METACOGNITIVE AWARENESS AND MOTIVATIONAL BELIEFS AS CORRELATES OF MATHEMATICS ACHIEVEMENT AMONG FORM THREE STUDENTS IN MAKUENI COUNTY, KENYA

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PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF EDUCATION (EDUCATIONAL PSYCHOLOGY) IN THE SCHOOL OF EDUCATION, KENYATTA UNIVERSITY

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DECLARATION

I declare that this project is my original work and has not been presented in any other university or institution for consideration of any certification. This research project has been complemented by referenced sources duly acknowledged. Where texts, data, graphics, pictures or tables have been borrowed from other sources, these are specifically accredited and reference cited using current APA system and in accordance with anti-plagiarism regulations.

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DEDICATION

This project is dedicated to my parent Regina Ndulu who introduced me to school and always encouraged me to work hard in my studies.

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ABBREVIATIONS AND ACRONYMS

CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
KCSE	Kenya Certificate of Secondary Education
MAI	Metacognitive Awareness Inventory
MAT	Mathematics Assessment Test
MBMQ	Motivational Beliefs on Mathematics Questionnaire
	School Education
SMASSE	Strengthening of Mathematics and Science in Secondary
STEM	Science Technology Engineering and Mathematics
TIMSS	Trends in International Mathematics and Science Study
USA	United States of America

ABSTRACT

Mathematics learning and quality achievement in the subject play a key role in innovation and advancement in technology for social and economic development. However, low mathematics achievement among students in Kenya Certificate of Secondary Examinations continues to be a major concern to parents, educators, and other education stakeholders. The study aimed at investigating on how students' metacognitive awareness and motivational beliefs correlate to their mathematics achievement. The study also looked into how gender differed in motivational beliefs and metacognitive awareness. Further, the predictive weights of metacognitive awareness, and motivational beliefs on students' mathematics achievement were established. Eccles and Wigfield's (2002) Expectancy Value Theory and Brown's (1987) Metacognition Model served as the research's guiding theories. A correlational research design was used in the investigation. All students in Makueni County's public secondary schools in form three made up the target population. To choose the target population, purpose sampling was employed and the study's region. Schools and research participants for the study were chosen utilizing both random and stratified sampling. A sample of 174 form three students out of 1322 accessible population were chosen from 6 secondary schools in Makindu Subcounty, Makueni County. One of the schools was used for a pilot study. MAI Questionnaire, and MBMQ were utilized to collect data from the research respondents. Students' mathematics achievement was measured using mid of term one 2024 mathematics examination records that were collected from their schools' examination departments. The data acquired was analyzed using inferential and descriptive techniques using SPSS. Students' metacognitive awareness showed a substantial positive relationship with mathematics achievement (r (170) =.73, $p < .05$). Similarly, a positive correlation between motivational beliefs and mathematics achievement (r (170) = .23, $p < .05$) was revealed by the study. Significant gender disparity was found in metacognitive awareness ($t = -2.20$, $p < .05$) and motivational beliefs ($t = -4.09$, $p < .05$). The results revealed that metacognitive awareness and motivational beliefs positively predicted mathematics achievement. Students' achievement in mathematics was found to be influenced by their motivational beliefs and metacognitive awareness. Based on the study results, recommendations were made that; parents, teachers, and school administrators, should work together to create home, and school environments that enhance metacognitive awareness and motivational beliefs for better mathematics achievement in secondary schools.

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

Included in the first chapter are the study's background, description of the problem, its underlying objectives, and purpose. This chapter also discusses the study's assumptions and provides an overview of its hypothesis, importance, limitations, and delimitations. In addition to theoretical and conceptual frameworks, the chapter concludes by providing operational definition of terms.

1.2 Background to the Study

Mathematical skills are essential in everyone's daily lives. A lot of choices of the day-to-day choices people make involve some sort of mathematics or data (Schleicher, 2023). In addition, Mathematics is widely applied in numerous fields such as engineering, medicine, computer science, business, biology, industry, economics, physics and finance. Moreover, it serves as the foundation for the majority of science-based courses which a country needs most for industrialization, improving health sector, scientific discovery, technological innovation and growth. Good achievement in mathematics is of benefit to the students since they can get opportunities for further skills training. This makes it possible for them to acquire the essential knowledge and abilities for one to effectively contribute to the county's and the nation's socio-economic prosperity. Furthermore, society is equipped with enough trained labor to match its desire for wealthy creation (Kaleve et al., 2019).

There have been reports of dismal achievement in mathematics in both developed and developing countries (Carnoy & Rothstein, 2016; Joefel, 2018). This is mainly attributed to students having a negative attitude towards mathematics, and the use of teacher centered learning which affects the students' interest and commitment to learning mathematics. (Yusof et al. (2019). For example, in the USA, mathematics achievement has been declining significantly over years according to Hanushek (2016). In Philippines, a concern has been raised in recent years regarding the success of Filipino students in mathematics subject. According to Cordova and Tan (2018), Filipino students have been achieving poorly in mathematics in both local and international examinations. This can be demonstrated well by International Students' Assessment Program results of the year 2018 where by Philippines was ranked second lowest in mathematics achievement out of all 78 countries that participated in that assessment.

A similar pattern of subpar performance in mathematics has been noted in many secondary schools in Sub-Saharan Africa. This has been mainly attributed to teaching methods, students' attitude, teachers' attitudes, classroom environment, and gender stereotypes (Ayebale 2020). McCarthy (2017) noted that South African students have been achieving worst when compared to the other upper middle-income nations that take part in Cross National Examinations of Educational Achievements, particularly in mathematics. He adds that in the year 2017, only 5% of all students who joined higher education institutions qualified to study mathematics as their field of specialization. This demonstrates that low mathematics achievement is a challenge among South African schooling students. In Botswana research reveals that, students' achievement in mathematics has been declining, as seen through the large percentage of elementary and secondary schools' students who fail the subject (Mwakwinja, 2022).

In Kenya, students sit for KCSE examination every year. However, below average achievement in mathematics has been observed over the years. For the past five years, the students' achievement in mathematics subject has been poor in comparison to the other subjects. KCSE examinations results in the year 2019, 2020,2021, 2022 and 2023 show that less than 20% of students nationwide scored a C plus or higher in mathematics in each year, with the majority scoring D or lower (KNEC, 2024). According to Githaiga, (2020), some of the causes of this poor performance include insufficient resources for teaching and learning mathematics, and students' negative attitude towards the subject.

Makueni County has followed the same pattern, with its candidates scoring dismally in mathematics. In 2019, 2020, 2021, 2022, and 2023 respectively, Makueni County's public secondary schools attained averages of 3.02, 2.82, 3.41, 3.17; and 3.08 respectively which are considerably lower than the respective KCSE national means in mathematics (Makueni County Director of Education, 2024). Makindu sub-county is one of Makueni county's nine sub counties, in comparison to other sub counties, the region has been recording poor outcomes in mathematics over the years, and the results continue to deteriorate further. The statistics on KCSE mathematics mean scores are presented in Table 1.1.

Table 1.1

KCSE Performance Mean scores from the year 2019 to 2023

Year	Sub- County								
	Mak	Mu	Kil	Kbz	Nz	Kath	MbE	MbW	Maki
2019	3.44	3.42	3.33	2.95	2.91	2.80	3.15	3.01	2.21
2020	3.31	3.44	3.17	2.67	2.88	2.71	2.73	2.77	2.03
2021	4.72	4.58	3.91	3.01	3.24	2.91	3.08	2.99	2.55
2022	3.57	3.41	3.33	3.17	3.08	2.94	3.31	3.11	2.62
2023	3.88	3.22	3.18	2.99	2.92	2.79	3.13	3.04	2.54

Source: County Director of Education, Makueni County (2024)

Note. Mak- Makueni, Mu- Mukaa, Kil- Kilome, Nz- Nzaui, Kath- Kathonzweni, MbE- Mbooni East, MbW- Mbooni West, Maki- Makindu.

Past studies done in Makueni County have revealed several factors that contribute to mathematics success. These include; positive attitude towards mathematics, consistent class attendance, adequate teacher-student ratio, and availability of learning resources, academic self-concept, and resilience (Gachingi, 2018; Sila, 2019).

Studies focusing on metacognitive awareness, motivational beliefs and mathematics achievement in Makindu subcounty are scarce. Additionally, the few available studies on the three variables have yielded varied findings and at times contradict each other. These studies have concentrated more on motivational beliefs; test anxiety (Ndolo et al. 2022), and goal orientations (Makumi, 2022) and metacognitive awareness; metacognitive experience (Marete et al. 2018) and metacognitive strategy (Muema, 2021).

Therefore, there was a need to undertake the present study focusing on constructs of motivational beliefs and metacognitive awareness that have not been extensively researched on to fill the gap.

Metacognition is the capacity to control and manage our own thinking, how we approach a problem, adopt ways to solve it, or ask ourselves questions about it (Norman, 2019). Metacognition is divided into metacognitive experience, metacognitive strategy and metacognitive awareness, which is the focus of this study. Metacognitive awareness is one's consciousness of own thinking and the techniques they employ when solving any given mathematics problem. Solving mathematical problems requires analysis of the presented problem, preparing the approach to be utilized to solve the problem, implementing the intended strategy, and determining whether the steps taken are proper. Metacognitive awareness entails understanding of cognition and its regulation, both of which are important to mathematics achievement (Baguin and Janiola, 2024).

The understanding that learners have of themselves is referred to as knowledge of cognition (Garcia & Pintrich, 2023). Amalina and Vidákovich (2023) reveals that knowledge of cognition is correlated to the level of mathematics achievement. Understanding cognition helps students to take the necessary actions to create suitable a pproaches to solving mathematical problems, assess the consequences and results, and modify the approach as necessary in light of existing knowledge (Manganelli et al., 2019). They add that, knowledge of cognition assists learners in achieving well in mathematics by selecting the appropriate methods. Conversely, the capacity of the learner to direct their own learning system is known as regulation of cognition, which includes goal setting, selecting and executing strategies, and monitoring their actions when solving mathematical problems (Borkowski & Thorpe, 2023). Abdelrahman (2020) stated that in order for an individual to solve mathematical problems effectively, one must demonstrate the capacity to regulate their cognition that is; plan, assess, regulate, and control their learning. The author adds that, individual's self-awareness as a student, understanding learning strategies available and when and why to use a particular learning strategy is highly connected to great mathematics achievement.

Empirical research has revealed that high level of metacognitive awareness leads to improved mathematics achievement among pupils. In the USA, Bol et el., (2016) carried out research on this construct and recommended that supporting training programs, instructing on how to adopt successful metacognitive awareness, and learning how to master knowledge are all choices for obtaining better achievement in mathematics. In India, research has also revealed that in order for students to achieve better and succeed in mathematics, metacognitive awareness is very crucial (Naufal et al., 2017; Parab et al., 2017). Numerous studies on metacognitive awareness have been undertaken in African countries, including South Africa, Ghana, Rwanda, and many others. A study by Du Toit (2017) among students in South Africa revealed that high metacognitive awareness among students supports mathematics problem-solving skills hence leading to better mathematics achievement. Similarly, Danquah (2021) maintained that students with better cognitive understanding and self-control outperforms those with low levels in terms of mathematics achievement in Ghana. Additionally, research that was done in Rwanda by Ndihokubwayo (2022) revealed that Students who exhibit high level of metacognition do well in solving mathematical problems as compared to those with low metacognitive awareness. Further, Otieno (2020) and Ong'uti (2018) notes that high metacognitive awareness resulted to mathematics achievement among Kenyan secondary school students.

Motivational beliefs is another important construct that is associated with Mathematics achievement. According to Basokcu, and Dogan (2019) forces that motivate someone to work towards a goal are motivational beliefs and are classified into two types: task value and self-efficacy belief. In a learning context, it may deal with the reasons that inspire learners to work persistently hard to earn better grades in mathematics. Task value is a student's assessment of the task's relevance, usefulness, and interest of a task such the mathematics resources and learning content in class (Salmela et al., 2021). Task is positively correlated with a student's mathematics achievement level as pointed out by Wigfield and Eccles (2020). Wigfield and Eccles (2020) indicated that mathematics tasks that are perceived by students as important, useful, interesting, or have some benefits are achieved better. Conversely, self-efficacy describes how students see their prior successes, a self-evaluation of their abilities, and a personal prediction of their future performance on mathematics tasks (Zhu & Kaiser, 2022). Ballew (2023) maintained that self-efficacy positively predicts mathematics achievement. Özcan and Kültür (2021) stated that students with greater self-efficacy levels perform more proficiently in mathematics due to their superior cognitive abilities, are more motivated to persevere in the face of difficulties, have less mathematics anxiety, and are more committed to study mathematics. Similarly, Benden and Lauermann (2023) suggested that high self-efficacy leads learners to have confidence in their ability for successfully solving mathematical problems, while learners with poor self-efficacy believe they are incapable of solving mathematical problems hence achieve poorly in mathematics.

Research has established that, self-efficacy and task value are positively connected with success in mathematics. Gladstone et al. (2018) investigated students in the USA and established that, students with high motivational beliefs outperform pupils with low motivational beliefs in mathematics. Meanwhile, high task value beliefs resulted to better mathematics achievement among Saudi Arabian pupils (Alotaibi, & Jabak, 2017). Level of students' motivational beliefs predicted mathematics achievement among students in Australia (Lazarides et al., 2020). High task value beliefs result to better mathematics achievement among students in Turkey (Mete, 2021). High levels of motivational beliefs lead to better mathematics achievement among female students in Chile (Sevilla, & Gonzalez, 2023). Furthermore, students who are metacognitively aware are always highly motivated; have courage and interest to solve any mathematics related activities hence achieve better in mathematics tasks (Rahman & Hassan, 2017). Additionally, learners that value, have confidence in their ability are determined in working out mathematical activities and do achieve well in mathematics.

