivated it is often due to the teacher giving clear goals addressing what Keller (2000) refers to as success expectations. When the teacher has provided tasks that are difficult the teacher is providing the learner with what Keller (2000) refers to as success opportunities (Keller, 2000). When teachers give learners a sense of autonomy this addresses Keller's (2000) sub-category of personal responsibility. Some peer-tutors did address these psychological needs in various ways by addressing the learners' motivation through boosting their confidence.

4.3.3.2 Group observations

4.3.3.2.1 Success expectations

During the observations it was noted that only five of the ten peer-tutors (50%) focussed on success expectations. The researcher observed:

> I was excited to see how PT2 set some basic goals at the beginning of the tutorial, when stating that "when you leave you need to understand … now that you have completed the exercise explain to me what you understand". (female, 23 May) (Appendix C)

By stipulating what is expected of learners, learners were able to reflect on what they were able to do and what they still had to accomplish. Cleary et al. (2017) and Hannula et al (2016) agree that stipulating expectations can create a more authentic learning practice and empower the learners to know what they need to prepare for in future tasks. The peer-tutors were clear on what was expected of the learners, not only during the tutorials, but for the mathematics topic, as well as for the tests and examinations. Success expectations can boost learners' confidence and motivate them to continue with the work they are doing.

4.3.3.2.2 Success opportunities

During the observations, it was evident that the peer-tutors were confident in organising the material in increasing levels of difficulty and explaining to the learners what was expected of them to complete the exercises (Keller, 1987). Seven of the ten peer-tutors (70%) were observed presenting various success opportunities to the learners. The researcher observed that "The peer-tutors gave learners different exercises with varying levels of difficulty and sat with the learners and helped them work through all the exercise"

(Appendix C). Also, PT1 was very clear with the learner what would be required of him in the upcoming test" (Appendix C). Success opportunities can be linked to extrinsic motivation (see section 2.3.2.3), notably the third extrinsic motivational style, identification, which impacts on the progression of learning as well as the opportunities with which learners are provided (Hannula et al., 2016; Pintrich, 2003). When the peer-tutors provided the learners with varying levels of difficulty to complete (i.e. enhancing their preparedness) and helped them to understand what to expect in upcoming tests, the learners were able to go into the tests with more confidence than otherwise.

4.3.3.2.3 Personal Responsibility

The researcher observed that six of the ten peer-tutors (60%) encouraged learners to take greater responsibility for the work that they were doing.

> I was glad to see that the peer-tutors did not just do the work for the learners, and constantly encouraged them to take responsibility for the work… the peer-tutors asked lots of reflective questions and didn't just give the answer to the leaners. (Appendix C)

The external motivation theory (see section 2.3.2.3) also addresses self-confidence. When learners are positively motivated by the community of learning (in this case tutorials), and they believe they can continue, self-confidence is impacted positively (Dailey, 2009; Dornyei, 2009). Furthermore, according to Ryan and Deci (2000a), when learners are able to take responsibility for the work they are doing, their competency and self-efficacy are positively impacted (see section 2.3.2.1). The peer-tutors, without having any formal training, appeared to understand the importance of learners taking personal responsibility for their work.

4.3.3.3 Weekly reflection reports

4.3.3.3.1 Success expectations

Three of the eight peer-tutors (37.5%) who submitted weekly reflection reports, commented on how they helped learners to know and understand what was required of them in tests or examinations, thus success expectations helped to boost learners' confidence. PT8 said "I explained to the learner what types of questions are normally asked … and how he should go about practising examples" (male, weekly reflection report 3, 30 May).

4.3.3.3.2 Success opportunities

Three of the eight peer-tutors (37.5%) discussed how they encouraged learners to work through difficult examples in an attempt to boost their confidence when they got them correct, thus emphasising success opportunities. PT5 encouraged learners to go back to simpler questions which they understood, to see if they were able to see how they could complete a difficult question. He went on to say that he also felt it was important to do a number of similar questions to check that the learner did understand the mathematical principles. He noted, "I encouraged them to do simpler questions to get the basics right and return to the difficult questions … I also encouraged them to do specific questions from different exercises" (male, weekly reflection report 7, 16 May). Githua and Mwangi (2003) acknowledge that if learners are not encouraged to pursue difficult mathematical questions, their self-confidence can be affected when they are not able to complete a challenging task, which can have a direct impact on their motivation. The peer-tutors made a concerted effort to encourage learners to complete challenging tasks. In addition, the peer-tutors gave the learners strategies to work through the challenging tasks. From this finding, it can be deduced that the learners, who attended the tutorials, felt more confident to complete similar tasks in the future, which, in turn, also impact positively on their motivation to do mathematics.

Two of the eight peer-tutors (25%) stated that they had helped the learners to set goals. Learners' expectations of themselves and their confidence rose when they were able to set realistic goals, and have a plan of work to reach these goals (Keller, 1987). PT1 noted, "I helped the learner set up a study timetable and show [the learner] how much work needs to be covered" (female, reflection report 3, 16 April). PT1 continue mentioning that she "broke the work down into smaller pieces, [this] helped them to feel less intimidated by the work and allowed the learners to feel more confident in what they can achieve" (female, reflection report 3, 16 April).

4.3.3.3.3 Personal responsibility

Seven of the eight peer-tutors (87.5%) encouraged the learners to take personal responsibility for their own work. PT9 made the same comment, "I encouraged them to do more examples until they were comfortable with the topic at hand" (female, weekly reflection report 7, 28 May). Independent motivational practices are important for learners'

self-confidence. According to Dailey (2009), self-confidence can be established through a positive attitude towards the community of learning. Hannula (2006) agrees that learners' self-confidence is important to their mathematical performance. Grehan et al., (2016) argue that when learners feel underprepared, it is difficult for them to work independently and to possess the self-confidence to interact in the learning community. From this finding of the study, it is evident that the peer-tutors did encourage learners to become increasingly independent and to increase their confidence in their mathematical ability.

4.3.4 Satisfaction

The fourth category in Keller's (1987) model of motivation is *Satisfaction. Satisfaction* addresses ways that make learners feel good about what they have achieved (Keller, 1987). The category of *Satisfaction* focuses on ways to help learners feel good about what they have achieved (Keller, 1987). This category is divided into three sub-categories, namely 1) intrinsic satisfaction; 2) rewarding outcomes; and 3) fair treatment. Table 4.6 displays the analysis of the category *Satisfaction*. The symbol *f* indicates the frequency of responses per code, while n refers to the number of peer-tutors who addressed a specific code.

Table 4.5: Analysis of Keller's (1987) category of *Satisfaction*.

Data Source	Category	Sub-category	Code	f	$n = 10$
INTERVIEWS	Satisfaction 15 (50%)	Intrinsic satisfaction 2 (13.3%)	Natural consequences	2 (100%)	2 (20%)
		Rewarding outcomes 13 (86.7%)	Unexpected rewards	3 (23.1%)	2 (20%)
			Positive outcomes	10 (76.9%)	5 (50%)
			Negative influences	0 (0%)	0 (0%)
		Fair treatment 0 (0%)	Scheduling	0 (0%)	0 (0%)
OBSERVATIONS	Satisfaction 9 (30%)	Intrinsic satisfaction		9 (100%)	7 (70%)
		Rewarding outcomes		0 (0%)	0 (0%)
		Fair treatment		0 (0%)	0 (0%)
WEEKLY REFLECTION REPORTS	Satisfaction 6 (20%)	Intrinsic satisfaction		6 (100%)	6 (75%)
		Rewarding outcomes		0 (0%)	0 (0%)
		Fair treatment		0 (0%)	0 (0%)

Satisfaction was addressed 30 of 258 times (11.6%) across all the data sources. *Satisfaction* is the category least addressed by the peer-tutors and observed by the researcher. *Satisfaction* was noted mainly during the interviews.

4.3.4.1 Interviews

The category *Satisfaction* was mentioned by nine of the ten peer-tutors (90%). Although this category consists of three sub-categories - intrinsic satisfaction, rewarding outcomes and fair treatment - the peer-tutors mainly addressed rewarding outcomes when discussing learners' satisfaction.

4.3.4.1.1 Intrinsic Satisfaction

Two of the ten peer-tutors (20%) touched on intrinsic satisfaction. Natural consequences, in the ARCS model of motivation, is allowing learners to use the skills that they have acquired and to reinforce the learners' intrinsic pride (Keller, 1987). PT9 explained that she tried to show the learners that they were able to get better marks if they focused on their mistakes more closely and then attempted to correct them:

> I told them, 'If you are getting like a 65% you can push for a 70%, so let's try look at the small little things you are doing wrong. [If] you can fix that, you can push for that higher mark". I am sure everyone [at the tutorials] wanted to get better marks'. So definitely doing small things and changing the little things that they are doing, can definitely contribute to them doing better. (Female, weekly reflection report 8, 4 June)

Dailey (2009) and Ryan and Deci (2000b) concur that intrinsic motivation is important, as it builds on the learners' inherent longing to learn. In mathematics, intrinsic motivation can often indicate how learners will achieve and what learners will be able to achieve in the long term (Singh et al., 2002). Some of the peer-tutors recognized learners' inherent desire to learn and attempted to give them some personal strategies to enable the learners to take charge of their own learning and by implication, futures. According to Keller (1987) addressing the learners' intrinsic satisfaction, should help increase the learners' motivation.

4.3.4.1.2 Rewarding Outcomes

(a) Unexpected Rewards

Three out of the 13 utterances (23,1%) made on the sub-category on rewarding outcomes refer to unexpected rewards (Keller, 2000). Unexpected rewards are rewards that encourage intrinsic motivation by rewarding boring tasks with unanticipated rewards (Keller, 1987). Two of the ten peer-tutors (10%) rewarded learners with unexpected rewards. PT1 spoke about how she allowed the learners to complete the task on the teacher's white-board, which really encouraged the learners to do the exercises (female, post-interview, 7 August). PT1 continued saying that she would have a competition, "I would give them the same questions, "okay whoever finishes the questions fastest, wins" and then I would give them a sweet" (female, post-interview, 7 August). Often in

mathematics learners' motivation is linked to a reward or punishment. According to Hagger, Sultan, Hardcastle, and Chatzisarantis (2015), learners will complete their work based on the perceived probability that the reward or punishment will be worth it. From this finding it can be deduced that the two peer-tutors who responded are aware that creating a competition and using rewards of writing on the white-board and giving sweets were motivation to help the learners to work and feel satisfied with the work that they had executed. This finding demonstrates that small, seemingly insignificant, rewards do impact on learners' motivation.

(b) Positive outcomes

Five of the ten peer-tutors (50%) addressed positive outcomes, categorised under the sub-category of rewarding outcomes. Positive outcomes can be given through verbal praise, giving personal attention to learners, informative feedback as well as motivating feed-back (Keller, 1987). The peer-tutors spoke about how they addressed *Satisfaction* by verbally praising the learners when they were completing work. PT5 said he would inform learners of the difficulty of the work they had done and praise them for doing it well. "[I] just told them to keep going, when they do get it, you know, 'That was really difficult you actually got it, well done'" (male, post-interview, 15 October). The attribution theory's second dimension (see 2.3.1.1), namely stability, refers to the likelihood that an outcome will reoccur (Weiner, 2010). According to Pintrich (2003) and Weiner (2010), if learners believe that in the future there is a possibility that they will be able to overcome past failures, then they are more likely to persevere. Peer-tutors who encourage the learners' mathematics satisfaction may be promoting learners' motivation to persevere in mathematics notwithstanding the challenges.

The peer-tutors empowered the learners to feel accomplished about the mathematics that they had done, or were currently doing, through external motivation (see 2.3.2.3). External motivation is understood to be a compulsion to complete a task, not simply for internal joy, but to complete a goal set by someone else or for praise, reward or avoiding punishment (Dailey, 2009; Pintrich, 2003; Ryan & Deci, 2000b). As discussed in chapter 2 there are four types of extrinsic motivational styles – external, introjection, identification and integration. Since attendance of tutorials was not compulsory, the learners

demonstrated a degree of motivation in attending. Even if learners' intrinsic motivation was not strong, the learners could, at the very least, identify positive outcomes. Identification of positive outcomes occurs when the learner has determined that an activity can add value and help in achieving his/her mathematics goals (Pintrich, 2003). Even though the learners demonstrated a desire to improve their mathematical abilities, they could still have been acting out of external motivation. Ryan and Deci (2000b) agree that it is important that learners still receive praise and rewards to encourage them to continue and feel a sense of connectedness. Yu and Singh (2018) also argue that learners need to feel that they are competent and that there is someone to support them.

(c) Negative influences

None of the ten peer-tutors spoke about negative influences under the sub-category of rewarding outcomes (Keller, 1987), thus avoiding threats and comparisons. It is likely that the peer-tutors understood that creating a negative experience for the learners would not be beneficial. However, it is also likely that the peer-tutors were themselves positively motivated and therefore mirrored their motivation to their learners.

4.3.4.1.3 Fair Treatment

(a) Scheduling

None of the ten peer-tutors addressed scheduling (or frequent reinforcing of what the learner has learnt) under the sub-category of fair treatment (Keller, 1987). Scheduling could possibly have been addressed indirectly or subconsciously by the peer-tutors during the tutorials, but it was not evident from the collected data.

