AKENTEN APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING AND

ENTREPRENEURIAL DEVELOPMENT

MATHEMATICS CONNECTION AND ACHIEVEMENT MOTIVATION: MEDIATING AND MODERATING EFFECTS OF TEACHING QUALITY, TEACHING COMPETENCE, AND HISTORY OF MATHEMATICS CONCEPTS

GYASI ALFRED BANNOR

MASTER OF PHILOSOPHY

2023

AKENTEN APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT

MATHEMATICS CONNECTION AND ACHIEVEMENT MOTIVATION: MEDIATING AND MODERATING EFFECTS OF TEACHING QUALITY, TEACHING COMPETENCE, AND HISTORY OF MATHEMATICS CONCEPTS

GYASI ALFRED BANNOR

(8210160011)

A thesis in the Department of Mathematics Education, Faculty of Applied Sciences and Mathematics Education submitted to the School of Graduate Studies in partial fulfilment

of the requirements for the award of the degree of

Master of Philosophy

(Mathematics Education)

in the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development

SEPTEMBER, 2023

DECLARATION

STUDENT'S DECLARATION

I, **GYASI ALFRED BANNOR,** declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……………………………...DATE: ……………………………….

SUPERVISOR'S DECLARATION

We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Kumasi.

PROF. YARHANDS DISSOU ARTHUR (Principal Supervisor)

SIGNATURE: …………………………………DATE: ………………………

DR. REV. BENJAMIN ADU OBENG (Co -Supervisor)

SIGNATURE: …………………… ………. DATE: ……………………….

DEDICATION

To my parents.

ACKNOWLEDGEMENT

I would like to acknowledge and give my warmest thanks to my supervisor (Prof. Yarhands Dissou Arthur) who made this work possible. His guidance and advice carried me through all the stages of drafting this thesis. Also, I wish to thank the entire department of mathematics education at AAMUSTED for shaping this work through their comments and suggestions. Special thanks also goes to my parents and the entire family for their continuous support and prayers which suatained me this far.

Finally, I give thanks to the Almighty God for His protection throughout the pursuit of this course.

TABLE OF CONTENTS

DECLARATION ... iii

DEDICATION ... iv

ACKNOWLEDGEMENT ... v

TABLE OF CONTENTS ... vi

LIST OF TABLES ... ix

LIST OF FIGURES ... x

ABSTRACT ... xi

CHAPTER ONE ... 1

INTRODUCTION ... 1

Overview ... 1

Background of the Study ... 1

Statement of the Problem ... 4

Purpose of the Study ... 7

Objectives of the Study ... 7

Hypotheses ... 7

Significance of the Study ... 8

Limitation of the Study ... 8

Delimitation of the Study ... 9

Organization of the Study ... 9

CHAPTER TWO ... 10

LITERATURE REVIEW 10
2.0 Overview 10
2.1 Conceptual Review 10
2.2 Theoretical Framework 20
2.3 Empirical Review 27
2.4 Conceptual Framework 44
CHAPTER THREE 47
METHODOLOGY 47
3.0 Overview 47
3.1 Study Area/Setting 47
3.2 Research Philosophy 48
3.3 Research Method 49
3.4 Research Design 51
3.5 Population 51
3.6 Sample Size 52
3.7 Sample and Sampling Technique 53
3.8 Data Collection Instruments 53
3.9 Validity and Reliability Measures of the Instrument 55
3.10 Data Collection Procedure 56
3.11 Ethical Consideration 57
3.12 Data Analysis 57

CHAPTER FOUR 59

ANALYSIS, RESULTS AND DISCUSSION 59

4.0 Overview 59

4.1 Analysis and Results 59

4.2 Presentations and Discussion of Results 76

CHAPTER FIVE 84

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 84

5.0 Overview 84

5.1 Summary of the Study 84

5.2 Major Findings 85

5.3 Conclusions 85

5.4 Recommendations 86

REFERENCES 88

APPENDIX A1 109

APPENDIX B2 112

APPENDIX C3 116

LIST OF TABLES

TABLE **PAGE**

Table 1: Course and Gender Distribution of the Study Population 52

Table 2: Demographics of Students 60

Table 3: Descriptive Statistics 62

Table 4: Alpha-reliability 63

Table 5: Results of Exploratory Factor Analysis 65

Table 6: Table of Confirmatory Factor Analysis 67

Table 7: Heterotriat-Monotrait Ratios 69

Table 8: Summary of Direct Path Estimates 71

Table 9: Summary of Mediation Analysis 73

Table 10: Summary of Moderation Analysis 74

Table 11: Summary of Moderated-Mediation Analysis 75

LIST OF FIGURES

FIGURE **PAGE**

Figure 1: WASSCE Core Mathematics Performance from 2017 to 2022 (WAEC, 2017, 2018, 2019, 2020, 2021, 2022) 6