In Africa, educational researches have also been conducted in relation to motivational beliefs. Gbollie and Keamu (2017) did a study in Liberia and found that motivational beliefs predict students' mathematics achievement. Students with high level of task value beliefs do well in solving mathematical problems in contrast to people who have low task value beliefs in Egypt as reported by Mantzicopoulos et al., (2020). Kyaruzi, (2021) also reported that students' achievement in mathematics may be enhanced by their self-efficacy beliefs in Tanzania. The author argues that students who possess low levels of self-efficacy are outperformed by those with high levels. In Kenya similar results have been established by Oluoch (2018) who found out that students who possessed high motivational beliefs do better in mathematics than those with low motivational beliefs. Mutisya et al., (2016) also found that student's level of self-efficacy predict their performance in mathematics. From the aforementioned studies, it is evident that Mathematics achievement may be affected by both metacognitive awareness and motivational beliefs. Students may have high levels of motivational beliefs, but without an appropriate level of metacognitive awareness, mathematics achievement may not be high.

Studies that have been conducted addressing perceived gender differences in metacognitive awareness and motivational beliefs have reported inconsistent results. Some studies show a significant correlation between metacognitive awareness, motivational beliefs and gender on mathematics achievement, others not. Gender has a great effect on whether or not a person is successful in mathematics (Lei, 2020). He explains that this could be due to gender differences in their level of metacognitive awareness and motivational beliefs. Farid, (2019) found that Pakistani students of both gender have various levels of metacognitive awareness and motivational beliefs, which have substantial contribution to their mathematics achievement. There is gender differences metacognitive awareness among students as reported by Rajkumar (2024) and Yakubu (2022) in South Africa and Ghana respectively. They add that this gender difference in favor of boys. Similarly, gender difference in motivational beliefs among students favoring girls was reported in Nigeria (Awofala, 2020) and in Uganda

(Kwarikunda, 2020). In kenya, Wanakacha (2018), noted no gender difference motivational beliefs among secondary school students.

Kenyan schools have struggled with low mathematics achievement. Though there have been several studies that have focused on mathematics achievement, they are insufficient since they have not examined all the potential variables yet. Studies that have been done on mathematics achievement in Kenya, have mostly concentrated on the significance of mathematics anxiety (Mutegi, 2021), attitude (Bii & Too, 2019), personality traits (Awuondo, 2019), and influence of home environment (Kembo, 2021). Despite all these researches, little has been done on the contributions of metacognitive awareness and motivational beliefs to students' mathematics achievement in Makueni county. Consequently, this study focused on examining the importance of metacognitive awareness, and motivational beliefs to students' mathematics achievement in Makueni County, Kenya.

1.3 Statement of the Problem

Student who perform well in mathematics are able to solve life's problems with ease besides making positive participation in the economic development of a country. Low mathematics achievement has been a challenge to secondary school students in Makueni County. Students' mathematics achievement means grades in KCSE examinations have been below average grade C constant over the years, and Makindu Sub- County attaining the lowest ranking among Makueni County's nine sub-counties as indicated in Table 1.1. Consequently, persistent poor mathematics achievement may result to motivational insufficiency, truancy, low self-esteem, loss of a lot of fulfilling life opportunities for individuals who may miss out in selection into post-secondary institutions to pursue courses of their interest, as well as gainful employment. Students may therefore lack the necessary skills, knowledge and expertise to compete in the worldwide marketplace and participate actively in both the county's and country's socioeconomic development.

and the country. Additionally, society may fall short of qualified workers to fulfil its needs for generating wealth.

As a result of dismal achievement in mathematics, much concern has been raised by all education stakeholders with regard to the considerable investment made in the education system. This downward trend in mathematics achievement can be reversed by identifying the reasons that lead to the subject's low achievement and then providing suitable guidance to help the students improve. Numerous studies have been carried out in Makindu sub-county to look into students' dismal achievement in mathematics. The studies have focused mainly on academic self-concept, absenteeism, teacher-student ratio, and availability of learning resources. Therefore, the study majorly aimed to uncover the relationship between metacognitive awareness, motivational beliefs, and form three students' achievement in mathematics in Makueni County, Kenya.

1.4 Purpose of the Study

This study intended to unveil how students' metacognitive awareness and motivational beliefs relate to their mathematics achievement. The study also, examined existence of gender variations in metacognitive awareness and motivational beliefs. In addition, the study explored the predictive equation of mathematics success from students' metacognitive awareness, and motivational beliefs. The results of this study may guide any intervention aiming at boosting students' mathematics achievement in Makindu subcounty, Makueni County.

1.5 Objectives of the Study

This study intended;

i. Investigate the relationship between students' metacognitive awareness and mathematics achievement.

ii. Examine the relationship between students' motivational beliefs and mathematics achievement.

iii. Find out if there are gender differences in students' metacognitive awareness and motivational beliefs among form three students in Makindu subcounty, Makueni County.

iv. Determine the prediction equation of mathematics achievement from metacognitive awareness, and motivational beliefs of form three students in Makindu subcounty, Makueni County.

1.6 Research Hypotheses

The research hypotheses that guided the study included:

H_{a1}: There is a significance relationship between students' metacognitive awareness and mathematics achievement.

H_{a2}: There is a significance relationship between students' motivational beliefs and mathematics achievement.

H_{a3}: There is a significance gender differences in students' metacognitive awareness and motivational beliefs.

H_{a4}: There is a significance prediction equation of mathematics achievement from metacognitive awareness and motivational beliefs.

1.7 Significance of the Study

The research results may enable students to have a better understanding of the role of metacognitive awareness and motivational beliefs on their accomplishment in mathematics. Similar, the results may help teachers put in place strategies meant at improving students' mathematics achievement derived from knowledge of the role of the two elements in the academic life of the students. The results may provide school administrators with information necessary for assisting students in becoming more self-aware and better manage their learning to enable them improve their mathematics ability. Finally, the findings of this investigation could add to our understanding of motivating beliefs and metacognitive awareness. This include their relationship to raising math achievement. This will help to enrich the field of educational psychology and learning/teaching in mathematics.

1.8 Limitations and Delimitations of the Study

1.8.1 Limitations of the Study

The causal relationship between the predictor and the outcome variables may not have been established because the predictor variables were not manipulated. The study involved six public secondary schools in Makueni County, as a result, the findings generalizability may be limited for students from other counties. The research instruments relied on self-reported experiences, thus prone to bias. To address this, the researcher utilized various data sets that enabled testing of the hypotheses and incorporated theories upon which the study was anchored.

1.8.2 Delimitations of the Study

Although other variables may have contributed to differences in students' mathematics achievement, the study only focused on metacognitive awareness and motivational beliefs as correlates of mathematics achievement. This study only included form three students from public schools in the Makindu sub-county in Makueni County, Kenya.

1.9 Assumptions of the Study

The first assumption was that the students had sufficiently developed and were aware of different levels of metacognitive awareness and motivational beliefs which resulted in varying degrees of achievement in mathematics. The study also assumed that, the students valued mathematics and were prepared for examinations that reflected their abilities.

1.10 Theoretical and Conceptual Framework

1.10.1 Theoretical Framework

Brown’s model of Metacognition and Expectancy Value theory guided this study.

Brown’s Model of Metacognition (1987)

The model of cognitive monitoring and regulation created by Brown in 1987 includes a number of metacognitive elements. These elements are metacognitive skills, knowledge, ideas, experiences and awareness. According to the theory, students who are aware of; own cognitive abilities, purposes of learning and tactics that can be used to achieve individual’s mathematics goals, constantly assess their level of understanding and may employ tactics that have previously worked for them solving mathematics related problems hence improving their mathematics achievement. Learners who possess metacognitive awareness are able to plan, control, evaluate, and monitor their mathematics learning process. Additionally, they are aware of learning strategies, and why and when to employ such strategies. These learners do better in mathematics tasks than those who have low metacognitive awareness (Tak et al., 2022).

Memis and Bozkurt (2018) used this theory in a study that showed a relationship between successful reading comprehension and metacognitive awareness among fifth-grade students in Turkey. Metacognitive awareness has also been demonstrated to enhance mathematics achievement among students according to Bryce et al. (2015). Locally in Nairobi Kenya, Mwaniki (2015) employed this theory effectively as a guide for an investigation that reported that metacognition and attitudes toward reading are correlated with performance in reading. The research respondents were class six pupils from Dagoretti Division. The researcher selected this theory to use in this study because it stresses on the importance of students' metacognitive awareness to their achievement in mathematics and it has been used in research across cultures.

Expectancy Value Theory (Eccles & Wigfield, 2002)

The theory suggests that, individuals' ability beliefs, expectations for success, and task value, all contribute in deciding their choices, effort, tenacity, and achievement. According to the theory, students who trust their ability to finish a task show greater interest and are more engaged in it, hence do better than those who are not. Students' level of self-efficacy determines their selection of tasks, level of effort, and accomplishment (Eccles & Wigfield, 2002). Students are more likely to find mathematics tasks more interesting, significant, and valuable, when they have confidence, that they can complete it successfully (Eccles & Wigfield, 2002). By application of the theory, Tareen, (2023) undertook a study that showed that students who possess higher levels of motivational beliefs achieve better in mathematics than those who possess lower levels. Similarly, Fan et al. (2020) studied on engineering students' motivational beliefs as a correlate of academic success using this theory as a guide. Students' academic progress and their motivational beliefs were found to be positively correlated. Expectancy value theory discusses the relevance of motivational beliefs in improving mathematical success, hence was suitable fit for this investigation.

Integrating the Two Theories

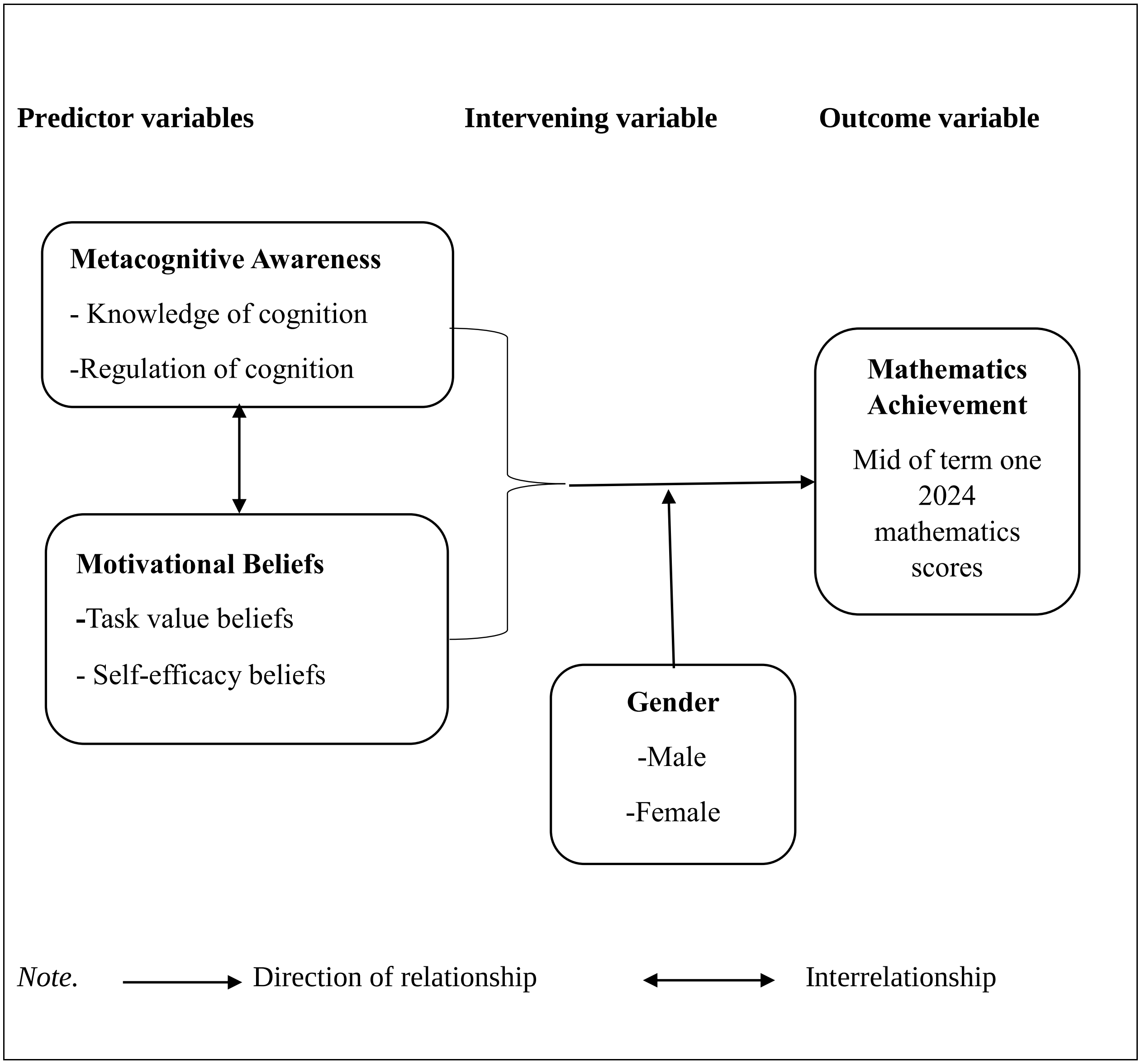
Integrating the two theories made it possible for the researcher to explore the studys' variables holistically considering the cognitive and expectancy aspects as espoused in the theories.

1.10.2 Conceptual Framework

Figure 1.1 demonstrates the relationship between and among the variables.

Figure 1.1

Relationship between Metacognitive Awareness, Motivational Beliefs and Mathematics Achievement



Source: Researcher Conceptualization (2024)

The study's, predictor variables were metacognitive awareness and motivational beliefs and outcome variable was mathematics achievement. The study hypothesized that metacognitive awareness and motivational beliefs were correlated with mathematics achievement. Further, both were expected to predict mathematics achievement. The study also hypothesized that, there were differences in metacognitive awareness and motivational beliefs based on gender. Metacognitive awareness was identified as comprising of cognitive knowledge and cognitive regulation, whereas students' motivational beliefs were classified as self-efficacy and task-value beliefs. Gender was treated as intervening variable.

1.13 Operational Definition of Terms

Metacognitive Awareness: Students' total scores on a self-assessment questionnaire on consciousness of their thinking and the techniques they employ when dealing with mathematical activities. Metacognitive Awareness Inventory (MAI) was used to assess this variable on an interval scale.

Mathematics Achievement: Standardized T score of mid of term one mathematics test scores attained by students in form three in the year 2024.