4.3.4.2 Group observations

4.3.4.2.1 Intrinsic satisfaction

It was observed that more than half of the peer-tutors (seven out of ten; 70%), encouraged learners to practise what they had just been taught, as soon as possible. Further it was viewed that learners were helping other learners with similar questions and peer-tutors were encouraging the learners by indicating when they completed a difficult question. The researcher noted, "PT3 not only encouraged a learner to complete a question that the learner felt he couldn't do, he also praised the learner at each correct step completed" (male, 24 July) (Appendix C). Ryan and Deci (2000b) agree that although learners have

an innate desire to learn, their motivation needs to be maintained and enhanced. Without support learners' motivation can get disrupted. When a learner's feelings or ability are encouraged, their intrinsic motivation can increase (Ryan & Deci, 2000b). The peer-tutors did address learners' feelings and encouraged their satisfaction with the work that they were completing, which could be an indication that learners' intrinsic satisfaction had been addressed.

4.3.4.2.2 Rewarding outcomes

No observations, other than verbal praise, was noted where learners were rewarded for their outcomes.

4.3.4.2.3 Fair treatment

No observations were made of the peer-tutors influencing learner's negatively through threats or hindering learner satisfaction through unfair treatment. Thus, it can be deduced that all eight peer-tutors observed treated the learners' fairly and without discrimination.

4.3.4.3 Weekly reflection reports

According to the weekly reflection reports, the peer-tutors did not use many methods to improve learner satisfaction. The peer-tutors felt satisfied if learners left the tutorial feeling more confident to complete the work, which loosely ties in with Keller's (1987) sub-topic of intrinsic satisfaction. None of the eight peer-tutors addressed rewarding outcomes or fair treatment.

Six of the eight peer-tutors (75%) focused briefly on learners' intrinsic satisfaction. PT8 and PT9 addressed learners' satisfaction in a similar way, PT8 noted, "they were able to answer questions they previously were unable to" (male, weekly reflection report 3, 30 May), and PT9 mentioned, "…by the end of the session they were doing examples correctly" (female, weekly reflection report 8, 4 June). In addition, PT10 remarked that, "they all willingly participated": he believed this showed learner satisfaction (male, weekly reflection report 4, 19 April). Schukajlow et al (2017) addresses learners' motivation in mathematics, by asserting that when learners enjoy the work that they are doing they are more likely to persevere. Ryan and Deci (2000b) concur that learners have a desire to seek out new and challenging activities that will promote their learning and growth. The environment that the learners find themselves in can influence learner satisfaction

(Novak, 2014) (see 2.4.3). The peer-tutors could link learners' willingness to persevere and seek out new challenges as an indication that Keller's (1987), category of *Satisfaction* had been addressed. From the finding, it can be deduced that there was learner satisfaction since learners had not only completed the work that they had, but they also completed it willingly.

4.3.5 Synthesis of the commonalities, contradictions and idiosyncrasies between the four categories

4.3.5.1 Commonalities

(a) Attention

Under the category of *Attention,* taking into account all the data collecting methods, it is apparent that the peer-tutors were able to capture learners' attention mainly through giving concrete examples and through using methods dissimilar to those taught in the classroom. During both the interviews and during the observations capturing learners' attention was the predominant method that was noted to get learners' attention. Maintaining attention through participation was addressed by the majority of the peer-tutors during the interviews (6 of 10; 60%) and weekly reflection reports (6 of 8; 75%) and was observed from four of the ten peer-tutors (40%) during the observations. Getting learners' attention through using different methods of engagement was the most common method utilised by peer-tutors (as transpired from the data).

When learners have a feeling of connectedness to the task that they are completing, their intrinsic motivation is developed (Ryan & Deci, 2000b). Furthermore, when learners have a positive experience of learning and believe that they have connected to the community of learning, in this case mathematics, their intrinsic motivation is strengthened (Winberg et al., 2014). These commonalities between the three different data sources could indicate that not only did the peer-tutors prioritise participation in a community of learning, but that learners' intrinsic mathematics motivation could have been developed or strengthened during the tutorials.

(b) Relevance

A commonality during the observations and the weekly reflection reports was that the learners were able to demonstrate the relevance of mathematics by relating the

mathematics to their personal goals. However, none of the peer-tutors addressed this sub-category in the interviews. This could indicate that relating the mathematics to the learner's personal goals is a good way to discuss with learners the relevance of mathematics and could improve learner motivation. This links with the new approach in motivation theory: possible selves (see section 2.3.3) as well as a cognitive strategy (see section 2.4.1) of reflection: empowering learners to access tasks that will be beneficial to them achieving their goals.

Furthermore, under the category of *Relevance* it is evident that the peer-tutors focused on matching learners' interests as the most common means of showing learners the relevance of mathematics. The main way this was indicated, through all the data sources, was through discussing the relevance of mathematics to the learners' future. Dailey (2009) discusses the need for instrumental motivation, motivation that encourages the learner to achieve because of future prospects. When learners believe that there are future incentives and successes in the offing, they are motivated to complete work now to enable them to reach their future goals (Weiner, 2010). Peer-tutors usually have a good understanding of this and believe that working towards a goal for the future makes mathematics relevant; they understand that this is a good way of linking the learners' future interests with what they are currently working on.

(c) Confidence

The peer-tutors focussed clearly on each of the three sub-categories under *Confidence* – success expectation, success opportunities and personal responsibilities. Only during the interviews, was there no evidence of data on success expectations. Peer-tutors view helping learners to improve their confidence in mathematics as important. When learners believe they can complete a task, often through preparedness, their motivation to continue in the future and to interact with the community of learning is positively impacted (Cleary et al., 2017; Grehan et al., 2016). According to the peer-tutors and the researcher's observations, learners' confidence was addressed successfully.

(d) Satisfaction

Intrinsic satisfaction was the predominant method the peer-tutors attempted to address the category *Satisfaction*. Intrinsic satisfaction was addressed mainly during the

observations and the weekly-reflection reports. Although Ryan and Deci (2000b) argue that it is often difficult to address learners' intrinsic satisfaction, the peer-tutors attempted to enhance learners' intrinsic motivation.

None of the ten peer-tutors addressed fair treatment. According to Keller (2000, p. 4) fair treatment can be done by "assisting [learners] in anchoring a positive feeling about their accomplishments". Although none of the peer-tutors addressed this and the researcher did not make any observations in this regard, over all, the tutoring appeared to be a positive experience.

4.3.5.2 Contradictions

(a) Attention

There were no obvious contradictions noted on how the category of *Attention* was addressed and/or viewed across the three data sources.

(b) Relevance

With regard to *Relevance*, a contradiction that is evident in the interviews is that only three of the ten peer-tutors indicated that they attempted to link mathematics to learners' experiences, and only through modelling. However, during the observations the researcher noted that all ten of the peer-tutors attempted in one way or another, to link learners' experiences to the mathematics they were working on. This finding could indicate that the peer-tutors were actually showing the relevance of mathematics through experiences and did not realise it, and therefore did not discuss it in the interviews and weekly reflection reports.

(c) Confidence

No obvious contradictions on the category of *Confidence* were noted or viewed during the interviews, observations or weekly-reflection reports.

(d) Satisfaction

A contradiction under the sub-category of rewarding outcomes, classified under *Satisfaction,* was that it was only addressed during the interviews, and not during the observations or in the weekly-reflection reports. This finding could indicate that the peer-tutors were uncomfortable with rewarding outcomes during the observations or in

revealing that in their weekly-reflection reports. Perhaps they viewed the reward of outcomes as the role of the researcher, who is also a practicing teacher, and who was present during the tutorials.

4.3.5.3 Idiosyncrasies

The only idiosyncrasy that was noted was under the category of *Attention*. An idiosyncrasy that was noted under the category of *Attention* was that stimulating inquiry was the least addressed means of getting learners' attention. During the observations, stimulating inquiry was not addressed at all. During the weekly reflection reports only half of the peer- tutors indicated that they attempted to stimulate inquiry to get the learners' attention. However, during the interviews, six of the ten peer-tutors (this equates to more than half of the peer-tutors) indicated that they attempted to get learners' attention through stimulating inquiry. It is peculiar that the peer-tutors did not address stimulating inquiry more during the weekly reflection reports and it was not noted during the observations. This finding could possibly indicate that the peer-tutors regard questioning and inquiry as a way of getting and keeping learners' attention as the role of the researcher, who is also a practicing teacher, and who was present during the tutorial sessions.

4.4 SUMMARY OF FINDINGS

This study endeavoured to answer three research questions in order to answer the main research question. From the findings the three research questions can be answered. A summary of the findings in relation the research questions can be found in table 4.6.

Table 4.6: Summary of findings in relation to research questions.

Research sub-questions	Data collection instruments	Keller's (1987) categories of motivation			
		Attention	***Relevance***	***Confidence***	***Satisfaction***
What are Grade 12 peer-tutors' views of their **role** as motivators for Grades 8 and 9 mathematics learners?	**Interviews** (see sections 4.5.1.1, 4.5.2.1, 4.5.3.1 and 4.5.4.1)	• Capturer of learners' attention. (4.5.1.1.1) • Stimulator of inquiry. (4.5.1.1.2) • Maintainer of learners' attention. (4.5.1.1.3)	• Matcher of learners' needs. (4.5.2.1.2) • Modeller of a mathematician. (4.5.2.1.3)	• Promoter of self-confidence. (4.5.1.3)	• Encourager. (4.5.4.1.2)
In what **ways** do Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners?	**Observations** (see section 4.5.1.2, 4.5.2.2, 4.5.3.2 and 4.5.4.2) **Weekly reflection reports** (see section 4.5.1.3, 4.5.2.3, 4.5.3.3 and 4.5.4.3)	• Concrete, varied and humorous examples. (4.5.1.2.1 and 4.5.1.3.1) • Encourage learners to complete work. (4.5.1.3.2) • Encourage participation. (4.5.1.2.3 and 4.5.1.3.3)	• Building on previous work. (4.5.2.2.1 and 4.5.2.3.1) • Positively motivation learners. (4.5.2.2.3)	• Set learners goals (4.5.3.2.1 and 4.5.3.3.2) • Organise content from easy to difficult. (4.5.3.2.2) • Encourage learners to take personal responsibility. (4.5.3.2.3 and 4.5.3.3.3)	• Complete work. (4.5.4.2.1) • Confident to work independently. (4.5.4.3) • Intrinsic satisfaction. (4.5.4.3)
Synthesis (see section 4.5.5)					
Commonalities		• Capturer of learners' attention through participation. • Maintainer of learners' attention.	• Matcher of learners' needs.	• Do not address success expectations.	• Intrinsic satisfaction. • No one addressed fair treatment.
Contradictions		• None.	• Modeller of mathematics.	• None.	• Rewarding outcomes.
Idiosyncrasies		• Simulator of inquiry.	• None.	• None.	• None.

4.4.1 Sub-question 1: What are Grade 12 peer-tutors' views of their role as motivators for Grades 8 and 9 mathematics learners?

Sub-question 1 asked what the Grade 12 peer-tutors' views of their role as motivators for Grades 8 and 9 mathematics learners were. The interviews were designed to understand what peer-tutors believed their role to be (see Appendix A and B). Under the category of *Attention*, from the findings, it is evident that the peer-tutors believed that their role as peer-tutors was to get learners' attention (see section 4.5.1.1). The findings indicate that peer-tutors were able to get learners' attention through capturing their attention through concreteness and variability (see section 4.5.1.1.1). Peer-tutors discussed their role to get learners attention by stimulating inquiry (see section 4.5.1.1.2) as well as maintaining learning attention through participation (see section 4.5.1.1.3).

Under the category of *Relevance* from the findings it is evident that most (70%) of the peer-tutors believed that their role was to demonstrate to learners the relevance of mathematics (see section 4.5.2) by matching learners' interests (see section 4.5.2.1.2) through demonstrating mathematics future usefulness and matching learners' needs. Peer-tutors also viewed their role as models to learners by tying learners' mathematics to experiences (see section 4.5.2.1.3).

Under the category of *Confidence* (see section 4.5.3), the findings show that peer-tutors understood their role to be to encourage learners to take personal responsibility (see section 4.5.1.3) for their work through attributing their work to the learners' effort and by encouraging learners to becoming increasingly self-confident in their mathematical abilities.

Finally, under the category of *Satisfaction* (see section 4.5.4) the peer-tutors demonstrated that their role was predominantly to encourage (4.5.4.1.2).

In short, from the findings, the peer-tutors' views of their role as motivators were to be 1) capturers of learners' attention; 2) stimulators of learners' mathematical inquiry; 3) maintainers of learners' attention; 4) matchers of learners' interests; 5) modellers of good mathematicians; 6) promoters of learners' self-confidence; and 7) encouragers.

4.4.2 Sub-question 2: In what ways do Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners?

Sub-question 2 focused on which ways the Grade 12 peer-tutors executed their role as motivators for Grades 8 and 9 mathematics learners. The observations and the weekly reflection reports were designed to discover these ways.

Under the category of *Attention* (see section 4.5.1), the findings show that peer-tutors executed their role by using concrete representations and varied mathematics examples as well as using humour (see section 4.5.1.2.1 and 4.5.1.3.1) on occasion to capture learners' interest. From the weekly reflection reports, the peer-tutors discussed how they stimulated inquiry by encouraging learners to practice the work that they had been taught (see section 4.5.1.3.2). In order to maintain learners' attention, the peer-tutors executed their role as motivators by encouraging learners to participate (see section 4.5.1.2.3 and 4.5.1.3.3).