Figure 2: Conceptual Framework 46

Figure 3: Diagrammatic Presentation of Confirmatory Factor Analysis 68

Figure 4: Diagrammatic Representation of Direct Paths 72

Figure 5: Diagram of Mediation Effects 73

Figure 6: Diagram of Moderation Effects 74

Figure 7: Diagram of Moderated-Mediation Effects 76

ABSTRACT

This study evaluated the mediating and moderating role of teaching quality, teaching competence, and history of mathematics concepts on the effects of mathematics connection on mathematics achievement motivation among senior high school students in Ghana. A descriptive survey was carried out on 400 students randomly selected from Kumasi Senior High Technical School. SPSS (V. 23) and AMOS (V. 23) were utilized to conduct preliminary analyses (exploratory factor analysis, alpha-reliability analysis, and confirmatory factor analysis). In addition, average variance extracted (AVE), convergent validity, discriminant validity, and composite reliability were computed in Microsoft Excel from factor loadings. Structural Equation Modelling (SEM) was run in Amos (V. 23) to determine direct, indirect and interaction effects among the main constructs. The study found that mathematics connection positively and significantly influenced mathematics achievement motivation of senior high school students. The indirect effects of mathematics connection on achievement motivation through teaching quality was positive and significant. It was also revealed that the interaction effects of teaching competence on the relationship between mathematics connection and achievement motivation was insignificant. Furthermore, the interaction effects of history of mathematic concepts on the indirect path between mathematics connection and achievement motivation through teaching quality was significantly negative. The study recommended that mathematics connection should be emphasized through quality teaching, and explanations to historical themes underlying topics.

CHAPTER ONE

INTRODUCTION

Overview

Malouff and collegues' (2008) assessment proved that the combination of appropriate instructor traits and effective teaching strategies significantly affect student's mathematics motivation. For instance, teachers' ability to relate mathematics to real-life circumstances and other disciplines (Aguilar, 2021; Arthur et al., 2017; Mazana et al., 2018). Even so, among Ghanaian senior high school students, the effects of other external factors to the highlighted relationship had gone understudied. So, the goal of this research was to explore the mediating and moderating effects of teaching quality, teaching competence, and history of mathematics concepts on the relationship between mathematics connection and students' mathematics achievement motivation. This chapter discusses the study's background and context first, then the research problem, purpose, objectives, and hypotheses, the significance and lastly, delimitations and limitations.

Background of the Study

Achievement motivation is most obvious in the military. “Boot Camp”, a term commonly referred to recruits receiving basic combat training. Driven by motivation, this training involves highly determined recruits to complete risk-taking as well as perilous combat training such as obstacle crossing and simulated combat with live fire. War movies portray scenes with soldiers single-handedly fighting selflessly hard to cover an entire retreating regiment. In education, achievement motivation drives pupils to study mathematics with full concentration and focus (Habibullah et al., 2022). Per empirical and theoretical perspectives (e.g. Cabalsa, n.d.; Lippke, 2017; Maehr & Sjogren, 1971; Wigfield, 1994), it is an important factor in students' mathematics comprehension and retention (Arthur et al., 2022; Awoniyi, 2022; Schiefele & Csikszentmihalyi, 1995; Tran & Nguyen, 2021; Obayemi et al., 2022; Peteros et al., 2019). Achievement motivation is most obvious in behaviors associated with intrinsic struggle, with competition tied to personality (Ryan & Deci, 2000; Bipp et al., 2008). It is the innate push that drives students to strive for higher levels, as well as their desire to overcome obstacles via risk-taking, involvement in productive activities, and the pursuit of effective techniques to improve outcomes (Yaman et al., 2015).

The study of mathematics achievement motivation has piqued the interest of researchers, since it had been found necessary for pupils' overall mathematics achievement. Extant studies confirmed motivation was a powerful predictor of mathematics achievement (Arthur, Boadu, et al., 2022; Arthur, Dogbe, et al., 2022; Boadu et al., 2023). Because motivation is vital, researchers had concentrated on motivational elements in mathematics instruction (see for e.g. Green, 2002; Keller, 1983). Several hypotheses regarding instructor-related achievement motivators have been developed and tested in various studies. Authors had come to consensus on the importance of factors which make mathematics teaching-learning more relevant and enjoyable. Among them, teachers ability to establish mathematical connections to the real world (Arthur et al., 2017).