Motivational Beliefs: Score on the students' perceptions of the value, significance they attach to mathematics and belief in their ability to succeed in mathematics subject. It was assessed using Motivational Beliefs on Mathematics Questionnaire and at an interval scale.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The relationship between students'; motivational beliefs and mathematics achievement, metacognitive awareness and mathematics achievement, and the predictive weight of metacognitive awareness and motivational beliefs on students' mathematics achievement are discussed in this chapter. Gender disparity in the students' metacognitive awareness and motivational beliefs, summary of the reviewed literature as well as the gap identification are also addressed.

2.2 Relationship between Students' Metacognitive Awareness and Mathematics Achievement

Studies on the correlation between academic success and students' metacognitive awareness have presented mixed findings or inconsistent results. Al-Balushi's (2022) study on students' metacognitive awareness and mathematics achievement discovered a positive correlation between the two variables. Research respondents comprised of 937 Oman students, 478 of whom were in grade five and 459 in grade nine. Metacognitive Awareness Perception Inventory was used in data collection. MANOVA was employed in the data analysis. Metacognitive awareness positively predicted mathematics achievement according to this research. The reviewed study involved respondents that were drawn from a country which is outside Africa. A related study was necessary in Kenya because there is little local literature that looks at the correlation between high school students' metacognitive awareness and their mathematics achievement. This was catered for by carrying out a similar study in Kenya.

In another study, using a research sample that comprised of 28 Malaysian university students of mean age 23 years, Tak et al. (2022) investigated students' metacognitive awareness as a correlate of mathematics achievement. After conducting data analysis by application of exploratory factor analysis, the study concluded that increase in metacognitive awareness of a student lead to improved mathematics profiency (Tak et al., 2022). The study's sample size was small, which may limit the results' applicability to a large population. The participants of this study were college students which may have fostered a higher level of metacognitive awareness. Additionally, their educational level and socio-cultural backgrounds, could all have a role in the reported results. The present study examined whether the situation is similar among Kenyan secondary school students using a younger population from a different culture.

Ajisuksmo and Saputri (2020) assessed the role of metacognitive awareness on students' mathematics achievement. The research sample consisted of 103 boys from senior secondary schools in Indonesia. Data was collected using the Metacognitive Awareness Inventory Questionnaire and Mathematics tests. Data analysis that applied Pearson product moment correlation revealed that students' metacognitive awareness make insignificant contribution to their mathematics achievement. Since the disparities in learning contexts between the two populations, this investigation was necessary. Additionally, Ajisuksmo and Saputri (2020) used a sample of the same gender, the present study included males and female students to evaluate any gender differences.

In different research, Ansah (2020) looked into the contribution of students' metacognitive awareness to their mathematics success. This study included 122 undergraduate university students from Accra Region of Ghana, aged between 22 to 28 years. The research employed experimental research design. Difficult Multiplication Test was used to assess arithmetic skills. Data analysis using Pearson product moment correlation revealed that students' regulation of cognition has an effect on their mathematics achievement. Students who possessed high levels of regulation of cognition achieve better in mathematics than those who possessed low levels of regulation of cognition according to Ansah (2020). Ansha (2010) studied an older cohort of undergraduate university students that may have developed greater metacognitive awareness and could have contributed to the study's findings. This study used correlational research design unlike the reviewed study that utilized experimental research design.

Otieno (2021), investigated 42 form two students that were selected from three Kenyan secondary schools. He investigated on how students' metacognitive awareness was related to their mathematics solving ability. Over the course of a four-month period, information on degree of students' metacognitive awareness was gathered using qualitative techniques like interviews, and reflective writings. The study discovered a strong relationship between students' achievement in mathematics and metacognitive awareness. The researcher suggested for a similar study in a different sub-county in Kenya to deepen the understanding of the two variables. This made the current study necessary.

2.3 Relationship between Students' Motivational Beliefs and Mathematics Achievement

Several researches have investigated the relationship between students' motivational beliefs and mathematics achievement with mixed findings as highlighted in the following section. Metallidou (2020) explored the influence of different motivational beliefs to mathematics performance. They used a research sample of 263 primary school children of mean age 10 years from Greece. MSLQ was used in the data collection. They noted some variations in the pattern of correlation between the components of motivational beliefs both within and between the two subject areas. When compared to task value and test anxiety, self-belief was found to be the most significant predictor of mathematics performance. Motivational beliefs were found to vary with age. This study was neither conducted in Kenya nor was it conducted among secondary school students. Hence, the ongoing study among Kenyan secondary school students was necessary. This is because the two samples varied in terms of their educational backgrounds, ages, and levels of motivational beliefs, which may have resulted to the disparities in their achievement in mathematics.

A study by Chick, and Vincent (2019), examined the correlation between motivational beliefs, and mathematics achievement among Cypriot pre-service teachers in Australia. The research respondents aged between 24 to 30 years. They used a correlational research design. MSLQ and a MAT was administered to 194 research respondents. Using stepwise multiple-regression, they determined whether motivational beliefs significantly predicted mathematics achievement. Mathematics achievement was predicted by motivational beliefs according to findings of this study. However, this study was carried out among pre-service teachers with significant varying learning experiences, which may have contributed in the study's findings. This justified undertaking current investigation.

Steinmayr et al. (2019) did a study titled importance of students 'motivational beliefs to their mathematics proficiency. The study's sample included 345 elementary school students of age between 8 to 10 years. The respondents were drawn from the top academic track (Gymnasium) in German. Task values beliefs, self-efficacy beliefs and success in mathematics were all reported by the students themselves. According to the findings, task values beliefs and self-efficacy beliefs positively predicted mathematics achievement. Due to the discrepancies in educational background and educational level, this study was necessary to determine whether secondary school students in Africa and elementary school children in Germany have similar or dissimilar motivational beliefs and how it is related to mathematics achievement.

In her study, Cera (2019), investigated how motivational beliefs could influence mathematics achievement. In total, 184 university students from Ibadan, Oyo State, Nigeria, participated in the study. Data was gathered using MAT and MSLQ. MANOVA and Linear Stepwise Regression were used to examine the data. This study found that mathematics achievement was positively correlated with motivating beliefs. Furthermore, it was discovered that academic goal orientation was not as good a predictor of mathematics as self-efficacy. The reviewed study was done in Oyo State's Ibadan city in Nigeria while present research was done in Makueni County, Kenya. This research did not focus on task value beliefs that was studied in the current study. Furthermore, despite the fact that the study was conducted in an Africa, its conclusion might not accurately reflect the situation among secondary school students in Kenya since the learning environment and education system are not similar.

In a study conducted in Botswana, Nkhwalume (2021) found a significant positive association between motivational beliefs of female students' and their mathematics achievement. The research involved 215 students. The students mean age was 19 years. Although the study was conducted in an African secondary school, the Kenyan educational system's curriculum and Botswana are different, which may result to variances in the findings. This necessitated the current investigation. Further, cultural backgrounds of respondents are different and could have played a role in the reported relationship. The current study allowed for cross-cultural comparison in results.

Patricia (2019) conducted research on how secondary school students' motivational beliefs correlated with their mathematics achievement in Kenya. Within the mixed-method approach, the study used a concurrent triangulation research design. The representative sample consisted of 250 students from selected secondary schools. Data gathering instruments were student questionnaires, document analysis, and principals' interview guide. The study discovered a weak positive link between motivational beliefs and mathematics achievement. A similar study was necessary in another Kenyan county to find out whether the situation is the same.

2.4. Gender Differences in Students’ Metacognitive Awareness and Motivational Beliefs

2.4.1 Gender Differences in Students’ Metacognitive Awareness

Researchers have also taken interest in whether there exist gender differences in students’ metacognitive awareness. In Colombia, Adriana (2020) investigated how metacognitive awareness, gender, and mathematics achievement were the correlated. The respondents comprised of 30 (13 boys and 14 girls) private school students from grades 6 to 9. The research respondents’ mean age was 14 years. MAI was used in the data collection from research respondents. This study reported no significant gender variation in metacognitive awareness. Furthermore, it demonstrated that students' growth of metacognitive awareness varied, favoring grade 6 over grade 9. Girls achieved better than boys in mathematics according to the study. Adriana's (2020) study included only 30 private school students, limiting the applicability of the study's findings to students from other countries, of varying ages, and different educational levels, such as Kenyan high school students.

In a different investigation, Mukesh (2022) looked into the correlation between metacognitive awareness, gender, school type, and mathematics achievement. The study’s sample comprised of 100 boys and 100 girls studying in IX grade from Kapurthala district in India, who were randomly chosen for the study. The research respondent mean age was 8 years. The examination reported no gender variation in mathematics achievement. However, significant difference in metacognitive awareness of boys and girls was reported. Since this study was done among students in India, the educational curricula of Kenya and India may differ, which may result to variances in its findings. This made the current study necessary. Furthermore, the study suggested that a comparable study be done in a different country using an older sample to compare the findings.

Munyambu (2020) explored the relationship between metacognitive awareness, gender, and problem-solving skills in mathematics among Kenyan primary school teachers. A sample of 284 (150 males and 134 females) was used in the study. The research respondents age ranged between 24 to 30 years. MAI and Mathematics Problem Solving was utilized in data collection for the study. Although no significant differences on metacognitive awareness based on gender found, however a significant gender differences on mathematics achievement, favoring male primary school teachers was revealed by the study. This study targeted older cohort of primary school teachers with a higher level of metacognitive awareness, while the current study focused on a much younger population of secondary school students to determine whether the situation is the same.

2.4.2 Gender Differences in Students' Motivational Beliefs

Gender disparities in students' motivating beliefs have been the subject of numerous research, with inconsistent results. Wang, and Kenny (2018) examined the impact of students' motivational beliefs, gender on achievement in mathematics. Data was collected from 133 (67 boys and 66 girls) undergraduate students of Cambridge University using MLSQ. This study found that boys achieved better mathematics results compared to girls. Boys were reported to have lower motivational beliefs when compared to the girls. The findings, however, due diverse educational levels and learning environments, both of which may have contributed to the reported results, it was interesting to have a different sample from another location to compare the research findings.

Tapola (2020) investigated the relationship between mathematics achievement and motivating beliefs using a sample of 966 (400 boys and 566 girls) Finnish 9th-graders. Motivational beliefs elements that were considered in this study included interest and self-concept. The Motivational Beliefs on Mathematics Questionnaire was used to gather data. Mathematics achievement was correlated to both boys' and girls' motivational beliefs. Additionally, boys were reported to have higher motivational when compared to girls. This study did not focus on self-efficacy beliefs and task value beliefs as opposed to the current study.

A study on association between motivational beliefs and five varying subject areas at a public university in Kenya was done by Hako (2019). The study involved 190 male and 184 female postgraduate students, ages 26 to 32. According to this study, male and female had different amounts of motivating beliefs, and females were more test-averse than male. The motivational components of task value and test anxiety were shown to vary significantly by department, and these views varied across academic fields. In order to ascertain whether younger secondary school students' motivational beliefs differed according to their gender the present study was necessary.

2.5 Prediction of Mathematics Achievement from Metacognitive Awareness and Motivational Beliefs

Several researchers have studied the prediction of mathematics from metacognition awareness and motivational beliefs. For example, a study that was conducted in Indonesia by Sercenia (2022), sought to investigate the predictive weight of metacognitive awareness and motivational beliefs on mathematics success. She involved 146 junior school learners. Online survey questionnaires on motivational beliefs, mathematics achievement, and metacognition were used to gather quantitative data. According to the research findings, metacognitive awareness predicted mathematics achievement better than the motivational beliefs. Secondary school students in Kenya and students in Indonesia may have varying metacognitive awareness and motivational beliefs which could have a hand in the study's findings. This is due to disparities in learning contexts, necessitating the current investigation.

A study on how to predict mathematics achievement from motivational beliefs, and metacognitive awareness was carried out by Osafo (2022). The research sample comprised of 187 medical students from Iran's Shiraz University of Medical Sciences made up the research sample. Information was gathered using a Motivated Strategy for Learning Questionnaire. According to the study's findings, metacognitive awareness was correlated to mathematics achievement, and motivational beliefs positively predicted the students' mathematics achievement. Motivational beliefs were correlated with metacognitive awareness. Compared to the current study which involved secondary school students, the reviewed research was conducted among an older cohort of university students whose level of metacognitive awareness and motivational beliefs might be higher than those of students in secondary schools.

Another study conducted by Luneta (2020), discovered that increase in students' motivational beliefs lead to low mathematics achievement among South African students. The study involved 78 students from two different secondary schools. Data analysis was done using multiple-regression. This study involved a small sample drawn from two secondary schools only. This may limit generalization of its results. The current study addressed this limitation by selecting a larger number of respondents.

Using a quasi-experimental research method, Mulavu and Aurah (2019) investigated the effects of motivational beliefs and metacognitive awareness on the mathematics success of Kenyan secondary school learners. This research involved 564 students that was selected from a population of 2,138 high school students using simple random sampling method. Two questionnaires, one on metacognitive prompting and the other on motivational beliefs were used to gather data. In addition, metacognitive awareness was found to correlate motivational beliefs. Through regression analysis it was found that metacognitive awareness and students' motivational beliefs significantly predicted mathematics achievement. A related investigation was necessary to evaluate whether the condition is similar to that reported by Mulavu and Aurah (2019), employing a different research design.

2.6 Summary of Literature Reviewed and Gap Identification

From the reviewed research on metacognitive awareness, motivational beliefs and mathematics achievement there is inconsistence in their findings. Some of them point out positive correlation between metacognitive awareness, motivational beliefs and mathematics achievement while others reveal a negative correlation or no correlation at all. Most of the reviewed studies were from outside Africa thus making it important to be done again using another population that is different in terms of age, and location. Additionally, research samples in the reviewed studies were mostly drawn from tertiary institutions hence there is paucity of studies involving secondary school samples.

Gender variations in metacognitive awareness and motivational beliefs have yielded contradicting results in studies. In some research, no gender differences in metacognitive awareness and motivational beliefs were discovered, however in others, male and female students had varying metacognitive awareness and motivational beliefs. The current study went deeper into gender differences in order to enable the researcher compare the results.