For the category of *Relevance* (see section 4.5.2), peer-tutors executed their role to relate mathematics to learners' goals by building on learners' previous work (see section 4.5.2.2.1 and 4.5.2.3.1) as well as explaining the future usefulness of mathematics (see section 4.5.2.2.2 and 4.5.2.3.2). Finally, peer-tutors executed their role as models of mathematics by positively motivating learners to execute their work (see section 4.5.2.2.3).

For the category of *Confidence*, peer-tutors as promotors of self-confidence (see section 4.5.3), set goals for the learners to achieve (see section 4.5.3.2.1 and 4.5.3.3.2) as well as explained what was required of them in upcoming assessments (see section 4.5.3.3.1). Peer-tutors organised examples in increasing levels of difficulty (see section 4.5.3.2.2) as well as encouraged learners to persevere with challenging questions (see section 4.5.3.3.2). Moreover, peer-tutors encouraged learners to take personal responsibility for their work (see section 4.5.3.2.3 and 4.5.3.3.3).

For the category of *Satisfaction*, peer-tutors as encouragers, addressed learners' mathematics satisfaction (see section 4.5.4) by encouraging learners to complete questions they had previously believed too difficult (see section 4.5.4.2.1). Furthermore,

the peer-tutors attempted to ensure learners left tutorials confident to complete work (see section 4.5.4.3) by focusing on learners' intrinsic satisfaction (see section 4.5.4.3).

To answer the second sub-question, the ways in which peer-tutors were able to execute their role as motivators were by 1) using concrete and varied and humours examples; 2) encouraging learners to complete their work; 3) encouraging participation; 4) building on previous work; 5) positively motivating learners; 6) setting goals for learners; 7) organising content from easy to difficult; 8) encouraging learners to take personal responsibility; 9) ensuring work was complete; 10) by encouraging learners to work independently; and 11) encouraging intrinsic satisfaction.

4.4.3 Main research question: How do Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners compare with Keller's (1987) ARCS model of motivation?

Following the findings pertaining to the sub-research questions, the main research question can be answered confidently. The main research question asked: How do Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners and how do these roles compare with Keller's (1987) ARCS model of motivation? (see section 1.5.1). To answer this question, the researcher will focus on the commonalities, contradictions and idiosyncrasies found in the results.

Under the category of *Attention*, from the commonalities between the data sources, peer-tutors were able to execute their role as capturers of learners' attention mainly through addressing participation. However, an idiosyncrasy that was revealed was that although peer-tutors believed that they should be stimulators of inquiry, there was little evidence that they were able to execute this role. For this reason it appears that peer-tutors' conception of their role as capturers and maintainers of learners' attention aligned with Keller's (1987) ARCS model of motivation. However, peer-tutors execution of their view of their role as stimulators of inquiry, was not executed in line with Keller's (1987) ARCS model of motivation.

Under the category of *Relevance*, peer-tutors' conception of their role as matchers of learners' needs by linking mathematics to learners' personal goals, was executed to

greater extent through practice, than how peer-tutors envisioned their role. Despite this, the peer-tutors' execution of their role as matchers of learners' interests, by linking mathematics to learners' current and future needs, was addressed in all the data sources. Furthermore, although during the interviews the peer-tutors indicated their role as modellers of mathematics briefly, there is much evidence that peer-tutors were able to execute their role significantly more than they initially believed. Therefore, peer-tutors conception of their role as matchers of learners' needs and modellers of good mathematics was executed in alignment with Keller's (1987) ARCS model of motivation.

Under the category of *Confidence*, peer-tutors believed their role as motivators was to promote learners' self-confidence. From the findings peer-tutors did not include addressing learners' success expectations as part of their role as motivators. During the observations only half of the peer-tutors (50%) were observed briefly executing this sub-category and only a third (37.5%) noted that they addressed success expectations during the weekly reflection reports. Consequently, although the peer-tutors understood that their role as motivators included promoting learners' self-confidence, they did not successfully execute all the sub-categories that Keller (1987) indicated. Under the category of *Confidence*, peer-tutors' conceptions of their role did not align completely with Keller's (1987) ARCS model of motivation.

Peer-tutors viewed their role as encouragers under the category of *Satisfaction*. Peer-tutors predominantly addressed intrinsic satisfaction despite the complexities of doing so. As encouragers, none of the peer-tutors addressed the fair treatment of the learners however, there was no indication that the peer-tutors treated any of the learners unfairly. Furthermore, during the observations and weekly reflection reports there was no indication that the peer-tutors rewarded outcomes despite peer-tutors acknowledging during the interviews that they had done so. Therefore, peer-tutors' conception of their role as motivators and encouragers of learners, although not entirely in alignment with Keller's (1987) ARCS model of motivation, was executed to some degree.

The findings have indicated that Grade 12 peer-tutors' conceptions of their roles as motivators compare closely to Keller's (1987) ARCS model of motivation. As indicated

above in section 4.6.3, the peer-tutors addressed each of the four main categories, namely *Attention, Relevance, Confidence* and *Satisfaction* that Keller (1987), laid out in his ARCS model of motivation.

Although the peer-tutors attended to the majority of the sub-categories, namely capturing interest, stimulating inquiry, maintaining attention, relating to goals, matching interest, tying to experiences, success expectations, success opportunities, personal responsibility, intrinsic satisfaction and briefly rewarding outcomes, fair treatment was not addressed outright. As more sub-categories are taken up than those being disregarded, it can be deduced that peer-tutors' conceptions of their roles as motivators for Grades 8 and 9 mathematics learners compare closely to Keller's (1987) ARCS model of motivation.

4.5 CHAPTER SYNTHESIS

Chapter 4 focused on the findings that were analysed from three data sources, namely interviews, observation sheets and reflection reports. The chapter began by laying out the data collection process. Data collection began by conducting one-on-one pre-interviews with each of the ten peer-tutors. Then, eight direct observations, observing each of the ten peer-tutors while engaging with Grades 8 and 9 learners, took place. Concurrently, eight of the ten peer-tutors completed eight weekly reflection reports. The data collection process was finalised with post-interviews with each of the ten peer-tutors. The vertical analytical model was used to analysis the data which began by analysis the biographical data of the ten peer-tutors. Peer-tutors' gender and race formed the basis of the biographical data. Once the biographical data had been address, the analyses of the data took place by systematically working through Keller's (1987) four categories, *Attention, Relevance, Confidence* and *Satisfaction* laid out in the ARCS model of motivation for each of the data sources. After the analysis of the categories was completed, the commonalities, contradictions and idiosyncrasies of the findings were addressed. Finally, a summary of the findings was provided to answer the sub-questions and main research question of the study. From the findings it was evident that the peer-tutors conceived their role as motivators for Grades 8 and 9 mathematics learners which closely aligned to Keller's (1987) ARCS model of motivation.

CHAPTER 5: CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

5.1 INTRODUCTION

Learners' performance in mathematics in South Africa continues to be viewed as poor compared to results from other developing countries, such as Morocco, Indonesia and Lebanon (Heyd-Metzuyanim & Graven, 2016; Waller & Maxwell, 2016). Many factors could be ascribed to learners' mathematics performance, including the teachers qualifications (Spaull & Kotze, 2015), overcrowded classrooms (Graven, 2014), time management issues (Taylor, 2008), curriculum challenges (Taylor, 2008) and weak leadership (Taylor, 2008; Van der Berg, 2008). In particular, motivation is a key factor that could influence how learners perform mathematically (Izmirli & Izmirli, 2015; Karakis et al., 2016). When teachers understand how learners are motivated, learning can be tailored to their learners' needs (Izmirli & Izmirli, 2015). For this reason, understanding how peer-tutors conceive their role of motivating learners was central to this study.

Peer-tutoring has the potential to impact learners' motivation to learn mathematics (Hoops et al., 2016; Ticknor et al., 2014). Keller (1987) stated that there are four main categories that can be addressed to improve motivation, namely *Attention, Relevance, Confidence* and *Satisfaction*. These categories informed the purpose of this study, namely to determine how Grade 12 peer-tutors conceived their role as motivators for Grades 8 and 9 mathematics learners in terms of the Keller's (1987) ARCS model of motivation (see section 1.5).

The final chapter of this dissertation incorporates an overview of the study and a summary of the overarching findings of the study to provide recommendations for further research. The findings of this study will be presented in line with the sub-questions of the study. The implications of the study will be presented along with the findings (see section 1.5.2). The limitations of the research study will be presented, as well as how this study can contribute to the body of knowledge. Recommendations for further research will be made, and this chapter will conclude with personal reflections on the study.

5.2 OVERVIEW OF THE STUDY

This research study is important as it focussed on motivation as a factor to address poor performance in mathematics at school level in South Africa. Research on motivation in mathematics education is limited in South Africa, despite its importance. Furthermore, a lack of motivation among South African learners has been identified as a concern (Letseka, 2014; Makonye, 2017).

Peer-tutoring has several benefits to learners. One benefit is that peer-tutoring enables learners to become increasingly self-regulated, which is an important element in motivation (see section 2.3.2.4). Thus, peer-tutoring has the potential to positively influence mathematics performance in South African schools (Heyd-Metzuyanim & Graven, 2016).

The purpose of the study was to determine how Grade 12 peer-tutors conceived their role as motivators for Grades 8 and 9 mathematics learners in terms of Keller's (1987) ARCS model of motivation (see section 1.5). There were three research objectives for this study (see section 1.6): Firstly, to establish what Grade 12 peer-tutors' views are, pertaining to their role as motivators for Grades 8 and 9 mathematics learners; secondly, to ascertain how Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners; and thirdly, to align Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners with Keller's (1987) ARCS model of motivation. These objectives aimed at better understanding whether the purpose of the study was attainable and whether it could be aligned with Keller's (1987) ARCS model of motivation (Given, 2008).

Chapter 2 gave a review of the literature on the topics of motivation, motivation in mathematics education, tutoring and Keller's (1987) ARCS model of motivation. Motivation was conceptualised and defined to be the compulsion, either intrinsically or extrinsically, that learners have to complete a task and to achieve their individual goals (see section 2.2). Furthermore, three periods in motivation research were expounded upon (see section 2.3). The first period - social psychological period (see section 2.3.1) - includes attribution theory and achievement goal theory. The second period - cognitive situated period (see section 2.3.2) - includes self-determination theory, intrinsic

motivation, extrinsic motivation and self-regulated learning. The most recent period (see section 2.3.3) addressed possible-selves theory – what motivates a person to act in the present. Motivation in mathematics education is impacted by three factors, cognitive factors, psychological factors and environmental or external factors (see section 2.4). In order for learners to be motivated to perform in mathematics, it is important to understand how they are motivated. Furthermore, tutoring, specifically peer-tutoring, was introduced as a suitable method to encourage and promote learners' mathematics motivation (see section 2.5). Finally, Keller's (1987) ARCS model of motivation was introduced as an effective framework to address and align peer-tutors conceptions of motivation. ARCS includes four categories, namely Attention*, Relevance, Confidence* and *Satisfaction* (see section 2.7).

Chapter 3 introduced the research design and methodology for the study. An interpretivist paradigm was implemented (see section 3.3.2.2). This paradigm focused on how peer-tutors experience their world and how they describe reality from their point of view and understanding (Creswell, 2013b; Thanh et al., 2015). The research methodology was qualitative (see section 3.3.2.3). The research approach was inductive and deductive, working from the assumption that a peer-tutor programme would have a positive influence on Grades 8 and 9 learners, towards understanding the extent of the influence on Grades 8 and 9 learners (Lichtman, 2006). The research strategy used was a descriptive case study, which described the peer-tutors' stories in detail: this was possible due to the researcher's close proximity to both the peer-tutors and the learners. The research choice was a qualitative research method which allowed for full and rich descriptions of the peer-tutors conceptions. Furthermore, the research process included three data sources to ensure trustworthiness through triangulation. Pre- and post-interviews were conducted with ten peer-tutors, who were also directly observed in their tutoring of Grades 8 and 9 learners. They also submitted eight weekly reflection reports. Ethical considerations were adhered to in order to protect the participants and the researcher. Finally, the data analysis procedures enabled the researcher to create meaning from the data collected. The data was analysed using Keller's (1987) ARCS model of motivation as the framework. The data was divided into categories and sub-categories and further coded

to determine how the peer-tutors conceived their role as motivators in terms of the Keller's (1987) ARCS model of motivation.

Chapter 4 focused on the data analysis and the findings. Biographical information of the peer-tutors was presented in terms of the peer-tutors' gender and ethnicity. The data from all three data sources were analysed according to Keller's (1987) four categories, *Attention, Relevance, Confidence* and *Satisfaction.* The sub-categories were taken from Keller's (2000) updated sub-categories and the codes were used from Keller's (1987) original conceptions. By using the four categories, relating sub-categories and codes, the researcher was able to better understand how peer-tutors conceived their role as motivators. Finally, the commonalties, contradictions and idiosyncrasies of the findings were presented. Overall, all ten peer-tutors were found to positively motivate the learners in line with Keller's (1987) ARCS model of motivation. The peer-tutors conceived their main role to get learners' attention, and to show learners the relevance of mathematics to their futures.