On the predictive weight of metacognition awareness and motivational beliefs on mathematics achievement, all studies found that metacognitive awareness and motivational beliefs predicted mathematics achievement. However, only one study highlighted that metacognitive awareness predicted mathematics achievement better than the motivational beliefs, an aspect of the study sought to clarify. Other studies also used small samples which may limit generalization of the finding.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter covers the following areas: research design, study location, target population, methods of sampling, size of the sample, instruments for research, data collection procedures, and logistical and ethical considerations.

3.2 Research Design

This research used a correlational research design. This research design aids in determining the strength and the direction two or more variables are correlated. It is focused on determining the underlying reasons of a current condition in which no attempts are made to modify the variables under study because the events of interest have already occurred or are occurring naturally (Gardner et al., 2015).

3.2.1 Research Variables

Metacognitive awareness and motivational beliefs were the predictor variables, while outcome variable was mathematics achievement. The two variables were measured at an interval scale. Gender was an intervening variable and was measured at nominal scale.

3.2.2 Research Methodology

The researcher used quantitative research methodology. Data was collected from the research respondents using questionnaires. This method is relatively quick, cheap, and simple and enables collection of huge amounts of data within a short length of time (Mackey, 2014).

3.3 Location of the Study

The research was conducted in Makindu Sub- County, Makueni County, Kenya. The sub-county was selected because majority of public secondary schools in the area have been recording low achievement in mathematics in KCSE examinations between the year 2019 and 2023 (KNEC, 2024). This is in comparison to the other sub-counties in Makueni County. Statistics from 2019 to 2023 show that, students' mathematics average grade in KCSE in Makindu sub-county has been below D plus (4 out of possible 12 points). As a result, only a minority of students enroll in institutions of higher education to study science related courses that are needed most for industrialization and technological growth. The issue of dismal mathematics achievement continues in spite of the effort made to remedy the situation. Since poor achievement has persisted, it is possible that metacognitive awareness and motivational beliefs that local research has not focused on may be amongst the contributing factors.

3.4 Target Population

All Makueni County's public secondary school students in form three in the year 2024 were targeted in this study. A total of 1322 learners in form three drawn from 18 public schools in Makindu Sub- County, Makueni County formed the accessible population. The reason behind this was that public secondary schools had a higher rate of low math achievement than private secondary schools. Form three students were given preference for participation in the study because, it was assumed that they had developed the capacity to actively recognize and consider one's own thought and learning processes and had improved motivational beliefs. Form four students were exempted because teachers were likely to be pushing them with lot of assignments and remedial lessons, in order to help students, finish the syllabus and have more time for revision in advance of the KCSE.

3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Techniques

Makindu Sub- County was purposively selected out all nine sub-counties in Makueni County as the study's locale because of persistent poor achievement mathematics in KCSE between the years 2019 to 2023. Form three classes was selected using purposive sampling, since they were thought to have developed some level of metacognitive awareness and motivational beliefs. The schools were stratified into three groups: co-educational schools, girls' schools and Boys' schools. This ensured that there was representation of schools from each category. The researcher selected nine out of all eighteen secondary schools from the three categories using proportional allocation. The strata ranged in size, allowing the sample sizes to stay proportional to the strata. According to Etikan and Bala (2017), proportionate allocation deemed very effective and beneficial since it assures that there is similarity within strata variance. As a result, one (1) boys' school, two (2) girls' schools and six (6) co-educational schools were chosen. Study respondents were selected using simple random sampling which ensured that each student had an equal chance of being chosen hence a sample that was really representative was obtained according to Kothari and Garg (2014).

3.5.2 Sample Size Determination

A total of 9 secondary schools and 174 form three students made up the research sample size. This sample size was selected because it was easy to administer, and allocate resources. The sample included 50% of the target schools and 13% of the student population, meeting Mason's (2013) and Vanroorhis and Morgan's (2007) thresholds for a normal distribution. Further, they opined that, a sample size of more than 30% and between 10%-20% respectively is suitable for any study. Table 3.1 illustrates the number and category of schools, as well as the sample size.

Table 3.1

Summary of the Sample Composition

Type of the school	**Population**			**Sample Size**		
	Schools	**Boys**	**Girls**	**Schools**	**Boys**	**Girls**
Boys' schools	2	410	-	1	54	-
Girls' schools	4	-	450	2	-	59
Co-educational	12	225	237	6	30	31
Total	18	635	687	9	84	90

Source: County Director of Education Office, Makueni (2024).

As shown in Table 3.1, 2 girls' secondary schools were chosen, and 30 respondents were selected from each of the girls' secondary school. The study involved one boy's secondary school. A total of 54 students from the selected boys' secondary school were sampled. The study sampled 61 students from 6 co-educational secondary schools.

3.6 Research Instruments

Questionnaires and a pro forma summary of students' mathematics results of mid-term one 2024 were used in data collection. Permission to use the questionnaires was given by their developers (refer to Appendix III and IV). The questionnaires were arranged in four sections. Section A consisted of the respondents' background information such as age, sex, and type of school. Section B consisted of information on students' metacognitive awareness. Section C collected information on students' motivational beliefs. Session D collected information on student's mathematics achievement. The questionnaires included closed-ended question items. Research respondents took about 40 minutes to fill in the questionnaires.

3.6.1 Metacognitive Awareness Inventory (MAI) Questionnaire by Schraw and Dennison (1994)

An adapted MAI scale was utilized to measure metacognitive awareness. Adaption was carried out by picking only question items on metacognitive awareness category which were pertinent to the current study. The researcher modified the questionnaire's wording to make it appropriate for the current research to measure mathematics achievement. For instance, the term "*academic achievement*" in the original questionnaire was changed to read "*mathematics achievement*". The scale contained 32 items classified under; knowledge of cognition (12 items) and regulation of cognition (20 items). The items were rated on a Likert scale that ranged from, 1 =*Strongly Disagree* to 5 = *Strongly Agree* (refer to Appendix B, section B). To assess a students' level of metacognitive awareness, scores for each research respondent were added up to get a total score. Scores for metacognitive awareness ranged between lowest 32 to highest 160. A score of 32 to 78 implied low metacognitive awareness while a score of 79 to 125 implied moderate metacognitive awareness. A score of 126 to 160 indicated high metacognitive awareness.

3.6.2 Motivational Beliefs on Mathematics Questionnaire by Rotgans and Schmidt (2010)

The researcher adopted MBMQ to measure the students' level of motivational beliefs. MBMQ is divided into; self-efficacy beliefs (8 items) and task value beliefs (7 items) (refer to Appendix B, section C). This questionnaire had 15 items in Likert scale format. The scores varied from 5 =*indicating great agreement* to 1= *indicating extreme disagreement*. The lowest attainable score was 15, while the highest attainable score was 75. A score between 15 and 35 indicated low motivational beliefs whereas a score between 36 and 56 indicated moderate motivational beliefs. A score between 57 and 75 implied high motivational beliefs.

3.6.3 Pro Forma Summary of Students' Mathematics Results

In order to determine students' mathematics achievement, mid-of-term one mathematics scores for the year 2024 for each research respondent were acquired and recorded in a pro forma table (see Appendix B, section D). For the purpose of comparison with students from other schools, the results were first changed into Z scores and then separately converted into T-scores.

3.7 Pilot Study

One co-educational secondary school from the population of the study was purposely selected for a pilot study. This secondary school was excluded from the main study. Pilot study sample included 10% of the main study's sample size was considered reasonable

(Hazzi & Maldaon, 2015). After sampling 18 form three students (9 boys and 9 girls) randomly selected for the pilot study, questionnaires were administered to them is a similar manner that would be done during the actual study's data collection. The average time taken in filling in the questionnaire was noted. Additionally, the researcher asked if the students had any difficulty in understanding any of the items. These were marked and eventually reworded. Further, the researcher asked the school's mathematics teachers to review the surveys and provide feedback on their clarity. For instance, the following items in MAI were marked as challenging to comprehend; '*I know how well I did once I finish a task*, *I am good at recalling information'*, and '*I know what the tutor expects me to learn'*. These items were rephrased to read as; '*I know how well I did once I finish solving mathematical problems'*, *'I am good at remembering mathematics concepts'*, and '*I know what my teacher expects me to learn in mathematics'*. The pre-testing was useful in improving the validity and reliability of the research tools. Further, the time allocated for the research respondents to fill the questionnaires was found to be adequate.

3.7.1 Validity of Research Instruments

The research instruments used for data collection had adequate validity. The content validity index for MAI is 0.78 (Schraw & Dennison, 1994), while Rotgans and Schmidt (2010) report that the content validity index for MBMQ is 0.71. Additionally, the researcher, relied on researcher's peers and expert judgment to ascertain content validity. The university supervisor examined the items in MAI and MBMQ to ascertain their level of measurement of the constructs under study. This improved the acceptance of the questionnaires for data collection because it helped to clarify all the items and made them more relevant.

3.7.2 Reliability of the Research Instruments

The instruments used for data collection had acceptable internal consistency reliability according to studies, MAI $\alpha \geq 0.94$ by Screw and Dennison (1994), and MBMQ $\alpha \geq 0.87$ by Rotgans and Schmidt (2010). The pilot research was used to evaluate the instruments' internal steadiness for the current sample because these coefficients were computed using a sample selected from different countries and population. This was done using Cronbach alpha. The results are displayed in Table 3.2.

Table 3.2

Reliability Coefficients of the Metacognitive Awareness and Motivational Beliefs Scales.

Subscale	Reliability Coefficient
Metacognitive Awareness Scale	0.80
Motivational Beliefs Scale	0.72

Source: Researcher (2024)

Table 3.2 show that the Cronbach reliability coefficient for MAI, and MBMQ were 0.80 and 0.72 respectively. The fact that the instruments were designed and validated with students in a different learning context may explain their relatively low reliability compared to the original instruments. In addition, the instruments were adapted and used in the study after some wordings were changed to make them more relevant to the participants and setting of the current investigation. The obtained coefficients were within the allowed threshold and therefore, suitable for the current study (Creswell, 2012).

3.8 Data Collection Techniques

The data was gathered by distributing questionnaires to research respondents at their respective schools. This ensured that there was a high return rate and it took place during the games time. Research respondents filled the questionnaires within 40 minutes. Also, the researcher collected the mid of term one mathematics scores of the year 2024, of the research respondents from their respective schools.

3.9 Data Analysis

The self-reports were cleaned by looking for and eliminating those that had either incomplete responses or multiple responses to a single question. The gathered data was coded and analyzed utilizing SPSS. Descriptive statistics including means, frequencies, standard deviations, and percentages, was used to describe the characteristics of the research respondents. The strength and direction of the correlation between the variables under study was determined using Pearson's product moment correlation. The null hypotheses were tested using pertinent inferential statistical techniques in the following section at α=0.05 level of significance.

H_{01}: There is no significant relationship between students' metacognitive awareness and mathematics achievement. Statistical test: Pearson's product moment correlation because the data was at an interval scale of measurement.

H_{02}: There is no significant relationship between students' motivational beliefs and mathematics achievement. Statistical test: Pearson's product moment correlation. This is because the data was at an interval scale of measurement.

H_{03}: There are no significant gender differences in students' metacognitive awareness and motivational beliefs. Statistical test; t-test for independent sample. This is because the two groups (males and females) were mutually exclusive and could not influence each other in their scores.

H_{04}: There is no significant prediction equation mathematics achievement from metacognitive awareness and motivational beliefs. Statistical test: Regression Analysis.

3.10 Logistical and Ethical Considerations

3.10.1 Logistical Considerations

The graduate school of Kenyatta University issued the researcher with a letter authorizing for collection of data. The researcher obtained a research permit from NACOSTI. Furthermore, Permission from the county director of education was requested by the researcher to carry out research in the chosen schools in Makueni County. The schools were then visited for familiarization and scheduling of appointments with the schools' principals. The students were given questionnaires by the researcher with assistance from the teachers.

3.10.2 Ethical Considerations

The research participants were not coerced to participate and were free to withdraw their participation without any consequences. Additionally, they were guaranteed of privacy and confidentiality of the information they would give, and would be utilized exclusively for the current study's objectives. Research respondents signed a consent before starting the study.

CHAPTER FOUR

PRESENTATION OF RESULTS, INTERPRETATIONS AND DISCUSSIONS

4.1 Introduction

In accordance with the study objectives, the research results, as well as their interpretation and discussion are displayed in this chapter. It begins with the respondents' background information, then moves on to the results, data analysis, and discussion of the results.

4.2 General and Background Information

This section contains the response rate to the questionnaire as well as statistics on the respondents' gender and age.

4.2.1 Questionnaire Return Rate

In total 174 students drawn from girls' secondary schools, boys' secondary schools, and co-educational secondary schools in Makindu Sub County participated in the study. The distribution of the questionnaires were done to research respondents in the three school categories as follows: 54, 59, and 61 in girls', boys', and coeducational secondary schools respectively.

The questionnaires were given out at both girls', co-educational and boys' secondary schools by the researcher in person. The return rate was 97.77%. This was due to the fact that four questionnaires were rejected after the researcher noticed that they had either unfinished work or respondents answered the same question more than once. As a result, 170 questionnaires were determined to be valid and were analyzed as shown in Table 4.1.

Table 4.1

Questionnaire Return Rate

Type of School	Sample Size			Return Rate		
	Schools	Students		Students		
		Boys	Girls	Boys	Girls	Percent
Boys secondary	1	54	-	54	-	100
Girls secondary	2	-	59	-	55	93.22
Coeducational	6	30	31	30	31	100
Total	9	84	90	84	86	97.77

Source: Researcher (2024

According to Table 4.1, both boys', and co-educational secondary schools recorded 100% return rate. In girls' secondary schools, only 55 questionnaires were returned, representing a 93.22 % response rate. Additionally, the table shows that co-educational secondary schools provided the greater number of the research participants (35.89%), followed by girls' secondary schools (32.35%), and then boys' secondary schools (31.76%).

4.2.2 Demographic Information of the Respondents

Table 4.2 displays the gender of the research respondents.

Table 4.2

Gender of the Respondents

	Frequency	Percent
Male	84	49.4
Female	86	50.59
Total	170	100.0

As shown in Table 4.2, females were more than half of the research participants (50.59%) and almost a half of the respondents were males (49.4%). Female students were outnumbered male students, as was already evident. This was because female students made the majority of the study's population. Although it was small, the gap would have no effect on the gender-based study's conclusions.

The researcher divided the respondents' ages into three groups as shown in Table 4.3

Table 4.3

Distribution of Respondents by Age, Gender and School Type

School Type	Age	Gender		Total		
		Girls	Boys	F	%	M(SD)
BS	14-18	-	40	40	23.5	
	19-25	-	14	14	8.2	
	Above 25	-	0	0	0	
GS	14-18	50	-	50	29.4	
	19-25	5	-	5	2.9	
	Above 25	0	-	0	0	17.01(0.79)
Coed	14-18	22	17	39	22.9	
	19- 25	9	13	22	12.9	
	Above 25	0	0	0	0	
Total	14-18	72	57	147	86.5	
	19-25	14	27	46	27.1	
	Above 25	0	0	0	0	
Total		86	84	170	100	

Note. BS- Boys Secondary; GS- Girls Secondary; Coed- Coeducational Secondary

Data in Table 4.3 indicate that, in the boys' secondary schools, 47.6% of students were between the ages of 14 and 18, and 16.7% were between the ages of 19 and 25. Most of the learners in the girls' schools were in the 14–18 age range, and a small percentage were in the 19–25 age range. Comparably, at the coeducational secondary schools, approximately 63% of students were in the 14–18 age range, and 36% were in the 19–25 age range. Additionally, Students aged 14 to 18-years were the majority in the three categories of secondary schools. This somewhat older cohort of students could be as a result of either repetition of lower-level classes or the implementation of a 100%

transition to secondary education, which drew into secondary schools' students, who had abandoned schooling. The average age and standard deviation of the respondents was 17.01 and 0.79 respectively. Accordingly, the majority of respondents in both genders, whose ages varied from 14 to 18, are within Kenya's recognized school age range for secondary education (UNESCO, 2019).

4.3 Relationship between Students' Metacognitive Awareness and Mathematics Achievement

The researcher was interested in determining the correlation between form three students' metacognitive awareness and mathematics achievement. A descriptive analysis of metacognitive awareness and mathematics achievement scores were carried out prior to conducting correlation analysis and testing the hypothesis.

4.3.1 Descriptive Statistics for the Respondents' Metacognitive Awareness

The students' metacognitive awareness scores were computed, including their minimum and maximum values, standard deviation, skewness, mean, kurtosis and range. Table 4.4 summarizes the results.

Table 4.4

Descriptive of Students' Metacognitive Awareness Scores

	N	R	Min	Max	*M*	*SD*	*Kur*	*Sk*
Metacognitive awareness	170	110.00	35.00	145.00	120.23.11	10.70	.25	-.34

Note. N- Sample size, M= Mean, SD = Standard Deviation, Kur = Kurtosis, SK – Skewness, Min = Minimum, Max = Maximum, R = Range

The analyzed results showed that mean of metacognitive awareness scores was 120.23 (SD=10.70) as displayed in Table 4.4. Additionally, the highest and lowest metacognitive awareness score were 145 and 35 respectively, while the expected highest score for metacognitive awareness was 160 and the lowest score was 32. The coefficient of skewness was -.34, suggesting that metacognitive awareness scores were slightly left skewed indicating that a number of students had high metacognitive awareness. The distribution of the scores was platykurtic since the Kurtosis coefficient, which was .25 was less than 1. This indicates a relatively peaked distribution with more data clustered around the tails and less around the mean.

Table 4.5

Descriptive Statistics for the Scores on the Sub Scales of Metacognitive Awareness

	N	Min	Max	*M*	*SD*	*Kur*	*Sk*
Regulation of Cognition	170	13.00	55.00	50.11	2.07	-.39	.111
Knowledge of Cognition	170	22.00	90.00	70.12	3.10	-.07	-.12

Note. N- Sample size, M= Mean, SD = Standard Deviation, Kur = Kurtosis, SK – Skewness, Min = Minimum, Max = Maximum

Regulation of cognition's mean was 50.11, with maximum and minimum values of 55 and 13, respectively, as shown in Table 4.5. On the other hand, knowledge of cognition's mean was 70.12, having a minimum of 22 and a maximum of 90. The subscales' kurtosis and skewness coefficients show that the scores distribution was roughly normal. Table 4.6 show the respondents' statistics on the three levels of metacognitive awareness.

Table 4.6

Respondents' Levels of Metacognitive Awareness

Level of Metacognitive Awareness	Frequency	Percentage
Low	1	0.8
Average	134	78.7
High	35	20.5
Total	170	100

According to the results in Table 4.6, more than three quarter majority of the respondents exhibited an moderate level of metacognitive awareness. Less than 1% of respondents reported having a low level of metacognitive awareness, whereas 20.5% displayed a high level of metacognitive awareness.

Three categories of schools took part in this study. These included; co-educational schools, girls' secondary schools, and boys' secondary schools. The results of metacognitive awareness scores per school category are shown in Table 4.7.

Table 4.7

Scores of Metacognitive Awareness as per the School Category

School type	**Mean score**
Girls' schools	120.30
Boys' schools	123.29
Coeducational secondary schools	117.10

From Table 4.7, it is seen that boys' secondary schools scored a mean of 123.29, followed by girls' secondary schools (120.30). Co-educational schools scored the lowest mean of metacognitive awareness at 117.10.

4.3.2 Descriptive Statistics for Mathematics Achievement Scores

To make the respondents' mathematics achievement comparable, the mid of term one 2024 mathematics scores of the research respondents were translated into standardized T scores. Table 4.8 display the scores.

Table 4.8

T Scores of Mathematics Achievement of the Respondents

	N	Range	Minimum	Maximum	*M*	*SD*	*Sk*	*Kur*
T-Score	170	55	26	81	47.21	9.24	1.053	1.06

Note. SD-Standard deviation; N-Sample Size

According to the findings shown in Table 4.8, the mean T-score was 47.21, SD = 9.24. The range of scores was 55.0 with a maximum of 81.0 and a minimum of 26.0. According to the skewness coefficient, the data had a leptokurtic peak and were regularly distributed. Respondents' mathematics achievement was arranged as low, falling between 20 and 40, average, falling between 41 and 60, and high, falling between 61 and above. Table 4.9 presents the results based on these categories.

Table 4.9

Levels of Mathematics Achievement of the Respondents

Achievement	Frequency	*M*	*SD*
Low	32(19.0%)	39.01	1.41
Average	118(69.5%)	57.3	5.54
High	20(11.5%)	62.6	6.44
Total	170(100%)		

According to Table 4.9, 11.5% of participants had a high score in mathematics achievement, while only 19% of respondents had a low score. The majority of respondents (69.5%) had an average score. Low, average, and high levels of mathematics achievement had mean scores of 39.01, 57.3, and 62.6, respectively. The mean score for mathematics achievement was 52.97. The biggest variability was found among students who performed well in mathematics (SD = 6.44), followed by those who performed averagely (SD = 5.54), and those who performed poorly (SD = 1.41).

The results reveal that only a small percentage of students 11.5% were excelling in mathematics implying that only these few may qualify for mathematics-based courses in higher education.

4.3.3 Hypothesis Testing

According to the null hypothesis, students' achievement in mathematics and their level of metacognitive awareness are not significantly correlated. The results of Pearson product correlation analysis performed to test the null hypothesis are shown in Table 4.10.

Table 4.10

Correlation between Metacognitive awareness and Mathematics Achievement

		Mathematics achievement
	N	170
	Pearson Correlation	.73
MA	Sig. (2-tailed)	.01

Note. MA – Metacognitive Awareness; N-Sample Size

Table 4.10 show that students' metacognitive awareness and mathematics achievement are positively and strongly correlated (r (170) =.73, $p < .05$). This led to the rejection of the null hypothesis. The findings imply that increased metacognitive awareness leads to improved mathematics achievement among students. Students with high metacognitive awareness are likely to outperform those with low levels in terms of mathematics achievement.

The correlation between the two domains of metacognitive awareness and mathematics achievement was investigated using bivariate correlation. The results are displayed in Table 4.11.

Table 4.11

Relationship between Domains of metacognitive awareness and Mathematics Achievement.

	Mathematics Achievement
Regulation of cognition	.11**
Knowledge of cognition	.11**

Note. **Correlation significant at p< .01

According to Table 4.11, the two metacognitive awareness domains separately demonstrated a weak positive relationship with mathematics achievement, as indicated by the values of r (170) =.11; $p < .01$ for all correlations. The results indicate that the two domains independently contribute less to the mathematics achievement than when the two elements are combined together as shown in Table 4.10. This is indicative of the synergistic effect of considering the two elements together. The researcher examined on how the three levels of mathematics achievement and metacognitive awareness are correlated. Table 4.12 gives the results.

Table 4.12

Correlation between Metacognitive Awareness and Mathematics Achievement across the Levels of Mathematics Achievement

Mathematics Achievement Level	r^a	***P***
Low	-.11	.36
Average	.15	.01
High	.27	.06

Note. $N = 170$.

Table 4.12 show that the relationship between mathematics achievement and metacognitive awareness differ depending on mathematics achievement levels. Only students with low mathematics achievement showed negative relationship (r (32) =-.11, p < .05) between mathematics achievement and metacognitive awareness. However, high and average metacognitive awareness and mathematics achievement scores were positively related (r (20) = .27, p =.06) and (r (118) = .15, p > .05) respectively. This indicate that the level of mathematics achievement depends on the students' metacognitive awareness. The more strongly two variables are correlated the higher the level of mathematics achievement.

4.3.4 Discussion of the Results

The findings that metacognitive awareness and mathematics achievement are significantly correlated agree with some prior research. The current study's results corroborate with those of previous research that used secondary school students' samples. Akben (2020) found that all dimensions of metacognitive awareness were positively associated to mathematics achievement in a sample of university students. The positive relationship may be due to the ability of the students to understand and regulate their cognition, hence successfully maneuver through the mathematics problem-solving without difficulties. In addition, Sari and Sumilah (2021) found comparable results among South Korean college students.

According to an investigation by Arum et al. (2019), students' metacognitive awareness significantly predicted their level of mathematics achievement. The results of the current investigation and the study by Arum et al. (2019) are consistent. These results suggest that Students with great metacognitive awareness are positioned to study more and obtain better results in mathematics than their counterparts whose metacognitive awareness is still developing.

Toraman et al. (2020) obtained similar results in India using a sample of undergraduate students from various universities. The study discovered that varying levels of metacognitive awareness correlated varied levels of mathematics achievement. The positive relationship may be because students who are aware of their cognition and regulate their cognition; they can plan, control, evaluate, and monitor their learning process. This lead to improved mathematics achievement.

The fact that numerous studies have demonstrated a correlation between metacognitive awareness and mathematics achievement is a sign that metacognitive awareness may be one of the major aspects to be addressed in trying to explain students' mathematics achievement. This is supported by the theoretical explanation that students increased metacognitive awareness enable them to identify which components of the mathematics task that are difficulty for them and adjust the available methods to focus more attention on their areas of weakness. Moreover, they are able to plan to manage their time effectively for the assigned mathematics work, implement the appropriate methods, monitor their progress, reflect on the final mathematics solutions, and, if required, alter the techniques employed for future when solving any mathematics problem (Brown, 1987).

According to Rahman and Hassan (2017), metacognitive awareness is substantially connected to individual’s mathematics achievement. Rahman and Hassan’s (2017) study reported that knowledge of cognition accounted for the most difference in mathematics achievement among university students when compared to regulation of cognition. This is contradicted by the result of the present. The inconsistency of the result may be due to the differences in the level of education between the population of the current study and that used by Rahman and Hassan (2017).

The current study's result negates those of research by Arum et al. (2019) that found metacognitive awareness not been strongly related to mathematics achievement. There may be a possible explanation for this disparity in results. It could be because of differences in students' level of education and study location. According to the results of the current study, poor achievement in mathematics among students may be attributed to low level of metacognitive awareness.

4.4 Relationship between Students' Motivational Beliefs and Mathematics Achievement

4.4.1 Descriptive statistics for Motivational Beliefs Scores

The second objective of the research was to determine the relationship between students' motivational beliefs and mathematics achievement. Descriptive statistics for motivational beliefs scores were obtained prior to the hypothesis being tested, and the results are shown in Table 4.13.

Table 4.13

Descriptive statistics for Motivational Beliefs scores

	N	R	Min	Max	*M*	*SD*	*Kur*	*Sk*
Motivational Beliefs	170	42.00	23.00	65.00	65.00	4.05	.42	-.19

Note. N- Sample size, M= Mean, SD = Standard Deviation, Kur = Kurtosis, SK – Skewness, Min = Minimum, Max = Maximum, R = Range

According to Table 4.13, the mean score for motivational beliefs was 54(standard deviation; 4.05). The range of scores was between 23 and 65, with a maximum score being 65. The highest and lowest projected scores on the scale were 75 and 12, respectively. The coefficient of skewness was -.19, suggesting that motivational beliefs scores were slightly left skewed implying that a number of students had high motivational beliefs. The positive value of kurtosis (.42) shows that the distribution was relatively peaked distribution with more data clustered around the tails and less around the mean.

Table 4.14 show descriptive statistic for the scores on the sub scales of motivational beliefs.

Table 4.14

Descriptive Statistics for the Scores on the Sub Scales of Motivational Beliefs

	N	Min	Max	*M*	*SD*	*Kur*	*Sk*
Self-Efficacy Beliefs	170	8.00	30.00	23.31	3.07	-.22	.12
Task-Value Beliefs	170	15.00	35.00	30.69	2.50	-.09	-.18

Note. N- Sample size, Kur = Kurtosis, SK – Skewness, Min = Minimum, Max = Maximum, M=Mean, SD=Standard Deviation

The mean score for self-efficacy beliefs was 23.31 (*SD*=3.07), with 30 as maximum and 8 as minimum values, as shown in Table 4.14. The mean score for task value beliefs was 30.69(*SD*=2.50), with 35 and 15 as the highest and lowest score respectively. The coefficients of kurtosis and skewness for all subscales show that the score distribution was roughly normal. Table 4.15 show the respondents' statistics on the three levels of motivational beliefs. The coefficient of skewness for self-efficacy beliefs was positive, suggesting that self-efficacy beliefs was slightly right skewed implying that most of the data was concentrated to the left side with some extreme values of high self-efficacy beliefs values on the right side. Conversely, the coefficient of skewness for task-value beliefs was negative, suggesting that task-value beliefs was slightly left skewed implying that most of the data was concentrated to the right side with some extreme values of high task-value beliefs values on the left side. The positive value of kurtosis for both self-efficacy beliefs and task-value beliefs shows that the distribution was relatively peaked distribution with more data clustered around the tails and less around the mean.