5.3 SUMMARY OF THE FINDINGS ACCORDING TO THE SUB-QUESTIONS AND OBJECTIVES

The main research question was to determine how the conceptions of Grade 12 peer-tutors of their role as motivators for Grades 8 and 9 mathematics learners compare with Keller's (1987) ARCS model of motivation (see section 1.5.1). In order to answer this question, it was important to establish what Grade 12 peer-tutors' views pertaining to their role as motivators for Grades 8 and 9 mathematics learners were (see section 1.6). The data to establish these views were collected through pre- and post- interviews (see Appendix A and B). It was also necessary to ascertain how Grade 12 peer-tutors executed their role as motivators for Grades 8 and 9 mathematics learners (see section 1.6). These data were collected through direct observations of the peer-tutors while engaging with learners during tutoring by the researcher (see Appendix C). Finally, it was necessary to align Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners with Keller's (1987) model of motivation (see section 1.6). This data were collected from eight weekly reflection reports, based on Keller's (1987) four categories laid out in the ARCS model of motivation, (see Appendix D) submitted by the

peer-tutors. To achieve these objectives, two sub-questions were designed (see section 1.5.2). Next, the findings for this study are presented in line with those sub-questions.

5.3.1 *Sub-question 1:* What are Grade 12 peer-tutors' views of their role as motivators for Grades 8 and 9 mathematics learners?

Sub-question 1 was addressed through the use of pre- and post-interviews. The interviews were conducted at the beginning of the research period and again at the end of the research period (3.4.1.2), using an interview schedule (see Appendix A and B). Once all the interviews had taken place, the interviews were transcribed word-by-word and analysed by means of the software package ATLAS.ti. The data were coded in line with Keller's (1987) four categories and sub-categories laid out in the ARCS model of motivation (see section 3.3.2.3).

Similarities were found between the pre and post interviews pertaining to the peer-tutors' beliefs about their role as motivators. All ten peer-tutors, in both the pre- and post-interviews, understood their role to be a supporter to learners, which can be achieved through positively reinforcing what the leaners had been taught in their mathematics lessons. The peer-tutors also conceived their role to be flexible relative to how the learners learnt. The peer-tutors discussed how they would attempt to improve learners' confidence by explaining work to the learners in ways that they could understand best. Furthermore, the peer-tutors were open to explaining and giving learners' work that matched their mathematical ability. The peer-tutors did not believe that they should simply assign work to the learners, but were conscious of ensuring that the learners were able to complete the work that they were given without overwhelming the learners and causing them to give up.

The main differences between the pre- and post-interviews balanced how the peer-tutors believed that they would address the relevance of mathematics. During the pre-interviews many of the peer-tutors discussed exploring future careers, in mathematics, and doing research with the learners so that the learners could apply mathematics to real world problems that interested them. However, although the peer-tutors mentioned that they addressed the relevance of mathematics by addressing its future relevance, they did not discuss that they related the relevance of mathematics to learners' personal, future plans.

Despite the differences that were noted during the pre- and post-interviews, how peer-tutors understood their role as motivators to Grades 8 and 9 mathematics learners was in line with the literature (see section 2.5). Peer-tutors knew that they needed to, and were able to, come alongside the Grades 8 and 9 mathematics learners to provide support that was relevant and engaging.

To answer the first sub-question, the peer-tutors' views of their role as motivators were to be 1) capturers of learners' attention; 2) stimulators of learners' mathematical inquiry; 3) maintainers of learners' attention; 4) matchers of learners' interests; 5) modellers of good mathematicians; 6) promoters of learners' self-confidence; and 7) encouragers.

5.3.2 *Sub-question 2:* In what ways do Grade 12 peer-tutors execute their role as motivators for Grades 8 and 9 mathematics learners?

Sub-question 2 was addressed by the data collected from eight direct observations of the peer-tutors while engaging with learners during tutoring, by using an observation sheet based on Keller's (1987) categories and updated sub-categories (Keller, 2000) (see Appendix C). As well as eight weekly reflection reports (see Appendix D). Each weekly reflection report focused on one of Keller's (1987) categories. Week one and five focused on *Attention,* week two and six on *Relevance*, week three and seven on *Confidence* and four and eight on *Satisfaction* (see Appendix D). Once the observations had taken place and the peer-tutors had submitted their weekly reflection reports, the researcher's notes and the weekly reflection reports were typed up and, by means of on the software package ATLAS.ti, analysed according to Keller's (1987) ARCS model of motivation (see section 3.4.1.3 and 3.4.1.4).

From the findings of the observations it was clear that the peer-tutors were able to execute their role as motivators effectively. Peer-tutors were able to get learners' attention by capturing the learners' interest in mathematics. This finding was observed through the peer-tutors using concrete mathematics representations, a variety of different teaching methods and humorous mathematics-related stories. Peer-tutors were able to maintain the learners' attention through inquiry. Learners appeared to be comfortable and willing to ask the peer-tutors questions and participate with the peer-tutors (see section 4.5.1.2 and 4.5.1.3).

Peer-tutors were also observed enabling the learners to become more aware of the relevance of mathematics. Peer-tutors were able to relate learners' mathematics goals with the content being taught. They were able to match learners' current interests with what was being taught as well as tie the content to experiences that the learners had had in the past, as well as the peer-tutors' experiences (see section 4.5.2.2, 4.5.2.3 and 4.6.2). Peer-tutors also focused on the future usefulness of mathematics (see section 4.5.2).

Moreover, peer-tutors were observed boosting learners' confidence in mathematics. Peer-tutors motivated learners to set their own goals, as well as reflect on the work that they had done and what they still had to accomplish. Peer-tutors were also able to motivate learners to feel confident about the work that they were doing, by creating opportunities for the learners to succeed. Opportunities were created through organising the material in increasing levels of difficulty. Finally, peer-tutors motivated learners to be confident by encouraging learners to take personal responsibility for their work (see section 4.5.3.2.3 and 4.5.3.3.3).

To conclude, peer-tutors attempted to motivate learners to becoming increasingly satisfied with the work that they were doing. Peer-tutors were observed addressing intrinsic satisfaction by encouraging the learners to complete the work that they were busy with and to persevere with difficult mathematics questions (see section 4.5.4.2 and 4.5.4.3).

From the observations, the Grade 12 peer-tutors were able to execute their role as motivators to Grades 8 and 9 mathematics learners in line with Keller's (1987) ARCS model of motivation. Peer-tutors were able to get learners' attention, show learners the relevance of mathematics, increase learners' mathematics confidence, and increase learners' satisfaction in mathematics.

To answer the second sub-question, the ways in which peer-tutors were able to execute their role as motivators was by 1) using concrete and varied and humorous examples; 2) encouraging learners to complete their work; 3) encouraging participation; 4) building on previous work; 5) positively motivating learners; 6) setting goals for learners; 7) organising content from easy to difficult; 8) encouraging learners to take personal responsibility; 8)

ensuring work was complete; 9) encouraging learners to work independently; and 10) encouraging intrinsic satisfaction.

5.3.3 Overarching finding

The answers to the two sub-questions enabled the researcher to answer the main research question: *How do the conceptions of Grade 12 peer-tutors of their role as motivators for Grades 8 and 9 mathematics learners compare with Keller's (1987) ARCS model of motivation?* (See section 1.5.1)

In order to determine how Grade 12 peer-tutors' conceptions of their role as motivators aligned with Keller's (1987) ARCS model of motivation, the commonalities, contradictions and idiosyncrasies from the findings were addressed (see section 4.5.5).

The commonalities found in the findings indicate that peer-tutors encouraged learners to participate with each other as well as the peer-tutors in an attempt to capture and maintain learners' attention. Peer-tutors were also consistently able to match learners' needs with the content being taught in order to show learners that mathematics was relevant to both their current and future needs. Under the category of *Confidence*, none of the peer-tutors, during the pre- and post- interviews addressed learners' success expectations as part of their role as motivators, and only a minority of the peer-tutors addressed this sub-category during the observations and weekly reflection reports. Furthermore, none of the peer-tutors addressed the fair treatment of learners during any of the data sources, but this does not imply that learners were treated badly. Despite what the peer-tutors did not address, the peer-tutors did focus on improving learners' intrinsic satisfaction. Thus, peer-tutors conceptions of their role as motivators to include capturing learners' attention, maintaining learners' attention, matching learners' needs, and encouraging learners did for the most part align with Keller's (1987) ARCS model of motivation. However, peer-tutors' execution of their view of their role as motivators to be stimulators of inquiry, and promoters of self-confidence did not align with Keller's (1987) ARCS model of motivation.

A contradiction that the findings indicated, was how peer-tutors viewed their role as modellers of mathematics. Peer-tutors did not indicate this role strongly in the pre- and post-interviews, but were able to execute this role exceptionally well according to the observations and weekly reflection reports. Furthermore, another contradiction that arose

from the findings was peer-tutors rewarding of learners' outcomes. During the interviews the peer-tutors acknowledged that they had made an effort to reward learners' outcomes, however, during the observations and weekly reflection reports this was not indicated.

The only idiosyncrasy that came out of the findings was that although peer-tutors indicated that they believed that their role as motivators was to stimulate inquiry, the peer-tutors showed little evidence that they were able to achieve this. Therefore, the role as motivator to stimulate inquiry was not executed in alignment with Keller's (1987) ARCS model of motivation.

Consequently, although the findings indicate that peer-tutors did not execute their role as motivators in complete alignment with Keller's (1987) ARCS model of motivation, for the most part, peer-tutors' conceptions did closely align with Keller's (1987) ARCS model of motivation.

Sub-question 1 focused on what peer-tutors viewed their role as motivators to be. This question was important since it enabled the researcher to understand, not only whether the peer-tutors' views of their role were aligned with the study, but also whether the peer-tutors' views had changed during the study. This sub-question revealed that the peer-tutors' views of their role did align with the literature and remained the same through the study.

Sub-question 2 focused on the ways the peer-tutors executed their roles as motivators. It was important to understand how the peer-tutors engaged with learners during tutoring in order to gain first-hand knowledge of how the peer-tutors enacted their role as motivators. This sub-question showed that peer-tutors were able to execute their role as motivators in 11 different ways, all of which positively impacted on learners' motivation. These ways are:

- Using concrete, varied and humorous examples;
- Encouraging learners to complete their work;
- Encouraging participation;
- Building on previous work;
- Positively motivating learners;

- Setting goals for learners;
- Organising content from easy to difficult;
- Encouraging learners to take personal responsibility;
- Ensuring work was complete;
- Encouraging learners to work independently; and
- Encouraging intrinsic satisfaction

Finally, the commonalities, contradictions and idiosyncrasies looked at how the peer-tutors' conceptions of their role as motivators aligned with Keller's (1987) model of motivation. It was important to answer this question to ensure that the framework for the study was relevant and that peer-tutors' actions were positively impacting on the learners. By focusing on the commonalities, contradictions and idiosyncrasies that arose during from the findings, Grade 12 peer-tutors' conceptions of their role as motivators did for the most part align with Keller's (1987) four categories, namely *Attention, Relevance, Confidence* and *Satisfaction*. Peer-tutors were able to capture learners' attention, maintain learners' attention, match learners' needs to current and future content and encourage learners successfully. Peer-tutors were, however, not able to demonstrate that they had been able to successfully stimulate learners' inquiry and promote learners' self-confidence in alignment with Keller's (1987) ARCS model of motivation.

Therefore, the peer-tutors' views of their role as motivators not only aligned with literature, but peer-tutors were able to execute their role as motivators, for the most part, in alignment with Keller's (1987) ARCS model of motivation. Intervention strategies, such as peer-tutoring in mathematics, can positively address mathematics motivation.

Therefore, the answer to the main research question: *How do the ways Grade 12 peer-tutors conceive their role as motivators for Grades 8 and 9 mathematics learners compare with Keller's (1987) ARCS model of motivation?*, is as follows:

From the findings it was evident that the peer-tutors were able to address each of the four categories laid out in Keller's (1987) ARCS model of motivation, *Attention, Relevance, Confidence* and *Satisfaction*. However, not all the sub-categories laid out were addressed in full, namely rewarding outcomes and fair treatment. Despite this, since majority of the sub-categories were addressed, it can be inferred that peer-tutors'

conceptions of their role as motivators for Grades 8 and 9 mathematics compare closely to Keller's (1987) ARCS model of motivation.

5.4 IMPLICATIONS OF THE STUDY

Implications for this study that are centred on the findings from this study, can be presented to high schools in South Africa to implement as an after-school programme. Recommending a peer-tutoring mathematics programme to high schools could have an impact on Grades 8 and 9 learners' motivation in learning mathematics, which could ultimately impact on mathematics results in South Africa. Moreover, a peer-tutoring programme could positively impact the way South Africa's adeptness to perform internationally is viewed (Bartelet, Ghysels, Groot, Haelermans, & Maassen van den Brink, 2016).

5.4.1 Implication 1: Development of peer-tutors' role as motivators

The first implication that arises from the findings is the development of peer-tutors' role as motivators. In developing peer-tutors' role as motivators, it is important to address and strengthen how peer-tutors can successfully get learners attention by being captors and maintainers of learners' attention and how peer-tutors can stimulate learners' inquiry. It is also important to develop and strengthen peer-tutors' ability to convey the relevance of mathematics to learners by successfully matching learners' needs and being modellers of what it is to be a good mathematician. Moreover, peer-tutors should be sensitised to build learners' confidence by promoting learners' self-confidence, as well as to foster learners' satisfaction by encouraging perseverance.

5.4.2 Implication 2: Execution of peer-tutor's role as motivators.

The ways in which peer-tutors execute their role as motivators are important in the development of learners' motivation. From the findings, various ways were addressed by the peer-tutors in their execution as motivators (see section 4.6.2).

Under the category of *Attention*, peer-tutors should be encouraged to incorporate concrete, varied and humorous examples, which are relevant to learners' lives, in their tutoring. They should work on different means to enable learners to complete their work, for example introducing the use of technology in the classroom, group work or projects, which address real life issues.

Under the category of *Relevance*, an implication is the way peer-tutors address the impact of mathematics on learners' mathematical knowledge in their everyday lives. Peer-tutors should ensure that learners are increasingly able to understand the relevance of the work that they did in the past and how that content will enable them to work towards future mathematical goals. These could, in turn, positively impact on learners' motivation.

An important implication is to address learners' mathematical confidence. Peer-tutors should assist learners to set worthy, attainable mathematics goals. In addition, peer-tutors should encourage learners to take personal responsibility for the work that they are doing. Furthermore, teachers should equip tutors with the skills to organise content in various levels of difficulty to address learners' mathematics confidence.

To ensure learners are satisfied in their learning of mathematics, peer-tutors should encourage learners to complete their work, either through intrinsic or extrinsic motivation. Peer-tutors should encourage learners to work independently in order to become increasingly self-regulated. Furthermore, when learners are encouraged to be intrinsically satisfied with their mathematics learning, they will be more motivated and will perform better in mathematics, which can also impact on South Africa's mathematics results in the future.

5.4.3 Alignment of peer-tutor's conceptions with Keller's (1987) ARCS model of motivation

From the findings on how peer-tutors' conceptions aligned with Keller's (1987) ARCS model of motivation, three roles that should be further developed in peer-tutors were revealed: 1) addressing success expectations clearly; 2) understanding how to address rewarding outcomes; and 3) focusing on fair treatment. Also, peer-tutors could be guided on how and to what extent to reward outcomes during tutorials. Peer-tutors should treat learners fairly and equally, but also give learners evidence of their success.

5.5 POTENTIAL CONTRIBUTIONS OF THE STUDY

Since this was a master's dissertation, it does not come with the expectation that it should contribute new knowledge. However, since this study addressed a gap in the literature with regards to research in South Africa concerning motivation and the impact it could have on mathematics learners' performance, this study has important findings to

contribute to motivation studies in South Africa (see section 1.4). The study highlights the advantages of peer-tutoring to motivate learners in their mathematics learning. These advantages are new findings for South African mathematics learning. The contributions of this study will be divided into three sections: the study's contribution for practice, its scholarly contribution and its policy and curriculum contribution.

This study contributes to practice by establishing the peer-tutors' role as motivator, which can be used by teachers to develop peer-tutors in this regard, but also in developing future peer-tutor programmes. This study adds value to support mechanisms at school to learners struggling with mathematics, but also to learners in general regarding their motivation in learning mathematics. This study also provides guidance to teachers on how to motivate learners in their mathematics classrooms.

The scholarly value of this study is that it provides a new avenue of using Keller's (1987) ARCS model of motivation to view Grade 12 peer-tutors' role as motivators of mathematics learners. The findings of this study also add to the literature of Keller's (1987) ARCS model of motivation and to existing research on motivation in mathematics, but also to research on intervention strategies, in this case peer-tutoring, to address poor performance in mathematics.

The study contributes to curriculum in the sense that the findings from this study could be included in South Africa's curriculum and assessment policy documents for mathematics. The inclusion of a peer-tutor programmes, as a support system to improve learners' motivation, in a policy document may affect the assessment of mathematics in general and in South Africa (with its poor performance record) in particular.

5.6 LIMITATIONS OF THE STUDY

There are a number of limitations in this study that need to be addressed. Firstly, the findings of this research were limited in terms of the short timeframe allocated to this study. Since the findings from this study were conducted over eight weeks of peer-tutoring, a longer period of time may have revealed deeper findings. Secondly, using a qualitative research design and interpretivist approach paradigm may infer researcher bias, however, this was addressed in the philosophical assumptions (see section 3.3.2.1). Thirdly, the sample used was a convenient, purposive sample, which was not

representative of all the learners in South Africa. Therefore, the findings cannot be generalised to other populations. Fourthly, this study took place in a well performing, ex-model C high school. Thus, the results may not be transferable to other contexts in South Africa, such as primary schools, under-performing schools or schools in rural areas. A fifth limitation to the study was that only Grade 12 peer-tutors were selected as participants. The findings could be different if participants were recruited form other Grades. A sixth limitation to this study is that only the conceptions of peer-tutors were investigated and not how their role could be developed or what the conceptions of the learners receiving tutoring were. Finally, a limitation to this study is that its focus was subject-specific, namely on mathematics; different findings could have been revealed for other subjects.

5.7 POSSIBILITIES FOR FUTURE RESEARCH

There are a number of possibilities for future research in the area of motivation in mathematics. First, a longitudinal study is recommended to focus on how to develop peer-tutors to execute their role effectively as motivators, but also to look at other roles, for example to develop peer-tutors' pedagogical content knowledge. Secondly, a larger more diverse sample could be used to include peer-tutors in different Grades and/or from different types of schools, for example primary schools, private schools, rural schools or underperforming schools. Thirdly, future research could concentrate on how learners engage in a peer-tutoring programme, and not focus only on the peer-tutors. Finally, future research could investigate other peer-tutor programmes that deliberate on subjects other than mathematics.

5.8 CONCLUSION

This chapter focused on the conclusions, recommendations and limitations for this study. The chapter started by giving an overview of the study, which summarised the previous four chapters of the study. A summary of the findings was presented according to the sub-questions and objectives laid out in the study. In answer to sub-question one, the peer-tutors indicated seven ways they viewed their role as motivators that aligned with Keller's (1987) ARCS model of motivation. In answer to sub-question two, the peer-tutors discussed eleven ways in which they were able to execute their role as motivators. these

ways all aligned with Keller's (1987) ARCS model of motivation. The commonalities, contradictions and idiosyncrasies indicated that although there were more ways that peer-tutors could execute their role as motivators, for the most part the peer-tutors' conceptions aligned with Keller's (1987) ARCS model of motivation. For this reason the answer to the research question was that peer-tutors conceptions of their role as motivators for Grades 8 and 9 mathematics learners compared closely to Keller's (1987) ARCS model of motivation.

Once the main research question was addressed the implications for this study were presented. Three implications were addressed namely, the development of peer-tutors' roles as motivators, the execution of peer-tutors' roles as motivators and the alignment of peer-tutors' roles as motivators with Keller's (1987) ARCS model of motivation. The contribution of the study was provided in terms of practice, research and policy.

Finally, the limitations of the study and the possibilities for future studies were addressed. Limitations regarding the timeframe of the study, researcher bias, sample size, location of the study, limited grade level of the peer-tutors, the limitation of focus of the study to peer-tutors' conceptions and the limitation of the study in terms of subject-specifically were noted. From the limitations, four possibilities for future studies were addressed, which included a longitudinal study on the development of peer-tutors, a more diverse sample size, future studies widening their focus to include learners attending the tutorials, and a larger subject range.

5.9 PERSONAL REFLECTIONS

This study has provided me, as a researcher, the opportunity to delve deeper into a topic of motivation, which I believe to be especially important in the field of education. I found a topic that interested and inspired me and kept me dedicated to my studies. During this study I have learnt what it means to persevere when I felt like giving up and I have learnt that I do have what it takes to work hard. I have been able to gain a better understanding of not only what motivation is, but also the impact that it can have on learners and mathematics.

Before I began the research, I believed that learners needed to find their own motivation and motivate themselves. However, right at the start of this study, I soon realised that it

was vitally important for the teacher to ensure that the learning environment was actually conducive to the expansion of motivation. The theoretical framework, namely Keller's (1987) ARCS model of motivation and the findings of the study have shown that, it is the peer-tutor/teacher who pioneers motivation amongst learners. Furthermore, because of the limited research in South Africa addressing motivation and the impact it may have on learners' performance in mathematics, I now believe, more than before I began this study, that motivation in mathematics needs to be addressed far more than it currently is, in education. This is an urgent call to action!

During this study I experienced a number of challenges, specifically around time management and working with participants. I had to learn how to prioritise my studies and my research. I found it frustrating and difficult trying to work around ten other peoples' schedules. Finally, as much as I really wanted everything to be perfect, I have learnt that we are all human and so 'good enough' is also acceptable.

In future, I believe I will work differently. I believe I now have a better understanding of what writing a research dissertation entails. I also have a greater appreciation of the role research has in developing the understanding of a subject. Therefore, I will ensure that I choose a topic that I believe in from the start. Furthermore, I will attempt to prioritise my research in such a way that it is my main focus. I will have clearer expectations of myself and of others.

Finally, I believe the Keller's (1987) ARCS model of motivation is a useful model to implement, not only in peer-tutor programmes, but in addressing motivation in the teaching of mathematics. Keller's (1987) model is easy to comprehend, use and implement and addresses not only extrinsic motivation, but aims to inspire intrinsic motivation as well.

I have realised that learner motivation needs to be the main focus in the classroom. Furthermore, I became aware of the importance that peers have in the learning environment, in strengthening mathematics skills, promoting motivation and building a positive learning environment where learners have the opportunity to be seen and heard. I also deem that encouraging the use of peer interaction and teaching is important to mathematics motivation and achievement. Mostly, I am now aware that I have much to

learn as a teacher, a researcher and a motivator and that all learning is active and should be a continuous, lifelong process that should be pursued with enthusiasm and joy.

REFERENCES

Alesksandrovna, C. E., Farman, A. N., Nikolaevna, K. S., Vladimirovna, Y. O., Valerievna, B. V., & Ivanovna, S. M. (2015). History of origin of tutoring in global educational practice. *Mediterranean Journal of Social Sciences*, *6*(6), 492–497. https://doi.org/10.5901/mjss.2015.v6n6p492

Areff, A. (2015). SA almost dead last in maths and science education. In *news24*. Retrieved from http://www.news24.com/SouthAfrica/News/SAalmostdeadlastinmathsandscienceeducationWEFreport20151001

Arroyo, I., Woolf, B. P., Burelson, W., Muldner, K., Rai, D., & Tai, M. (2014). A multimedia adaptive tutoring system for mathematics that addresses cognition, metacognition and affect. *International Journal of Artificial Intelligence in Education*, *24*(4), 387–426. https://doi.org/10.1007/s40593-014-0023-y

Ashwin, P. (2005). Variation in students' experiences of the Oxford tutorial. *Higher Education*, *50*(4), 631–644. https://doi.org/10.1007/sl0734-004-6369-6

Bartelet, D., Ghysels, J., Groot, W., Haelermans, C., & Maassen van den Brink, H. (2016). The differential effect of basic mathematics skills homework via a web-based intelligent tutoring system across achievement subgroups and mathematics domains: A randomized field experiment. *Journal of Educational Psychology*, *108*(1), 1–20. https://doi.org/10.1037/edu0000051

Baumgartner, W., Spangenberg, E., & Jacobs, G. J. (2014). *Motivation strategies of ex-mathematical literacy learners in a university foundation programme* (pp. 101–110). pp. 101–110. Retrieved from https://pdfs.semanticscholar.org/1fb5/9aab999c4ba9ae865824d5a707268dcd8ccb.pdf

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, *13*(4), 544–599. Retrieved from http://nsuworks.nova.edu/tqr%5Cnhttp://nsuworks.nova.edu/tqr/vol13/iss4/2

Bellamy, C. (2011). *Principles of methodology: Research design in social science*. London: Sage.

Bernacki, M. L., Nokes-Malach, T. J., & Aleven, V. (2015). Examining self-efficacy during learning: variability and relations to behavior, performance, and learning. *Metacognition and Learning*, *10*(1), 99–117. https://doi.org/10.1007/s11409-014-9127-x

Beswick, K. (2011). Putting context in context: An examination of the evidence for the benefits of "contextualised" tasks. *International Journal of Science and Mathematics Education*, *9*(2), 367–390. https://doi.org/10.1007/s10763-010-9270-z

Botha, H., & Van Putten, S. (2018). How mathematical literacy teachers facilitate mathematisation in modelling situations. *African Journal of Research in Mathematics, Science and Technology Education*, *22*(1), 93–102. https://doi.org/10.1080/18117295.2018.1437337

Brophy, J. (1999). Toward a model of the value aspects of motivation in education: Developing appreciation for particular learning domains and activities. *Educational Psychologist*, *34*(2), 75–85. https://doi.org/10.1207/s15326985ep3402

Chue, K. L., & Nie, Y. (2017). Study orchestrations and motivational differences in a mathematical context. *Learning and Individual Differences*, *57*(June), 77–84. https://doi.org/10.1016/j.lindif.2017.06.002

Clarence, S. (2016). Peer tutors as learning and teaching partners: a cumulative approach to building peer tutoring capacity in higher education. *Critical Studies in Teaching and Learning*, *4*(1), 39–54. https://doi.org/10.14426/cristal.v4i1.69

Clarence, S. (2018). Towards inclusive, participatory peer tutor development in higher education Sherran Clarence. *Critical Studies in Teaching and Learning*, *6*(1), 58–74. https://doi.org/10.14426/cristal.v6i1.141

Cleary, T., Velardi, B., & Schnaidman, B. (2017). Effects of the self-regulation empwerment program on middle school students' strategic skills, self-efficacy, and mathematics achievement. *Journal of School Psychology*, *64*(April), 28–42.

https://doi.org/10.1016/j.jsp.2017.04.004

Creswell, J. W. (2013a). *Qualitative inquiry and research design* (3rd ed.). Los Angeles: Sage.