Table 4.15

Respondents' Levels of Motivational Beliefs

Level of Motivational Beliefs	Frequency	Percentage
Low	5	3
Average	134	79.1
High	31	19.9
Total	**170**	**100**

According to Table 4.15, 79.1% of the respondents scored on average in terms of motivational beliefs. Only 3% of the students indicated they had low levels of motivational beliefs, whereas 19.9% recorded high level of motivational beliefs. The results show that a larger number of the study's research respondents had motivational beliefs that ranged from average to high. The results reveal that only a small percentage of students 5% had low level of motivational beliefs implying that most of the students were positively disposed to perform well in mathematics. The researcher determined the students' motivational beliefs scores based on the three school categories. The results are shown in Table 4.16

Table 4.16

Scores of Motivational Beliefs by School Categories

School type	Mean score
Girls' Secondary Schools	50.76
Boys' Secondary Schools	62.44
Coeducational Secondary Schools	48.8

According to the results shown in Table 4.16, coeducational secondary schools had the lowest mean score on motivational beliefs (48.8), followed by boys' secondary schools with a mean of 50.76. Girls' secondary schools had the highest mean score on motivational beliefs (62.44). The results reveal existence of differences in motivational beliefs based on school type.

4.4.2 Hypothesis Testing

Table 4.17 summarizes the results.

Table 4.17

Correlation between students' Motivational Beliefs and Mathematics Achievement

		Mathematics Achievement
Motivational Beliefs	Pearson Correlation	.23*
	Sig. (2-tailed)	.00
	N	170

Note. T Score-Standardized score for Mathematics Achievement

N- Sample Size; *Correlation significant at $p < .05$

Table 4.17 show that there was a weak positive relationship between motivational beliefs and mathematics achievement (r (170) =.23, $p < .05$). The null hypothesis that stated that, there is no significant correlation between motivational beliefs and achievement in mathematics was thus rejected. This imply that students should be exposed to mathematics work that seem to be of importance to them and that they perceive to have the ability to solve in order to achieve better. According to the results the higher the students' motivational beliefs, the higher their mathematics achievement, and vice versa.

Table 4.18 displays the independent linear relationships that were found between the domains of motivational beliefs and mathematics achievement. The results are displayed in Table 4.18.

Table 4.18

Relationship between Domains of Motivational Beliefs and Mathematics Achievement

Domains of Motivational Beliefs	Sig
Self-Efficacy	.38**
Task-Value	.28**

Note. *N*= 170.

** Correlation significant at $p < .05$.

Table 4.18 displays the self-efficacy and task value correlation coefficient results. Task value revealed a positive relationship with achievement in mathematics, r (170) =.28, $p < .05$. Self-efficacy also demonstrated a positive correlation, r (170) = .38, $p < .05$). The results imply that increased students' self-efficacy and task value beliefs led to higher achievement in mathematics. According to this result, students who perceive mathematics as important, and useful to them do better in terms of mathematics achievement. In addition, students who belief in their capacity to achieve well in mathematics do well in mathematics examinations. The researcher investigated the correlation between the three levels of mathematics accomplishment and motivational beliefs. Table 4.19 presents the results.

Table 4.19

Correlation between Motivational Beliefs and Mathematics Achievement across the Levels of Mathematics Achievement

Mathematics Achievement Level	***r*[a]**	***P***
Low	-.21	.26
Average	.17	.03
High	.23	.08

Note. *N* = 170.

Table 4.19 show that the relationship between mathematics achievement and motivational beliefs vary based on mathematics achievement levels. Students with low mathematics achievement level showed a negative relationship (r (5) =-.21, $p < .05$) between motivational beliefs and mathematics achievement. However, the relationship was positive r (31) = .23, p =.08), and r (17) = .17, $p > .05$) for students with high and average level of mathematics achievement respectively. The results can be interpreted that students with higher level of mathematics achievement have better motivational beliefs. This imply that students should be trained on how to boost their motivational beliefs which in turn may lead to success in mathematics.

4.4.3 Discussion of the Results

The results of this study corroborated those of prior research by Hsieh and Simpkins (2022), and Perez et al. (2019), that a positive correlation existed between students' motivational beliefs and mathematics achievement. Additionally, the studies that involved university students reported results similar to that of the current investigations. Motivational beliefs were discovered to be positively connected to mathematics achievement, regardless of age, level of education and diverse study settings. This implies that students who value the significance of good scores in mathematics stand a higher chance of becoming top achievers in mathematics.

Motivational beliefs is argued to have a strong positive link with mathematics achievement by Liou and Jessie (2018). Students who recorded high levels of motivational beliefs outperformed pupils with low levels in mathematics. Similar results to this of the current study was reported by Burić and Kim (2020), and Tsai (2020). According to El-Adl and Alkharusi (2020) students' goals, levels of confidence, and perceived importance of mathematics success contribute to great better achievement in mathematics. The study's descriptive statistics showed that most respondents had average motivational beliefs. The results of this research are coherent to those of an investigation that was done by Snodgrass et al. (2020) using primary school pupils. They argued that, students who scored high on the MBMQ's test of motivational beliefs also achieved well in mathematics. Additionally, Swedish students who scored poorly on motivational beliefs were reported to do poorly in mathematics by Widlund et al. (2024). The results suggested that the value attributed to the significance of confidence in one's ability to solve mathematical problems determine their success in mathematics.

A study that investigated the correlation between motivational beliefs and low, average and high levels of mathematics by Alzahrani (2022) found that students' level of achievement in mathematics was significantly associated to their motivational beliefs. Further, current study results are well aligned to those of Alzahrani (2022), that the students' level of mathematics achievement improves with increase in their motivational beliefs. This result suggested that students' success in mathematics may be attributed to their perceived ability and desire for better achievement in mathematics.

Prior studies have found a relationship between motivational beliefs and mathematics achievement, indicating that motivational beliefs may be one of the key factors to consider when determining students' mathematics achievement. This is backed by the Expectancy Value theory (Eccles & Wigfield, 2002) that postulates that students who belief in their abilities to complete a mathematics task demonstrate greater interest and engagement in it, and hence perform better than those who are not. Students' self-efficacy determines their choice of alternative solutions, effort to put when learning mathematics, and hence their success in mathematics. The way students perceive the importance and benefits of mathematics motivate them to actively participate in mathematics studies. Individuals are more likely to find mathematical activities more meaningful, and worthwhile when they are certain that they can accomplish them successfully.

The present study results, negate those of Oppermann et al. (2018) who reported that motivating beliefs did not significantly influence mathematics achievement among overseas students. Similar to this, Ozkal (2019), and Leavy and Hourigan (2024) found that middle school pupils' motivational beliefs do not relate their mathematics achievement. Moreover, the current study results were inconsistent with those reported by Fong et al. (2021), who concentrated on elementary school students and discovered a strong and negative link between students' mathematics achievement and their motivational beliefs. This discrepancy in the results can be explained by age variations and level of education. It is possible that younger students perceive mathematics tasks as more difficult. Notably, majority of the previously cited studies were done in other countries, and there is little doubt that the daily experiences of students in these countries in terms of schooling and home life is dissimilar to those of their counterparts in Kenya.

4.5 Gender Differences in Students' Metacognitive Awareness and Motivational Beliefs

4.5.1 Description of Gender Differences in Metacognitive Awareness

The results of the analysis of the respondents' metacognitive awareness scores to determine the mean and standard deviation are shown in Table 4.20.

Table 4.20

Gender differences in Metacognitive Awareness

	Gender	N	Mean	Standard Deviation
Metacognitive Awareness	Girls	86	58.00	3.28
	Boys	84	62.23	3.1

Note. N-Sample Size

Table 4.20 indicates that the mean score on metacognitive awareness for girls and boys, respectively, were 58.0 and 62.23. Boys therefore had a slightly higher mean than girls for metacognitive awareness. The results imply that compared to girls, boys maybe better able to organize, monitor, assess and modify their own mathematics learning behaviors to better handle mathematics challenges more effectively.

In addition, the research respondents were categorized into three groups based on their metacognitive awareness scores and gender. The results are shown in Table 4.21.

Table 4.21

Level of Metacognitive Awareness and Gender of the Respondents

		Boy	Girl	Total
Level of Metacognitive Awareness	Low	F 25(29.76)	20(20.81)	45
	Average	F 57(67.86)	46(43.49)	103
	High	F 2(2.39)	20(23.81)	22
Total		F 84(100)	86(100)	170

Note. F-frequency; ( ) Percent

According to the results in Table 4.21, more boys than girls were found to have average, and low levels of metacognitive awareness. However, the number of girls that rated themselves high in metacognitive awareness scores exceeded that of boys. This result may imply that more girls than boys were more metacognitively aware an indication that more girls where mindful of mathematical activities they are dealing with, why, and how the abilities they are gaining may be applied differently when solving mathematical problems in comparison to boys. The girls were evenly distributed across the three categories, however more than half of the boys fell into the average level of metacognitive awareness category. Given that metacognitive awareness comprises numerous areas, gender differences in these domains was investigated. Table 4.22 shows the outcome of this analysis.

Table 4.22

Gender Differences in Means of the Domains of Metacognitive Awareness

Domain of Metacognitive Awareness	**Gender**	**N**	**Mean**	**Standard Deviation**
Knowledge of cognition	Girl	86	23.43	4.81
	Boy	84	26.68	4.98
Regulation of cognition	Girl	86	32.02	5.01
	Boy	84	38.10	5.91

Note. N-Sample Size

According to the results in Table 4.22, boys outperformed girls across all domains of metacognitive awareness. These areas include knowledge of cognition and regulation of cognition.

4.5.2 Description of Gender Differences in Motivational Beliefs

The motivational beliefs scores of the respondents were examined to determine the mean and standard deviation. The results are shown in Table 4.23.

Table 4.23

Gender Differences in Motivational Beliefs

	Gender	N	Mean	Standard Deviation
Motivational Beliefs	Girl	84	22.78	3.22
	Boy	86	31.22	5.93

Note. N-Sample Size

According to the results in Table 4.23, the mean score for girls on motivational beliefs was 22.78. Boys had a higher mean score of 31.22 on motivational beliefs compared girls.

The results show that boys' perception in the relevance of mathematics and desire for success in mathematics was higher than that of girls.

The respondents were divided into three groups based on their motivational beliefs scores; high, average, and low levels. The three levels were cross-tabulated with gender, and thq2e results are shown in Table 4.24.

Table 4.24

Levels of Motivational Beliefs and Gender

			Boy	Girl	Total
Level of Motivational Beliefs	Low	F	15(17.85)	17(19.77)	32
	Average	F	51(60.71)	41(47.67)	92
	High	F	18(21.42)	28(32.56)	46
Total		F	84(100)	86(100)	170

Note. F-frequency; () Percent

Table 4.24 reveal that the majority of respondents with low levels of motivational beliefs were girls, whereas the majority of respondents with average levels of motivational beliefs were boys. Further, the mean differences in two domains of motivational beliefs were analyzed while taking gender disparities into account. Table 4.25 shows the outcome of this analysis.

Table 4.25

Gender Differences in Means of the Domains of Motivational Beliefs

Domain of Motivational Beliefs	Gender	N	Mean	Standard Deviation
Self-Efficacy	Girl	86	11.29	3.17
	Boy	84	12.02	4.99
Task- Value	Girl	86	13.41	5.65
	Boy	84	17.28	4.01

Note. N-Sample Size

Table 4.25 show that boys attained a higher mean compared to girls in the two domains of motivational beliefs. This result is in line with that in Table 4.23, where the majority of the males were classified as having higher mean score on motivational beliefs.

4.5.3 Testing Gender Differences in Metacognitive Awareness and Motivational Beliefs

The study's third objective was to determine whether there were gender variations in students' metacognitive awareness and motivational beliefs. The associated third null hypothesis stated that:

H_{03}: There are no significant gender differences in students' metacognitive awareness and motivational beliefs. Two more supplementary null hypotheses were presented in order to evaluate this hypothesis. As follows:

$H_{03.1}$ There are no significant gender differences in students' metacognitive awareness

$H_{03.2}$ There are no significant gender differences in students' motivational beliefs

a. Testing the First Supplementary Hypothesis

The data on the respondents' metacognitive awareness was subjected to an independent samples t-test in order to evaluate this null hypothesis. Table 4.26 presents the results.

Table 4.26

Independent Samples T-Test for Gender Differences in Metacognitive Awareness

Variable	T	Df	Sig.(2-tailed)
Metacognitive Awareness	-2.20	170	0.05

According to the results in Table 4.25, boys exhibited significantly higher levels of metacognitive awareness than girls (t = -2.20, df = 170, P < .05). Hence, the first supplemental null hypothesis being rejected. It is important to highlight that the reported difference only applied to the two domains of metacognitive awareness combined and that further research was required to see whether gender disparities existed in each of the two domains of metacognitive awareness. Therefore, the gathered data was put through an independent samples t-test while taking into account the various domains of metacognitive awareness. Table 4.27 presents the results

Table 4.27

Independent Samples t-test for Gender differences in Domains of Metacognitive Awareness

Domains of Metacognitive Awareness	t	Df	Sig. (2-tailed)
Knowledge of cognition	-0.33	170	0.03
Regulation of cognition	-3.62	170	0.01

N=170

There was a substantial gender differences in regulation of cognition (t= -3.62, df = 170, $p < .05$) according to Table 4.27. This disparity was in favor of boys. It was determined that boys were more metacognitively aware than the girls. The current study's results on gender differences in metacognitive awareness supported those of previous research by Merchán et al. (2020), which reported differences in knowledge of cognition and regulation of cognition based on gender, more specifically, favoring boys. The gender differences in metacognitive awareness may be linked to the boys being better than girls in analyzing mathematics tasks, evaluating their mathematics strengths and weaknesses, planning, implementing methods and monitoring progress, and reflecting and adjusting techniques, when necessary, when doing mathematical activities. There are many different factors that can contribute to gender differences in metacognitive awareness. These factors may include boys been; more exposed to educational opportunities, attending classes regularly, proactive and socializing better with others when compared to girls which in turn enhances their metacognitive awareness. Moreover, this finding may be as a result of the students from different home backgrounds with diverse gender roles that may have influenced their metacognitive awareness.