Creswell, J. W. (2013b). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). London: Sage publications.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks: Sage.

Dailey, A. (2009). Key motivational factors and how teachers can encourage motivation in their students. *University of Birmingham*, 2–24. Retrieved from https://www.birmingham.ac.uk/Documents/college-artslaw/cels/essays/secondlanguage/DailySLAKeyMotivationalFactorsandHowTeachers.pdf

De Backer, L., Van Keer, H., & Valcke, M. (2015). Exploring evolutions in reciprocal peer tutoring groups' socially shared metacognitive regulation and identifying its metacognitive correlates. *Learning and Instruction*, *38*, 63–78. https://doi.org/10.1016/j.learninstruc.2015.04.001

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, *49*(3), 182–185. https://doi.org/10.1037/a0012801

Denzin, N. K., & Lincoln, Y. S. (2000). *Handbook of qualitative Research* (2nd ed.; N. K. Denzin & Y. S. Lincoln, Eds.). Thousand Oaks: Sage.

Denzin, N. K., & Lincoln, Y. S. (2008). *The landscape of qualitative research* (3rd ed.). Thousand Oaks: Sage.

Department of Basic Education. (2016). *National senior certificate examination report 2016* (pp. 1–78). pp. 1–78. South Africa: Basic Education: Department of Education.

Dornyei, Z. (2009). Motivation and the vision of knowing a second lanuage. In *IATEFL*

(pp. 16–22). Retrieved from https://www.academia.edu/2695417/2_Psychology_matters

Duah, F., Croft, T., & Inglis, M. (2014). Can peer assisted learning be effective in undergraduate mathematics? *International Journal of Mathematical Education in Science and Technology*, *45*(4), 552–565. https://doi.org/10.1080/0020739X.2013.855329

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, *34*(3), 169–189. https://doi.org/10.1207/s15326985ep3403

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluae research in Education* (8th ed.). New York: McGraw-Hill.

Gabdulhakov, V. F. (2014). *Methodology of multicultural education*. London: Oxford University.

Gardner, R. C. (1985). *Social psychology and second language learning: The role of attitudes and motivation*. London: Arnold.

Gardner, R. C., & Lambert, W. E. (1959a). Motivational variables in second-language acquisition. *Canadian Journal of Psychology*, *13*(4), 266–272. https://doi.org/10.1037/h0083787

Gardner, R. C., & Lambert, W. E. (1959b). Motivational Variables in Second-Language Acquisition. *Canadian Psychological Association*, *13*(4), 266.

Gilal, F. G., Zhang, J., Gilal, R. G., & Gilal, N. G. (2018). Linking motivational regulation to brand passion in a moderated model of customer gender and age: an organismic integration theory perspective. *Review of Managerial Science*, 1–27. https://doi.org/10.1007/s11846-018-0287-y

Githua, B. N., & Mwangi, J. G. (2003). Students' mathematics self-concept and motivation to learn mathematics: relationship and gender differences among Kenya's secondary-school students in Nairobi and Rift Valley provinces. *International Journal of Educational Development*, *23*, 487–499.

https://doi.org/10.1016/S0738-0593(03)00025-7

Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods*. Thousand Oaks: Sage.

Goetz, T., Bieg, M., Lüdtke, O., Pekrun, R., & Hall, N. C. (2013). Do girls really experience more anxiety in mathematics? *Psychological Science*, *24*(10), 2079–2087. https://doi.org/10.1177/0956797613486989

Grant, C. (2005). From a distance: tutors as a community of practice. *Education as Change*, *9*(1), 80–100. https://doi.org/10.1080/16823200509487104

Graven, M. H. (2014). Poverty, inequality and mathematics performance: the case of South Africa's post-apartheid context. *ZDM Mathematics Education*, *46*, 1039–1049. https://doi.org/10.1007/s11858-013-0566-7

Grehan, M., Mac an Bhaird, C., & O'Shea, A. (2016). Investigating students' levels of engagement with mathematics: critical events, motivations, and influences on behaviour. *International Journal of Mathematical Education in Science and Technology*, *47*(1), 1–28. https://doi.org/10.1080/0020739X.2015.1050706

Grills, S. (2017). Incorporating peer mentor tutorials into a success course for diverse students. *Journal of the Australia and New Zealand Student Services Association*, *49*(49), 100–109. Retrieved from https://submissions.scholasticahq.com/api/v1/attachments/4253/download

Grobler, B., Moloi, C., & Thakhordas, S. (2017). Teachers' perceptions of the utilisation of Emotional Intelligence by their school principals to manage mandated curriculum change processes. *Educational Management Administration and Leadership*, *45*(2), 336–355. https://doi.org/10.1177/1741143215608197

Hagger, M. S., Sultan, S., Hardcastle, S. J., & Chatzisarantis, N. L. D. (2015). Perceived autonomy support and autonomous motivation toward mathematics activities in educational and out-of-school contexts is related to mathematics homework behavior and attainment. *Contemporary Educational Psychology*, *41*, 111–123. https://doi.org/10.1016/j.cedpsych.2014.12.002

Hannula, M. S. (2006). Motivation in mathematics: goals reflected in emotions. *Educational Studies in Mathematics*, *63*(2), 165–178. https://doi.org/10.1007/s10649-005-9019-8

Hannula, M. S., Di Martino, P., Pantziara, M., Zhang, Q., Morselli, F., Heyd-Metzuyanim, E., … Goldin, G. A. (2016). Attitudes, beliefs, motivation and identity in mathematics education. In *Attitudes, beliefs, motivation and identity in mathematics education* (pp. 1–35). https://doi.org/10.1007/978-3-319-32811-9_1

Harandi, S. R. (2015). Effects of e-learning on students' motivation. *Procedia -Social and Behavioral Sciences*, *181*, 423–430. https://doi.org/10.1016/j.sbspro.2015.04.905

Heckhausen, H. (2018). Historical trends in motivation research. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation and Action* (3rd ed., pp. 1–909). https://doi.org/10.1007/978-3-319-65094-4

Heyd-Metzuyanim, E., & Graven, M. (2016). Between people-pleasing and mathematizing: South African learners' struggle for numeracy. *Educational Studies in Mathematics*, *91*(3), 349–373. https://doi.org/10.1007/s10649-015-9637-8

Hodges, C. B., & Kim, C. (2013). Improving college students' attitudes toward mathemathics. *TechTrends*, *57*(4), 59–66. https://doi.org/10.1007/s11528-013-0679-4

Hoops, L. D., Yu, S. L., Wang, Q., & Hollyer, V. L. (2016). Investigating postsecondary self-regulated learning instructional practices: the development of the self-regulated learning observation protocol. *International Journal of Teaching and Learning in Higher Education*, *28*(1), 75–93. Retrieved from https://eric.ed.gov/?id=EJ1106342

Huang, X., Craig, S. D., Xie, J., Graesser, A., & Hu, X. (2016). Intelligent tutoring systems work as a math gap reducer in 6th grade after-school program. *Learning and Individual Differences*, *47*, 258–265. https://doi.org/10.1016/j.lindif.2016.01.012

Izmirli, S., & Izmirli, O. S. (2015). Factors motivating preservice teachers for online learning within the context of ARCS motivation model. *Turkish Online Journal of*

Distance Education, *16*(2), 56–68. Retrieved from http://dergipark.ulakbim.gov.tr/tojde/article/viewFile/5000109824/5000102151

Johnson, R. S. C. (1961). Two misconceptions of ancient education. *Melbourne Studies in Education*, *5*(1), 237–255. https://doi.org/10.1080/17508486109555947

Joubert, Y. T., & Snyman, A. M. (2017). Challenges experienced with online tutoring in an ODL institution. *Progressio*, *39*(1), 126–145. https://doi.org/10.25159/0256-8853/2139

Karakis, H., Karamete, A., & Okcu, A. (2016). The effects of a computer-assisted teaching material, designed according to the ASSURE instructional design and the ARCS model of motivation, on students' achievement levels in a mathematics lesson and their resulting attitudes. *European Journal of Contemporary Education*, *15*(1), 105–113. https://doi.org/10.13187/ejced.2016.15.105

Keller. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development*, *10*(3), 2–10. Retrieved from http://www.springerlink.com/index/72828K22416P4156.pdf

Keller. (2000). How to integrate learner motivation planning into lesson planning: the ARCS model approach. *VII Semenario, Santiago, Cuba*, 1–13. https://doi.org/10.1111/modl.12214

Kim, Park, S. W., Cozart, J., & Lee, H. (2015). From motivation to engagement : the role of effort regulation of virtual high school students in mathematics courses. *Educational Technology & Society*, *18*(4), 261–272. Retrieved from http://www.jstor.org/stable/jeductechsoci.18.4.261

Kim, Y. C., Gough, N., & Jung, J. (2018). Shadow education as an emerging focus in worldwide curriculum studies. *Curriculum Matters*, *14*, 8–30. https://doi.org/10.18296/cm.0027

Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, *6*(5), 26–41. https://doi.org/10.5430/ijhe.v6n5p26

Kleinginna, P. R., & Kleinginna, A. M. (1981). A categorized list of motivation definitions, with a suggestion for a consensual definition. *Motivation and Emotion*, *5*(3), 263–291. https://doi.org/10.1007/BF00993889

Korsakova, T., & Korsakov, M. (2017). Tutor system as a source of harmonizing the educational system with the needs of economics. *Bulgarian Comparative Education Society*, *15*, 224–230. Retrieved from https://files.eric.ed.gov/fulltext/ED574214.pdf

Kroeger, S. D., & Kouche, B. (2006). Using peer-assisted learning strategies to increase response to intervention in inclusive middle math settings. *Teaching Exceptional Children*, *38*(5), 6–13. https://doi.org/10.1177/004005990603800501

Layton, D., & McKenna, S. (2016). Partnerships and parents – relationships in tutorial programmes. *Higher Education Research and Development*, *35*(2), 296–308. https://doi.org/10.1080/07294360.2015.1087471

Lazarides, R., Buchholz, J., & Rubach, C. (2018). Teacher enthusiasm and self-efficacy, student-perceived mastery goal orientation, and student motivation in mathematics classrooms. *Teaching and Teacher Education*, *69*, 1–10. https://doi.org/10.1016/j.tate.2017.08.017

Lemos, M. S., & Veríssimo, L. (2014). The relationships between intrinsic motivation, extrinsic motivation, and achievement, along elementary school. *Procedia-Social and Behavioral Sciences*, *112*, 930–938. https://doi.org/10.1016/j.sbspro.2014.01.1251

Letseka, M. (2014). The illusion of education in South Africa. *Procedia - Social and Behavioral Sciences*, *116*, 4864–4869. https://doi.org/10.1016/j.sbspro.2014.01.1039

Lichtman, M. (2006). *Qualitative research in education a user's guide*. Thousand Oaks: SAGE Publications, Inc.

Linnenbrink-Garcia, L., Patall, E. A., & Pekrun, R. (2016). Adaptive motivation and emotion in education. *Policy Insights from the Behavioral and Brain Sciences*, *3*(2), 228–236. https://doi.org/10.1177/2372732216644450

Linnenbrink, E. A., & Pintrich, P. R. (2002). Achievement goal theory and affect: an asymmetrical bidirectional model. *Educational Psychologist*, *37*(2), 69–78. https://doi.org/10.1207/S15326985EP3702

Lips, H. M. (2004). The gender gap in possible selves: divergence of academic self-views among high school and university students. *Sex Roles*, *50*(5–6), 357–371. https://doi.org/10.1023/B:SERS.0000018891.88889.c9

Luneta, K. (2015). Understanding students' misconceptions: An analysis of final grade 12 examination questions in geometry. *Pythagoras*, *36*(1), 1–11. https://doi.org/10.4102/pythagoras.v36i1.261

Lutovac, S., & Kaasila, R. (2014). Pre-service teachers' future-oriented mathematical identity work. *Educational Studies in Mathematics*, *85*(1), 129–142. https://doi.org/10.1007/s10649-013-9500-8

Ma, X. (1997). Reciprocal relationships between attitude toward mathematics and achievement in mathematics. *The Journal of Educational Research*, *90*(4), 221–229. https://doi.org/10.1080/00220671.1997.10544576

Maher, M. (2015). Lighting up learning: mathematics becoming less of a "killer subject" in KwaZulu-Natal, South Africa. *International Journal for Mathematics Teaching and Learning, Online.* Retrieved from http://www.cimt.plymouth.ac.uk/journal/maher.pd

Maher, M. (2016). Self-efficacy enhanced in a cross-cultural context through an initiative in under-resourced schools in initiative in under-resourced schools in KwaZulu-Natal, South Africa. *Intercultural Education*, *27*(1), 85–100. https://doi.org/10.1080/14675986.2016.1144329

Makonye, J. P. (2017). Migrant teachers' perceptions of the South African mathematics curriculum and their experiences in teaching in the host country. *SAGE Open*, *7*(2). https://doi.org/10.1177/2158244017706713

Mercader, J., Presentación, M.-J., Siegenthaler, R., Molinero, V., & Miranda, A. (2017). Motivation and mathematics performance: a longitudinal study in early educational stages. *Revista de Psicodidáctica (English Ed.)*, *22*(2), 157–163.

https://doi.org/10.1016/j.psicoe.2017.05.008

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: a guide to design and implementation* (4th ed.). San Francisco: John Wiley & Sons.

Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Student/teacher relations and attitudes toward mathematics before and after the transition to junior high school. *Child Development*, *60*(4), 981–992. Retrieved from https://0-www-jstor-org.ujlink.uj.ac.za/stable/pdf/1131038.pdf?refreqid=search%3A5eaa1ab47cb15bdc2d973b55eeba64dc

Mills, L. A. (2016). Informal learning for possible science selves. In *Competencies in Teaching, Learning and Educational Leadership in the Digital Age*. https://doi.org/10.1007/978-3-319-30295-9

Milman, N. B., & Wessmiller, J. (2016). Motivating the online learner using Keller's ARCS Model. *Distance Learning*, *13*(2), 67–71. Retrieved from http://search.proquest.com/openview/cc9521dac16a0618c33784a4435a2127/1?pq-origsite=gscholar&cbl=29704

Mondada, F., Bonnet, E., Davrajh, S., Johal, W., & Stopforth, R. (2016). R2T2: Robotics to integrate educational efforts in South Africa and Europe. *International Journal of Advanced Robotic Systems*, *13*(5), 1–13. https://doi.org/10.1177/1729881416658165

Montague, M. (2008). Self-regulation strategies to improve mathematical problem solving for students with learning disabilities. *Learning Disability Quarterly*, *31*(1), 37–44. https://doi.org/doi: 10.2307/30035524

Moodaley, R. R., Grobler, A. A., & Lens, W. (2006). Study orientation and causal attribution in mathematics achievement. *Psychological Society of South Africa*, *36*(3), 634–655. https://doi.org/10.1177/008124630603600312

Novak, E. (2014). Toward a mathematical model of motivation, volition, and performance. *Computers and Education*, *74*, 73–80. https://doi.org/10.1016/j.compedu.2014.01.009

Olafsen, A. H., Deci, E. L., & Halvari, H. (2018). Basic psychological needs and work motivation: A longitudinal test of directionality. *Motivation and Emotion*, *42*(2), 178–189. https://doi.org/10.1007/s11031-017-9646-2

Oswald, M., & Rabie, E. (2016). Rethinking gifted education in South Africa: The voices of gifted grade 11 students. *Gifted Education International*, *33*(3), 1–13. https://doi.org/10.1177/0261429416642285

Palfreyman, D. (2002). *The Oxford Tutorial: "Thanks, you taught me how to think"* (D. Palfreyman, Ed.). Oxford: OxCHEPS.

Patton, M. Q. (2003). Utilization-focused evaluation. In *International handbook of educational evaluation* (pp. 223–242). https://doi.org/10.1007/978-94-010-0309-4_15

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, *95*(4), 667–686. https://doi.org/10.1037/0022-0663.95.4.667

Pourhasan, E., & Zoghi, M. (2017). The role of willingness to communicate and motivation in anguage learning in Iran. *Journal of Language and Translation*, *7*(1), 59–67. Retrieved from http://ttlt.azad.ac.ir/article_529574.html

Rachvelishvili, N. (2017). Achievement motivaion toward learning English language in modern educaitonal context of Georgia. *Problems of Educationin the 21st Centrugy*, *75*(4), 366–374. Retrieved from http://oaji.net/articles/2017/457-1503750847.pdf

Reddy, V., Visser, M., Winnaar, L., Arends, F., Juan, A., Prinsloo, C., & Isdale, K. (2016). *TIMSS 2015: Highlights of mathematics and science achievement of grade 9 South African learners*. Retrieved from http://www.hsrc.ac.za/en/research-data/ktree-doc/17642

Rheinburg, F., & Engeser, S. (2018). Intrinsic motivation and flow. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation and Action* (3rd ed., pp. 1–909). https://doi.org/10.1007/978-3-319-65094-4_14

Roulston, K. (2010). *Reflective interviewing: a guide to theory and practice*. Thousand Oaks: Sage.

Ryan, R. M. (1995). Psychological needs and the faciliation of integrative processes. *Journal of Personality*, *63*(3), 397–429. https://doi.org/10.1111/j.1467-6494.1995.tb00501.x

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Powelson, C. L. (1991). Autonomy and relatedness as fundamental to motivation and education. *Journal of Experimental Education*, *60*(1), 49–66. https://doi.org/10.1080/00220973.1991.10806579

Savin-Baden, M., & Major, C. H. (2010). *New approaches to qualitative research: Wisdom and uncertainty*. New York, NY: Routledge.

Schiefele, U. (2017). Classroom management and mastery-oriented instruction as mediators of the effects of teacher motivation on student motivation. *Teaching and Teacher Education*, *64*, 115–126. https://doi.org/10.1016/j.tate.2017.02.004

Schoenfeld, A. H. (2016). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics. *Journal of Education*, *196*(2), 1–38. Retrieved from http://gse.berkeley.edu/sites/default/files/users/alan-h.-schoenfeld/Schoenfeld_1992 Learning to Think Mathematically.pdf

Schukajlow, S., Leiss, D., Pekrun, R., Blum, W., Müller, M., & Messner, R. (2012). Teaching methods for modelling problems and students' task-specific enjoyment, value, interest and self-efficacy expectations. *Educational Studies in Mathematics*, *79*(2), 215–237. https://doi.org/10.1007/s10649-011-9341-2

Schukajlow, S., Rakoczy, K., & Pekrun, R. (2017). Emotions and motivation in

mathematics education: theoretical considerations and empirical contributions. *ZDM Mathematics Education*, *49*(3), 307–322. https://doi.org/10.1007/s11858-017-0864-6

Seaton, M., Parker, P., Marsh, H. W., Craven, R. G., & Yeung, A. S. (2014). The reciprocal relations between self-concept, motivation and achievement: juxtaposing academic self-concept and achievement goal orientations for mathematics success. *Educational Psychology*, *34*(1), 49–72. https://doi.org/10.1080/01443410.2013.825232

Simon, M. A. (2017). Explicating mathematical concept and mathematical conception as theoretical constructs for mathematics education research. *Educational Studies in Mathematics*, *94*(2), 117–137. https://doi.org/10.1007/s10649-016-9728-1

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: effects of motivation, interest, and academic engagement. *Journal of Educational Research*, *95*(6), 323–332. https://doi.org/10.1080/00220670209596607

Skinner, E. a, Baltes, M., Baltes, P., Brandtstaedter, J., Brim, B., Connell, J., … Wellborn, J. (1996). Personality processes and individual differences: A guide to constructs of control. *Journal of Personality*, *71*(3), 549–570. https://doi.org/10.1037//0022-3514.71.3.549

Smeyers, P. (2008). Qualitative and quantitative research methods: old wine in new bottles? On understanding and interpreting educational phenomena. *Paedagogica Historica*, *44*(6), 691–705. https://doi.org/10.1080/00309230802486168

Spaull, N. (2013). Poverty & privilege: primary school inequality in South Africa. *International Journal of Educational Development*, *33*(5), 436–447. https://doi.org/10.1016/j.ijedudev.2012.09.009

Spaull, N., & Kotze, J. (2015). Starting behind and staying behind in South Africa. The case of insurmountable learning deficits in mathematics. *International Journal of Educational Development*, *41*, 13–24. https://doi.org/10.1016/j.ijedudev.2015.01.002

Starčič, A. I., Cotic, M., Solomonides, I., & Volk, M. (2016). Engaging preservice primary and preprimary school teachers in digital storytelling for the teaching and learning of mathematics. *British Journal of Educational Technology*, *47*(1), 29–50. https://doi.org/10.1111/bjet.12253

Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal*, *11*(2), 63–75. https://doi.org/10.3316/QRJ1102063

Taylor, N. (2008). What's wrong with South African schools ? *What's Working in School Development Conerence, JET Education Services*. Retrieved from https://pdfs.semanticscholar.org/111e/a0d528929a4f745dd5d194761ce8c68ddb06.pdf

Textbook delivery trips up provincial education departments. (2017, January 14). *ENCA*. Retrieved from https://www.enca.com/south-africa/limpopo-education-ordered-to-deliver-textbooks

Thanh, N. C., Thi, T., & Thanh, L. (2015). The interconnection between interpretivist paradigm and qualitative methods in education. *American Journal of Educational Science*, *1*(2), 24–27. Retrieved from http://www.aiscience.org/journal/ajes

The Oxford online dictionary of English grammar. (2014). Oxford: Oxford University Press.

Ticknor, C. S., Shaw, K. A., & Howard, T. (2014). Assessing the impact of tutorial services. *Journal of College Reading and Learning*, *45*(1), 52–66. https://doi.org/10.1080/10790195.2014.949552

Tobin, R. (2012). Descriptive case study. In A. J. Mills, G. Durepos, & E. Wiebe (Eds.), *Encyclopedia of Case Study Research* (pp. 289–293). https://doi.org/10.4135/9781412957397

Topping, K. J., Campbell, J., Douglas, W., & Smith, A. (2003). Cross-age peer tutoring in mathematics with seven- and 11-year-olds: influence on mathematical vocabulary, strategic dialogue and self-concept. *Educational Research*, *45*(3), 287–308. https://doi.org/10.1080/0013188032000137274

Tremblay, P., & Gardner, R. C. (1995). Expanding the motivational construct in language learning. *The Modern Language Journal*, *79*(4), 505–520. Retrieved from https://0-www-jstor-org.ujlink.uj.ac.za/stable/pdf/330002.pdf

Trochim, W. M. K. (2006). Qualitative measures. *Research Methods Knowledge Base*, *361*, 29–31. Retrieved from https://pdfs.semanticscholar.org/ca82/06e94c0beb7d63e10d04131966233f3d2a70.pdf

Underhill, J., & Mcdonald, J. (2010). Collaborative tutor development: enabling a transformative paradigm in a South African university. *Mentoring and Tutoring: Partnership in Learning*, *18*(2), 91–106. https://doi.org/10.1080/13611261003678853

Van der Berg, S. (2008). How effective are poor schools? Poverty and educational outcomes in South Africa. *Studies in Educational Evaluation*, *34*(3), 145–154. https://doi.org/10.1016/j.stueduc.2008.07.005

Vavrus, F., & Bartlett, L. (2006). Comparatively knowing: making a case for the vertical case study. *Current Issues in Comparative Education*, *8*(2), 95–103. Retrieved from https://eric.ed.gov/?id=EJ847389

Waller, P. P., & Maxwell, K. L. H. (2016). Mathematics teachers' perceptions of resources and curriculum availability in post-apartheid schooling. *International Journal of Science and Mathematics Education*, 1–17. https://doi.org/10.1007/s10763-016-9713-2

Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist*, *45*(1), 28–36. https://doi.org/10.1080/00461520903433596

Wilkins, J. L. M. (2000). Preparing for the 21st century: the status of quantitative literacy in the United States. *School Science and Mathematics*, *100*(8), 405–418. https://doi.org/10.1111/j.1949-8594.2000.tb17329.x

Wilkins, J. L. M., & Ma, X. (2003). Modeling change in student attitude toward and

beliefs about mathematics. *Journal of Educational Research*, *97*(1), 52–63. https://doi.org/10.1080/00220670309596628

Willis, J. W., Jost, M., & Nilakanta, R. (2007). *Foundations of qualitative research: interpretive and critical approaches*. Thousand Oaks: Sage.

Winberg, T. M., Hellgren, J. M., & Palm, T. (2014). Stimulating positive emotional experiences in mathematics learning : influence of situational and personal factors. *European Journal of Psychology of Education*, *29*(4), 673–691. Retrieved from http://www.jstor.org/stable/43551164

Yu, R., & Singh, K. (2018). Teacher support, instructional practices, student motivation, and mathematics achievement in high school. *Journal of Educational Research*, *111*(1), 81–94. https://doi.org/10.1080/00220671.2016.1204260

APPENDIX A: Pre- interview schedule

For statistical purposes

- Gender
- Age
- Grade 11 Mathematics (and Additional Math) mark.

Interview questions:

1. What do you think your role is as a mathematics peer-tutor? Elaborate.
2. How do you think your role as a mathematics peer-tutor will affect learners? Elaborate.
3. What challenges do you foresee as a mathematics peer-tutor?
4. How will you as a mathematics peer-tutor get learners' attention?
5. How will you as a mathematics peer-tutor ensure learners' attention is kept?
6. How do you plan to ensure that learners are able to see the relevance of mathematics?
7. How do you plan to ensure that leaners are able to understand the importance of mathematics?
8. What strategies do you think you could use to improve learners' confidence in mathematics?
9. How do you think a peer-tutor can help learners feel good about executing mathematics?
10. How do you think a peer-tutor can help learners feel good about the mathematics they execute?
11. Do you have any further comments?