However, the present study's result negates those of past research by Barokah et al. (2020), which reported that girls were more metacognitively aware compared to boys. Additionally, the current study contradicts the results of Kurdal and Kaplan (2023), who found that girls were more metacognitively aware than boys after using a population of university students. The current study found that boys have more metacognitive awareness than girls. Contradictory results were also found by earlier research done by Al Shabibi and Alkharusi (2018), and Bulut (2021) who discovered that across all levels of education, girls were much more metacognitively aware than boys. The fact that the home, educational background, and cultural environment of the current study's participants may differ significantly from those of the participants employed in prior studies may account for the lack of agreement between the current study results and those of previous mentioned investigations.

In the majority of the research reviewed, girls had higher levels of metacognitive awareness than boys. The inconsistency between the current study's results and some of those highlighted in the literature review by Adriana (2020) may be due to the studies having been conducted in a different culture, where learners' attention may have differed relatively to their gender. This may result in variation in their metacognitive awareness that has proven to influence mathematics achievement. The variations in the results could also have been caused by the age and kind of learning environment since secondary school students are more likely than primary school pupils to have developed a greater amount of metacognitive awareness.

b. Testing the Second Supplementary Hypothesis

To ascertain whether there were any differences in motivational beliefs based on gender, the second supplemental null hypothesis was presented. Table 4.28 shows the independent samples t-test results used to test the hypothesis.

Table 4.28

Independent Samples T-Test for Gender Differences in Motivational Beliefs

Variable	T	Df	Sig. (2-tailed)
Motivational Beliefs	-4.09	170	0.05

According to Table 4.28, there were significant difference in the mean scores for overall motivational beliefs based on gender (t = -4.09, df =170, $p < .05$), which was in favor of boys. Therefore, the second additional null hypothesis was rejected. It was discovered that boys had higher motivational beliefs than girls. These results matched those of McKellar et al. (2019) and Thomas (2017) reported in Ethiopia. Overall, these results imply that boys have strong motivational beliefs hence perform better in mathematics classes because they have confidence in their ability to solve mathematical problems, value the importance of success in mathematics and put forth a lot of effort to comprehensively understand mathematics.

However, the results of the current study contradicted those of Keller et al. (2022), who reported that girls showed higher motivational beliefs than boys. In another study, Lesperance et al. (2022) researched among leaners in college in the United States and found no differences in motivational beliefs and mathematics achievement based on gender. Furthermore, the current study result contradicts those of a few other researches who found no gender difference in motivational beliefs (Chan, 2022; Li and Singh, 2022; Twohill et al., 2023). The foregoing discussion yielded conflicting outcomes that can be attributed to age, and the level of education differences. However, these studies did not investigate whether there were gender disparities in the various domains of motivational beliefs.

The researcher in the current study looked into whether there were any notable gender disparities with regard to the two different components that make up motivational beliefs. Therefore, an independent samples t-test was performed on the respondent's scores for each element of motivational beliefs, and the results are shown in Table 4.29.

Table 4.29

Independent Samples t-test for Gender differences in Motivational Beliefs

Motivational Beliefs	t	Df	Sig. (2-tailed)
Self-Efficacy Beliefs	-3.71	170	0.00
Task- Value Beliefs	-4.02	170	0.00

Note. N-Sample Size

The results in Table 4.29 reveal that there were significant gender differences in the two domains of motivational beliefs, in favor of boys. The results indicate that boys and girls had different perceptions of the relevance of mathematics and desire for success in mathematics. Gender disparities in motivational beliefs are strongly influenced by socialization and achievement experiences. In addition, students home environment significantly affects the formation of their competency beliefs and interests. Boys display higher levels of interest and ability in mathematics, than girls.

4.6 Prediction of Mathematics Achievement from Metacognitive Awareness and Motivational Beliefs

The study's final objective was to determine the prediction equation of mathematics achievement from metacognitive awareness, and motivational beliefs. The null hypothesis presented below was developed.

4.6.1 Hypothesis Testing

H_{04}: There is no significant prediction equation of mathematics equation from metacognitive awareness and motivational beliefs.

A correlation matrix of students' metacognitive awareness, motivational beliefs, and mathematics achievement was calculated, and inferential statistics were employed to test the null hypothesis. The criterion variable in this hypothesis was mathematics achievement, and the predictor variables were metacognitive awareness and motivational beliefs. Data was first put through a bivariate correlational analysis utilizing Pearson's product-moment correlation coefficient in order to verify this hypothesis, and the results are shown in Table 4.30.

Table 4.30

Correlation Matrix of Metacognitive Awareness, Motivational Beliefs and Mathematics Achievement

Variables		1	2	3	4	5
1	KC	1				
2	RC	-.09*	1			
3	TV	.18**	.19**	1		
4	SE	.09*	-.16**	-.29**	1	
5	Math. Ach	.11**	.11**	.28**	.38**	1

Note. *N*=170; KC-Knowledge of cognition; RC-Regulation of cognition; TV-Task value; SE- Self-efficacy

*Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.30 revealed that knowledge of cognition was positively and significantly associated to task value (r (170) =.18, $p < .01$) and positively and significantly correlated to self-efficacy (r (170) =.09, $p < .05$), while regulation of cognition was positively and significantly correlated to task value (r(170) =.19, $p < .01$) and negatively and significantly correlated to self-efficacy beliefs (r (170) =-.16, $p < .01$). Knowledge of cognition correlated positively with mathematics achievement (r (170) =.11, $p < .01$), but regulation of cognition correlated significantly positively with mathematics achievement (r (170) =.11, $p < .01$). The task value had a substantial positive relationship (r (170) =.28, $p < .01$) with mathematics achievement, whereas self-efficacy beliefs had a significant positive association (r (170) =.38, $p < .01$). These results indicated that increase in task value beliefs led to high mathematics achievement. Similarly, high self-efficacy beliefs led to improved mathematics achievement.

The researcher further conducted more investigation to determine whether students' metacognitive awareness and motivational beliefs predicted mathematics achievement considerably or not. Table 4.31 summarizes the results.

Table 4.31

Regression Analysis of Metacognitive Awareness, Motivational and Mathematics Achievement

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	.41[a]	.25	-.12	9

a. Predictors:(Constant), MA, MB

Note. MA- Metacognitive Awareness; MB-Motivational Beliefs.

Achievement in mathematics may be predicted from the independent variables, as indicated by the multiple correlation coefficient of 0.41. The calculated R square value of 0.25 indicates that 25% of the variation in mathematics achievement can be accounted for by knowledge of cognition, regulation of cognition, task value, and self-efficacy.

Table 4.32

ANOVA Summery

Model	Sum of Squares	*df*	Mean Square	*F*	Sig.
Regression	3360.20	6	620.11	8.27	.00[b]
Residual	18324.87	170	78.43		
Total	11807.66	178			

Note. a. Dependent Variable: Mathematics achievement

b. Predictors: (Constant) Metacognitive Awareness, Motivational Beliefs.

The F ratio in the ANOVA table shows that metacognitive awareness and motivational beliefs are significantly related to mathematics achievement, F (6, 178) = 8.27, P =.00.

Table 4.33

Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	sig
	B	Std Error	Beta		
Constant	32.14	3.21	.21	8.60	.00
KC	.28	.11	.15	2.77	.00
RC	.15	.04	.16	2.82	.00
SE	.17	.17	.05	1.02	.30
TV	.24	.13	.12	1.91	.05
MA	.15	.24	.03	.62	.53
MB	.29	.10	.15	2.80	.00

Note. KC-Knowledge of Cognition; RC-Regulation of Cognition; SE- Self-Efficacy; TV-Task Value; MA-Metacognitive Awareness; MB-Motivational Beliefs.

According to the results in Table 4.33, metacognitive awareness had a predictive value of 0.15, while motivational beliefs had a value of 0.29. Motivational beliefs predicted better achievement in mathematics when compared to metacognitive awareness. Table 4.18 shows the prediction equation for mathematics achievement based on motivational beliefs and metacognitive awareness domains:

Mathematics Achievement= 32.14 + 0.15(MA) + 0.29(MB)   (R^2=.13) $p < .05$.

The greatest predictive index is associated with knowledge of cognition, which is followed by task value and then self-efficacy. The least predictive function was seen in regulation of cognition. The results of this study show that metacognitive awareness and motivational beliefs are important determinants of mathematics achievement.

4.6.2 Discussion of the Results

The results of the present study show that students' metacognitive awareness and motivational beliefs positively predict their mathematics achievement. The two had significant variances in their contributions. This could imply that both can account for individual variances in students' mathematics achievement. The results on possible relationship between metacognitive awareness and motivational beliefs on mathematics achievement supported those of a study by Cakir and Guven (2019) that reported that the two predictor variables are useful in enhancing mathematics achievement. The current study's results confirm those of Teng and Yang (2021), who discovered that students who normally do well in mathematics than their peers had a tendency to attribute their success in mathematics to higher metacognitive awareness and motivational beliefs.

The current results were in coherent to those reported by Street et al. (2024) in a study that evaluated the relationship between metacognitive awareness and motivational beliefs on mathematics achievement among Chinese college students. He used a sample size of 1342 students. The results demonstrated that knowledge of cognition, regulation of cognition, self-efficacy, and task value beliefs singly and combined contributed to better achievement among students. Similarly, the current investigation results are also compatible with those of a study by Siqueira et al. (2020).

The results of the current study are similar to those of Zhou and Wang (2020), who looked at how students' metacognitive awareness and motivational beliefs significantly predict students' achievement in mathematics. Students' self-efficacy, task value beliefs, knowledge of cognition and regulation of cognition were reported to have a positive impact to the students' mathematics grades. Additionally, the variables were reported to be a strong predictor of students' success in mathematics in that research. In another study that examined prediction effect of metacognitive awareness and motivational beliefs on mathematics achievement among Iranian students engaged in remote education, Bourdeaud'hui et al. (2021) similarly observed comparable results. In a study done by Leavy, and Hourigan (2024) found that motivational beliefs were significant predictors of mathematics achievement of university students. In domain wise, task value belief was found to have the strongest predictive power compared to the self-efficacy.

The relationship between metacognitive awareness and motivational beliefs greatly influence success in mathematics. The two variables combined enable students to detect mathematics concepts that are difficult to comprehend and choose appropriate learning tactics. In addition, they understand how to implement the tactics they've chosen and carry out their overall study programs. They can analyze their strategies and alter their plans based on the results. Further, the students can perceive mathematics as important, and have confidence in their mathematics solving abilities achieve higher in mathematics. Such students are always focused, put more effort in their studies, and do not give up easily. They approach mathematics learning challenges with a positive outlook and are consistently motivated to learn mathematics. These students ultimately excel in their mathematics examinations in the long run. This study reveals that regardless of age and level of schooling, motivational beliefs determine mathematics achievement.

Adinda's et al. (2023) study that involved university students reported a substantial correlation between the two variables being studied and mathematics success. The greatest contribution to success in mathematics was found to be regulation of cognition, which was followed by self-efficacy and task value beliefs. In the current study, knowledge of cognition was reported to better predictor of success in mathematics when compared to task value beliefs and self-efficacy. This somehow contradicting results may be attributed to the differences in age, learning environment and level of education.

Based on present study's results, poor achievement in mathematics in most schools in Makindu Sub- County may be attributed to low metacognitive awareness and low motivational beliefs among the schooling students. The findings show that irrespective of level of education, and age; motivational beliefs, and metacognitive awareness, have significant predictive weight on mathematics achievement.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

The overview of the results, conclusions drawn in light of the study's objectives, and recommendations are presented below**.**

5.2 Summary

The broad objective of the study was to determine whether motivational beliefs and metacognitive awareness were correlated with mathematics achievement. Also, the study looked into whether there was a significant association between students'; metacognitive awareness and their mathematics achievement, motivational beliefs and their success in mathematics. Furthermore, the research looked for disparities between genders in the students' metacognitive awareness and motivational beliefs. Finally, the study assessed how the students' mathematics achievement may be predicted from their metacognitive awareness, and motivational.

The study's first objective was to determine the association between students' metacognitive awareness and their mathematics achievement. A significant positive correlation between the factors was found by this investigation. The null hypothesis, which indicated that there is no substantial relationship between students' metacognitive awareness and mathematics achievement, was not supported. It was also discovered that the majority of respondents exhibited average metacognitive awareness. The majority of respondents had average scores in mathematics, according to an analysis of their achievement results. A further in-depth examination of metacognitive awareness scores revealed that boys' secondary schools had the greatest mean score, followed by girls' secondary schools, and coeducational secondary schools had the lowest mean score.

The study's second objective was to determine the strength of the association between students' motivational beliefs and their mathematics achievement. The results revealed that students' motivational beliefs were connected to their mathematics achievement. This suggests that students who possessed high motivational beliefs are likely to do well in mathematics than those with low motivational beliefs. According to the results, mathematics achievement scores increase as motivational beliefs increase and vice versa.

The study's third objective was to examine if there were any gender disparities in students' metacognitive awareness and motivational beliefs. Significant differences in the two factors were found, and these disparities favored boys. Boys' task value beliefs and self-efficacy beliefs were higher than girls. Significant variations were also observed in the regulation of cognition and, in knowledge of cognition based on gender, in favor of boys.

The study's final objective was to find out if there was predictive weigh of metacognitive awareness and motivational beliefs on mathematics achievement. The results of the current study revealed that metacognitive awareness and motivational beliefs predicted mathematics achievement. Regression analysis found that metacognitive awareness and motivational beliefs were significant predictors of students' mathematics achievement. Metacognitive awareness outperformed motivational beliefs as a predictor.

5.3 Conclusions

The first objective of this research was to determine the relationship between metacognitive awareness and mathematics achievement. The study concludes that there was a substantial positive correlation between the two variables. According to the results, the greater the metacognitive awareness, the higher the mathematics achievement score, and vice versa.

The researcher's second objective was to investigate the relationship between motivational beliefs and mathematics achievement. The study led to the conclusion that a substantial positive relationship exists between motivational beliefs and achievement in mathematics. These results imply that the stronger the motivational beliefs, the higher the mathematics achievement with the converse being true.

In the third objective, the study revealed that boys outperformed girls in both metacognitive awareness and motivation beliefs. This led to the conclusion that there were gender differences in students' metacognitive awareness and motivation beliefs. Finally, an investigation on the predictive weight of metacognitive awareness and motivation beliefs on students' mathematics achievement led to the conclusion that the outcomes of the study revealed that metacognitive awareness and motivational beliefs predicted achievement in mathematics.

5.4 Recommendations of the Study

5.4.1 Policy Recommendations

The development of motivational beliefs and metacognitive awareness was found to have a beneficial and substantial effect on students' mathematics achievement.

i. School administrators, should ensure that the school integrate teaching and learning strategies that help students to develop these constructs.
ii. The Ministry of Education should make policies that are geared towards developing motivational beliefs and metacognitive awareness among students.
iii. The Kenya Institute of Curriculum Development (KICD) should incorporate teaching and learning strategies that develop motivational beliefs and metacognitive awareness among students in the school curriculum.
iv. To boost students' achievement in mathematics, teachers should create a supportive classroom environment and activities that strengthens students' motivational beliefs and raises their level of metacognitive awareness.
v. In order to improve their performance in mathematics, students should concentrate on learning activities that foster the growth of metacognitive awareness and motivational beliefs.
vi. Appropriate intervention programs in schools such as guidance, group discussions, and symposiums, particularly targeting girls, should be developed to help reduce the gender differences found in students' metacognitive awareness and motivational beliefs.

5.4.2 Recommendations for Further Research

i. The generalizability of the results beyond this demographic may be limited because this study only included form three students from Makueni County. Due to the effects of cultural or regional factors that could alter the results, the study can be replicated in different countries.

ii. The researcher suggests a more in-depth investigation of the variables, particularly the causes of the significant variations in metacognitive awareness and motivational beliefs across schools and gender.

iii. The results of the data analysis, which was mostly focused on correlational techniques, did not reveal the cause of the established correlations between the variables. Additional study approaches should be used because the data only gave a limited grasp of how each aspect influences and/or is influenced by other elements.

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APPENDICES

Appendix I: Informed Consent Form

Dear student,

I am a student undertaking a Master's Degree in Educational Psychology at Kenyatta University. I am carrying out research to understand why students underperform in mathematics subject. You have been selected to participate in this study**.** You are required to fill in the questionnaires provided. The information that you will give will be treated with confidentiality and will be used only for purpose of this research. You may withdraw from participation in this research without any conditions. Do not write your name or your admission number on the questionnaire.

Please if you agree to participate, sign at the end of this letter.

Thank you,

I agree to participate in this study.

Signature……………………………………

Vincent Mwendwa Ndulu

Masters student, Kenyatta University

Department of Educational Psychology

Appendix II: Questionnaire for the Students

General Instructions

This questionnaire is for collecting data for research purpose only. Please complete it to help in this great work. The data collected will be confidential.

Fill in blanks

Mark (√) where applicable

SECTION A: Demographic Information

1. Respondent code ………………….

(tick appropriately)

2. What is your Gender?

   a) Male

   b) Female

3. Your age………...years.

4. Type of the school

A	Boys' only secondary	
B	Girls' only secondary	
C	Co-educational secondary	

SECTION B: Metacognitive Awareness Inventory (MAI) by Schraw and Dennison (1994)

(Answer the statements below by indicating with a tick to show how much you agree or disagree with them).

Key: SD= Strongly Disagree; D= Disagree; U= Undecided; A=Agree; SA= Strongly Agree

Statement	SD	D	U	A	SA
1.I understand my mathematics intellectual strengths and weaknesses					
2.I know what kind of mathematics concepts are most important to learn					
3.I am good at remembering mathematics concepts taught					
4.I have the ability to completely concentrate on solving mathematics tasks in spite of all other disturbing situations					
5.I do know when I have not understood well mathematics concepts taught.					
6.I understand better when I am interested in a particular mathematics topic					
7.I find myself using helpful mathematics learning methods automatically					
8.I am aware of the best methods to use when I am studying mathematics subject					
9.I try to use methods that have worked in the past to solve mathematics questions					
10.I learn best when I know something prior about the mathematics topic, I am studying					
11.I can motivate myself to learn mathematics subject					

12.I use my mathematics intellectual strengths to compensate for my mathematics weakness					
13.I ask myself periodically if I am meeting my mathematics subject goals					
14.I consider several alternatives, when solving mathematical problems					
15.when it is time to learn mathematics, I do learn it without post phoning					
16. After completing a mathematic task, I always ask myself as to whether there are other ways of solving the same task.					
17.I slow down when I encounter important mathematics concepts					
18.I consciously focus my attention on important mathematics information					
19.I ask myself if there was an easier way to solve a mathematics question after I finish a mathematics task					
20.I periodically revise to help me understand important mathematics concepts					
21.I think of several ways of solving mathematical problems and then I choose the best one					
22.I summarize what I have learnt about mathematics after I finish					
23.I ask others for help when I do not understand something about mathematics subject					
24.I draw pictures or diagrams to help me understand while learning mathematics					
25.I ask myself if I have considered all available options after I solve any mathematics problem					
26.I read instructions carefully before I begin any mathematics task					

27.I ask myself if what I am reading about mathematics is related to what I already know					
28.I organize my time to best attain my mathematics subject goals					
29.I try to break studying mathematics down into smaller and simple steps for better understanding					
30.I ask myself if I learnt as much as I could have, once I finish any mathematics lesson					
31.I stop and go back over new mathematics concepts that are not clear					
32.I stop and reread when I get confused while studying mathematics					

SECTION C: Motivational Beliefs on Mathematics Questionnaire by Rotgans and Schmidt (2010)

(Answer the statements below by indicating with a tick to show how much you agree or disagree with them).

Key: SD= Strongly Disagree; D= Disagree; U= Undecided; A=Agree; SA= Strongly Agree

Statement	**SD**	**D**	**U**	**A**	**SA**
1.I think I will be able to apply mathematics skills I learn in class in my daily life activities					
2.It is of important to learn mathematics for what I want to do after secondary school					
3.I think the mathematics knowledge I am learning in class is useful for me to learn					
4. I like learning mathematics subject					
5.Solving mathematical problems correctly is of great importance to me					
6. I believe I will be able to use mathematics in my future career when needed.					
7. I believe I will pursue a course that requires mathematics in future.					
8. I believe I can complete all of the assignments given in mathematics class					
9. I believe I am good at mathematics					

10. I feel confident enough to ask questions in my mathematics class.					
11. I believe I can get excellent grade in a mathematics test					
12. I feel confident when taking mathematics test					
13. I feel confident when using mathematics outside of school					
14. I believe I can do well on a mathematics test					
15. I believe I can learn well in a mathematics class					

SECTION D: Pro Forma Summary of Students' Mathematics Achievement Results

School Name……………………………………...

Respondent's Code	**Mathematics score of mid of term one 2024**

Appendix III: Permission to use MAI

Hi Vincent,

We received your request to adapt our Metacognitive Awareness Inventory. The content of that form comes from "Schraw, G. & Dennison, R.S. (1994), Assessing metacognitive awareness. Contemporary Educational Psychology, 19, 460-475". You may adapt it but with appropriate citation from the reference.

Mit freundlichen Grüßen,

Best Regards,

Erika Strube

Instructional Designer

Adjunct Faculty, German

Rowan College of South Jersey,
Gloucester Campus

856.494.5703

Appendix IV: Permission to Use MBMQ

Dear Vincent,

Thank you for your email.

Yes, you can use the Motivational Beliefs on Mathematics Questionnaire. If you do that, please cite the reference appropriately and say that it has been adopted for your own study.

All the best for your project.

Many thanks.

Regards,

John

Appendix V: Research Authorization

KENYATTA UNIVERSITY
OFFICE OF THE EXECUTIVE DEAN GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: E55/CE/26377/2019

DATE: 23rd January 2024

Director General,
National Commission for Science, Technology and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. VINCENT MWENDWA – REG. NO. E55/CE/26377/2019

I write to introduce Mr. Vincent Mwendwa who is a Postgraduate Student of this University. He is registered for M.Ed. degree programme in the **Department of Educational Psychology.**

Mr. Vincent Mwendwa intends to conduct research for a M.Ed. Thesis Proposal entitled, ***"Metacognitive Awareness and Motivational Beliefs as Correlates of Mathematics Achievement Among Form Three Students in Makeuni County, Kenya".***

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
EXECUTIVE DEAN, GRADUATE SCHOOL

REPUBLIC OF KENYA

MINISTRY OF EDUCATION
STATE DEPARTMENT FOR BASIC EDUCATION

Telephone: ....
Fax: ....
Email:cdemakueni@gmail.com
When replying please quote
Ref No. MKN/C/ED/5/33/VOL.II/195

County Director of Education Office
P.O. BOX 41 - 90300
MAKUENI

27th February, 2024

Vincent Mwendwa Ndulu
KENYATTA UNIVERSITY

RE: RESEARCH AUTHORIZATION

This office is in receipt of a letter from the Director General, National Commission for Science, Technology and Innovation (NACOSTI) authorizing you to carry out research on **" Meta-Cognitive Awareness and Motivational Beliefs as Correlates of Mathematics achievement among form three Students in Makueni County",** for the period ending 8th **February, 2025.**

Following this authorization, you are allowed to proceed with your research as requested.

27/02/2024

Samuel Maghanga
For County Director of Education
MAKUENI COUNTY

COUNTY DIRECTOR OF EDUCATION
DATE
P.O. BOX 41-90300
MAKUENI
MAKUENI COUNTY

CC:
Director General/ CEO, NACOSTI

Appendix VI: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 981793

Date of Issue: 08/February/2024

RESEARCH LICENSE

This is to Certify that Mr.. VINCENT MWENDWA NDULU of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Makueni on the topic: META-COGNITIVE AWARENESS AND MOTIVATIONAL BELIEFS AS CORRELATES OF MATHEMATICS ACHIEVEMENT AMONG FORM THREE STUDENTS IN MAKUENI COUNTY, KENYA for the period ending : 08/February/2025.

License No: **NACOSTI/P/24/32985**

981793

Applicant Identification Number

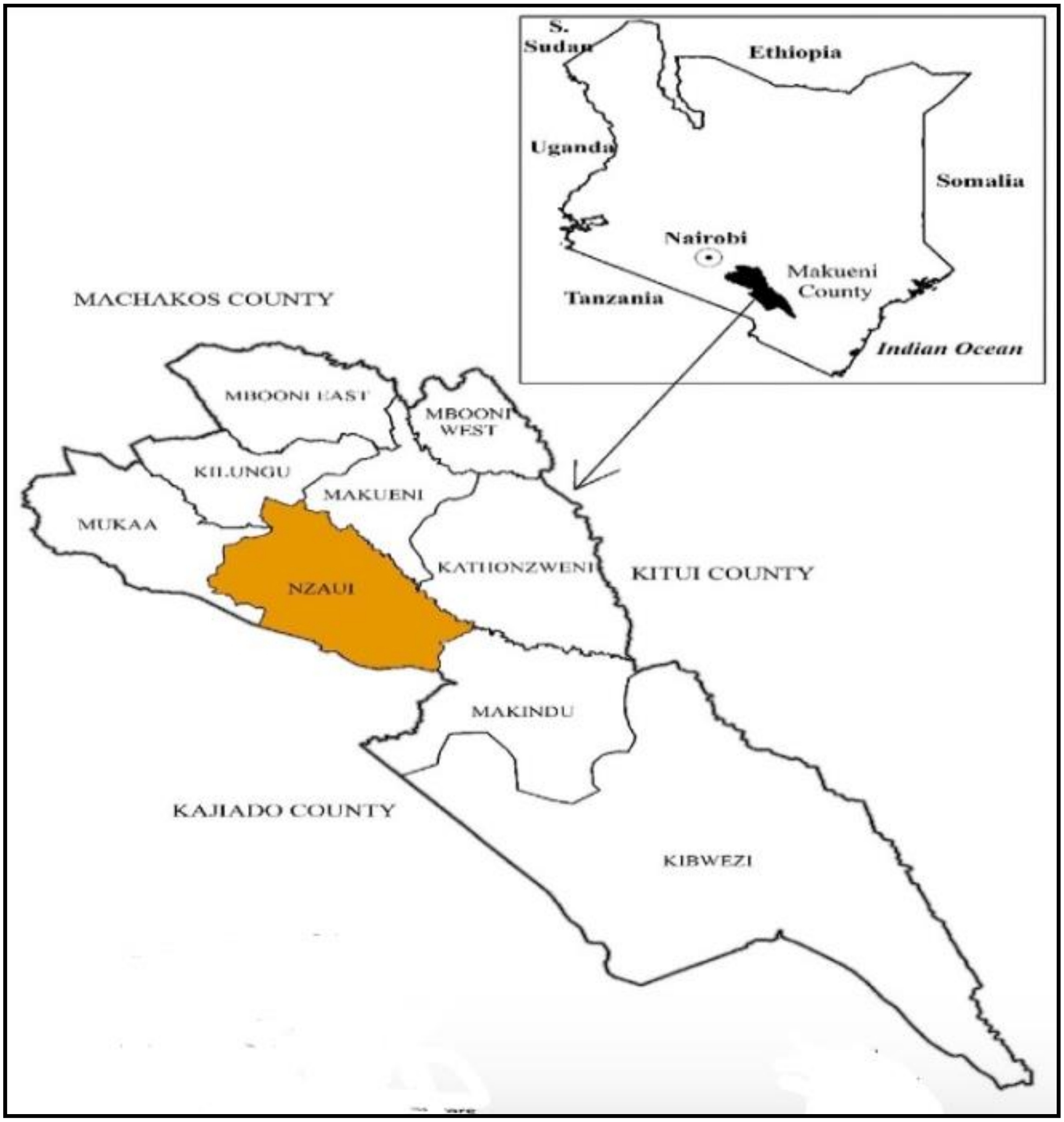
Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix VII: Map of Makueni County



Source: Retrieved from www.researchgate.net/figure/Map-of-Makueni-County_fig1_310424975.