Adapted from:

Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Johnson, K. Y. M. (2016). Teachers Perceptions of the Use of Small-Group Tutorial. Doctoral dissertation. Jackson: Warden University. Retrieved from http://search.proquest.com/openview/5171a0eb9b0262247e4052e94937fe5c/1?pq-origsite=gscholar&cbl=18750&diss=y

APPENDIX B: Post-interview schedule

For statistical purposes:

- Gender:
- Age:
- Grade 11 Mathematics and Additional Math mark:
- Average number of hours tutoring done per week:

Interview questions:

12. What do you think your role was as a mathematics peer-tutor? Please elaborate on your answer.
13. How do you think your role as a mathematics peer-tutor has affected the learners whom you tutored? Please elaborate on your answer.
14. What challenges did you face as a mathematics peer-tutor?
15. How did you attempt to overcome these challenges?
16. In what ways do you think that you, as a mathematics peer-tutor, were able to keep the learners' attention? Please elaborate on your answer.
17. How did you ensure that the learners were able to understand the importance of mathematics?
18. What strategies did you implement to improve learners' confidence in mathematics?
19. How did you, as a peer-tutor, motivate the learners feel good about executing mathematics?
20. How did you as a peer-tutor motivate the learners feel good about the mathematics they had executed?
21. Do you have any further comments?

Adapted from:

Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Johnson, K. Y. M. (2016). Teachers' Perceptions of the Use of Small-Group Tutorial. Doctoral dissertation. Jackson: Warden University. Retrieved from http://search.proquest.com/openview/5171a0eb9b0262247e4052e94937fe5c/1?pq-origsite=gscholar&cbl=18750&diss=y

APPENDIX C: Observation Sheet

OBSERVATION SHEET

Date:_____

Tutors present:_____

_____

ATTENTION

Capture learners' attention (Incongruity, conflict, concreteness, variability, humour): _____

_____

Stimulate inquiry: _____

_____

Maintain attention (participation): _____

_____

RELEVANCE

Relate to goals (experience and present worth): _____

_____

Match interests (future usefulness, need matching): _____

_____

Tie to experiences (modelling, choice): _____

_____

CONFIDENCE

Success expectations (learning requirements):

Success opportunities (difficulty, expectations):

Personal responsibility (attributions, self-confidence):

SATISFACTION

Intrinsic satisfaction (natural consequences):

Rewarding outcomes (unexpected rewards, positive outcomes, negative influences) :

Fair treatments (scheduling):

Further comments:

APPENDIX D: Weekly reflections

Week 1

Weekly Reflection: Strategies for retaining learner attention

Starting date: _____

Name/Pseudonym: _____

How many hours of (face-to-face) tutoring did you complete this week? _____

Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. This week how did you show learners different ways of calculating problems that they could use in the future? _____

   _____

2. This week how did you show learners different ways of solving problems that they could use in the future?_____

   _____

3. Did you use any visual representations of topics from your own personal experiences and contexts this week? _____If yes, how? If no, elaborate on how you could do so in the future. _____

   _____

4. Did you use any examples from your own personal experiences and contexts this week? _____If yes, how? If no, elaborate on how you could do so in the future. _____

   _____

5. Did you allow for 'change' in the way that knowledge was presented to the learners this week? For example, did you let them use the white board, move the position of the desk, go outside, work in groups etc.? _____ If yes, how? If no, elaborate on how you could do so in the future. _____

   _____

6. What positive experiences did you have with regard to retaining learners' attention this week? _____

7. What negative experiences did you have with regard to retaining learners' attention this week? _____

8. What changes would you like to make pertaining to the retaining of learners' attention? _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 2

Weekly Reflection: Strategies for remaining relevant

Date: _____

Name/Pseudonym: _____

How many hours of (face-to-face) tutoring did you complete this week? _____

Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. In tutoring, have you been able to use learners' previous experiences (subject-related or personal) to help them understand the mathematical concepts? _____
   If yes, how? If no, elaborate on how you could do this in the future. _____
   _____
2. In what ways did you encourage the learners? _____
   _____
3. In what ways did you praise the learners? _____
   _____
4. In which ways have you been able to link what the learners are doing now in mathematics to their future needs pertaining to mathematics content? _____
   _____
5. What positive experiences did you have pertaining to the addressing of the relevance of the mathematics content this week? _____
   _____
6. What negative experiences did you have pertaining to the addressing of the relevance of the mathematics content this week? _____
   _____
7. What changes would you like to make pertaining to addressing the relevance of mathematics content? _____
   _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 3

Weekly Reflection: Strategies to build learner confidence

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____
Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. How have you helped learners this week in terms of explaining what to focus on for tests? _____
2. How have you helped learners this week in terms of explaining what to focus on for future topics or grades?_____
3. Have you had an opportunity to help the learners with their study plans? _____ If yes, elaborate. If no, are there other ways you have been able to help the learners with their mathematics achievement for the future? _____
   _____
4. Have you had an opportunity to help the learners with their ideas of how they might achieve their mathematics goals?_____ If yes, elaborate. If no, are there other ways you have been able to help the learners with their mathematics achievement for the future? _____
   _____
5. What positive experiences did you have with regard to build learners' confidence to execute mathematics? _____
   _____
6. What negative experiences did you have with regard to build leaners' confidence to execute mathematics? _____
   _____
7. What changes would you like to make pertaining to build learners' confidence to execute mathematics? _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 4

Weekly Reflection: Strategies for improving learner satisfaction

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. How did you encourage learners to use their newly acquired knowledge?

   _____

   _____

2. In what ways were you able to determine learners' satisfaction with the help provided? _____

   _____

3. What positive experiences di you have in keeping learners satisfied this week? __

   _____

   _____

4. What negative experiences did you have in keeping leaners satisfied this week?_

   _____

   _____

5. What changes would you like to make in keeping learners satisfied? _____

   _____

   _____

   _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 5

Weekly Reflection: Strategies for retaining learner attention

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. How did you attempt to keep the learners' attention while you were tutoring this week?_____
_____
_____
_____
2. How did you ensure learners would be able to attempt more challenging problems when they were by themselves and not simply give up?_____
_____
_____
3. What positive experiences did you have with regard to retaining learners' attention this week? _____
_____
4. What negative experiences did you have with regard to retaining learners' attention this week? _____
_____
5. What changes would you like to make pertaining to the retaining of learners' attention? _____
_____
_____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 6

Weekly Reflection: Strategies for remaining relevant

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. How did you attempt to demonstrate the need for mathematics this week? _____

   _____

   _____

   _____

2. In what ways did you provide learners with a variety of contexts in which the mathematics topic could be used?_____

   _____

   _____

3. What positive experiences did you have pertaining to the addressing of the relevance of the mathematics content this week? _____

   _____

4. What negative experiences did you have pertaining to the addressing of the relevance of the mathematics content this week? _____

   _____

5. What changes would you like to make pertaining to addressing the relevance of mathematics content? _____

   _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 7

Weekly Reflection: Strategies to build learner confidence

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. In what way did you encourage the learners' successes this week? When learners got a question correct, how did you encourage them? _____
2. In what way did you recognise the leaners' successes this week? _____
3. How did you attempt to encourage the learners when they were not able to find the correct answer? _____
4. What strategies did you employ to encourage the learners to work independently?
5. What positive experiences did you have with regard to build learners' confidence?
6. What negative experiences did you have with regard to build leaners' confidence?
7. What changes would you like to make pertaining to build learners' confidence? _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

Week 8

Weekly Reflection: Strategies for improving learner satisfaction

Date: _____
Name/Pseudonym: _____
How many hours of (face-to-face) tutoring did you complete this week? _____
Approximately how many learners did you assist this week? _____

Please complete this reflection as honestly as possible. Try not to leave any spaces blank. If you need more space, please write the question number on a separate piece of paper, with your answer, and hand it in with this page.

1. Elaborate on how you were able to assess leaners' satisfaction with your tutoring.

   _____

   _____

   _____

2. Did you have learners who had returned to the tutor session, because they had known that you would tutor? _____. How did these 'regular' learners respond to your tutoring sessions?_____

   _____

   _____

3. What positive experiences have you had in keeping learners satisfied this week? .

   _____

   _____

4. What negative experiences have you had in keeping leaners satisfied this week?_

   _____

   _____

5. What changes would you like to make in keeping learners satisfied in future? ___

   _____

   _____

Adapted from: Keller, J.M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development,* 10(3),2-10. Retrieved from http:// www.springerlink.com/index/72828K22416P4156.pdf

APPENDIX E: University of Johannesburg Ethics Clearance Certificate

NHREC Registration Number REC-110613-036

UNIVERSITY OF JOHANNESBURG

ETHICS CLEARANCE

Dear AK Roberts

Ethical Clearance Number: 2018-021

Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8-9 mathematics learners.

Ethical clearance for this study is granted subject to the following conditions:

- If there are major revisions to the research proposal based on recommendations from the Faculty Higher Degrees Committee, a new application for ethical clearance must be submitted.
- If the research question changes significantly so as to alter the nature of the study, it remains the duty of the student to submit a new application.
- It remains the student's responsibility to ensure that all ethical forms and documents related to the research are kept in a safe and secure facility and are available on demand.
- Please quote the reference number above in all future communications and documents.

The Faculty of Education Research Ethics Committee has decided to

☒ Grant ethical clearance for the proposed research.
☐ Provisionally grant ethical clearance for the proposed research
☐ Recommend revision and resubmission of the ethical clearance documents

Sincerely,

Prof Geoffrey Lautenbach
Chair: FACULTY OF EDUCATION RESEARCH ETHICS COMMITTEE
2 February 2018

APPENDIX F: Gauteng Department of Education Research Approval letter

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	30 July 2018
Validity of Research Approval:	05 February 2018 – 28 September 2018 2018/211
Name of Researcher:	Roberts AK
Address of Researcher:	24 Albuca Ave
	Weltevreden Park
	1709
Telephone Number:	072 331 9594
Email address:	Abigail.roberts@randparkhigh.co.za
Research Topic:	Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8-9 mathematics learners.
Type of qualification	Masters
Number and type of schools:	One Secondary School.
District/s/HO	Johannesburg North.

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this*

30/07/2018

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.

2. The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.
3. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.
4. A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.
5. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.
6. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.
7. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.
8. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.
9. It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.
10. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
11. The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.
12. On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.
13. The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.
14. Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

.....

Mr Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 30/07/2018

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX G: Permission to conduct research at school

ASGAAI AVENUE
RANDPARK RIDGE
EXTENSION 1
RANDBURG 2194

PRINCIPAL
A. WILKE

P.O. BOX 77245
FONTAINEBLEAU
2032
TEL: (011) 793-1246

FAX: (011) 792-6581
WEBSITE: www.randparkhigh.co.za
EMAIL: rphs@randparkhigh.co.za

Rand Park High School

(GAUTENG DEPARTMENT OF EDUCATION)

21 February 2018

TO WHOM IT MAY CONCERN

I, Mr Alan Wilke, Principal of Rand Park High School and Mrs Trudi Lingens, HOD of Maths, hereby grant permission for Miss Abigail Kim Roberts (ID No: 8906200044089) to conduct research at Rand Park High School for her Master's degree.

The title of her dissertation is: ***Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners.***

Should you require any further information, please do not hesitate to contact us.

T LINGENS
HOD: MATHS

A WILKE
PRINCIPAL

APPENDIX H: Informed Consent/Assent Form

SECTION D: Signatures required for consent/assent

(for all participants, parents, guardians and other stakeholders)

Informed Consent/Assent Form

Project Title:
Grade 12 peer-tutors' conceptions of their role as motivators for Grades 8 and 9 mathematics learners.

Investigator:
A.K. Roberts

Date:
13 February 2018

Please mark the appropriate checkboxes. I hereby:

☐ Agree to be involved in the above research project as a participant.
☐ Agree to be involved in the above research project as an observer to protect the rights of:
  ☐ Children younger than 18 years of age;
  ☐ Children younger than 18 years of age that might be vulnerable*; and/or
  ☐ Children younger than 18 years of age who are part of a child-headed family.
☐ Agree that my child, _____ _____ may participate in the above research project.
☐ Agree that my staff may be involved in the above research project as participants.

☐ I have read the research information sheet pertaining to this research project (or had it explained to me) and I understand the nature of the research and my role in it. I have had the opportunity to ask questions about my involvement in this study. I understand that my personal details (and any identifying data) will be kept strictly confidential. I understand that I may withdraw my consent and participation in this study at any time with no penalty.

☐ Please allow me to review the report prior to publication. I supply my details below for this purpose:
☐ Please allow me to review the report after publication. I supply my details below for this purpose:
☐ I would like to retain a copy of this signed document as proof of the contractual agreement between myself and the researcher

Name: _____

Phone or Cell number: _____

e-mail address: _____

Signature: _____

If applicable:

☐ I willingly provide my consent/assent for using audio recording of my/the participant's contributions.
☐ I willingly provide my consent/assent for using video recording of my/the participant's contributions.
☐ I willingly provide my consent/assent for the use of photographs in this study.

Signature (and date): _____

Signature of person taking the consent (and date): _____

* Vulnerable participants refer to individuals susceptible to exploitation or at risk of being exposed to harm (physical, mental, psychological, emotional and/or spiritual).

APPENDIX I: Certificate of language editing

Proofreading and Grammar Editing

To whom it may concern

This serves to confirm that I, Victoria Jane Ter Morshuizen, ID number 710125 0043 089, have conducted an English proofreading and grammar edit on the Masters thesis entitled "Grade 12 peer-tutors' conceptions of their role as motivators for Grade 8 and 9 mathematics learners" by Abigail Kim Roberts, through the faculty of Education at the University of Johannesburg.

Victoria Ter Morshuizen

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28 May 2019

Associate Member of the

Professional EDITORS Guild