Students' motivation arouse when teachers use teaching tactics that connect mathematics to real-life situations (Krpan, 2018), explain concepts through problem-solving methodologies, or tell the story of mathematics as an abstract depiction of naturally occurring phenomena. Mathematics connection ability is therefore a crucial instructor trait (Arthur et al., 2018) which enhances active participation and promotes academic performance (Boadu et al., 2023; Xia et al., 2022). Authors found that pupils are motivated to learn mathematics when teachers establish links between conceptual ideas and real-world events (Durmus & Karakirik, 2006; Gainsburg, 2008). According to Arthur et al. (2017, 2018), the relationship between mathematics and the actual world allows students to investigate the role that mathematics plays in describing real-world phenomena. Teachers, for example, might stimulate the study of percentages and rates by creating a scenario in which future businesspeople would collaborate on a project. They can simulate the investment of a loan amount on a farm, suggest the interest rate, and calculate the profit. By so doing, students develop higher levels of motivation to study mathematics.

Aristotle (384 – 322 B.C.) once said, “If you would understand anything, observe its beginning and its development”. This supports the fact that incorporating the history of mathematics concepts into teaching is critical to mathematics education. During teaching, the illustration of the historical background of mathematical concepts stimulates student interest growth (Arthur, Appiah, et al., 2022). Understudies can learn about the origins of concepts and how they evolved. Using history as a teaching tool, Baah-Duodu et al. (2021) asserted that pupils understand the function of mathematics in civilizations.

The quality of teaching guarantees that pupils are motivated (Comadena et al., 2007; Ekmekci & Serrano, 2022; Ruiz-alfonso et al., 2021). As a result, in general, quality teaching has been explored to enhance problem solving in real-world experience. One important challenge with being a successful teacher is not just a greater understanding of concepts, rather information from several perspectives that motivate students to think, which according to George Polya is peculiar to quality teachers (Wittmann, 2021). Because thinking leads to mathematical sense making and comprehension (Wittmann, 2021). Students' exposure to quality teaching helps them to build on their strengths while also considering their deficiencies. Quality instructors employ a variety of techniques to remedy students' faults via experiential learning (Uyen et al., 2022). It is created the knowledge that mistakes and failure are necessary for mathematical comprehension. Explanation to teaching quality begins that in challenging situations, teachers should utilize words of praise, offer positive feedback, and acknowledge learners' accomplishment. Inspiration to realize full potential and achieve one's learning objectives is a teaching quality that boosts students' achievement motivation.

Teachers' mastery of mathematical topics, as well as their ability to apply a range of techniques to foster comprehension, are necessary. An instructor's teaching competence includes both content knowledge and pedagogical expertise (Guerrio, n.d.; Jeschke et al., 2021). Using visual aids and diverse exercises at the learners' discretion promotes understanding. Another skill is the teacher's ability to use graphic organizers to depict concepts and relate them to past knowledge (Owolabi & Adaramati, 2015; Zollman, 2009). Competent teaching promotes cooperative learning (Klang et al., 2021), which lays the groundwork for active student engagement in which students investigate the role of mathematics in their daily lives.

If one wants to figure out the appropriate mathematics achievement motivators, the best way is to concentrate on instructor-related traits, because teachers are the leaders in mathematics teaching-learning. This study is based on the idea that mathematics connection is contingent on the levels of teaching competence, and teaching quality to adopt and adapt to changing classroom situations and strategies, and the use of historical themes in pedagogical practice to improve understudies' motivation.

Statement of the Problem

Senior high school graduates must obtain at least a credit pass to continue their education at the postsecondary level (Adam & Mahmoud, 2014). According to Figure 1, the proportion of graduates with aggregate A1-C6 in mathematics (core) was 47.23%. This value decreased to 38.33% in 2018, and increased sharply to 65.31% in 2019, and 65.71% in 2020. The highest performance rate ever recorded in 2020 could not be maintained, decreasing to 54.11% in 2021, and increased to 61.39% in 2022. Figure 1 clearly depicts that the mathematics performance of school candidates who sat for final examinations over the six-year period (2017-2022) had been fluctuating. Dossel (1993) ascribed such unsteady performance to the bad nature of understudies' mathematics phobic and anxious behaviors caused by amotivation (Tran & Nguyen, 2021). Amotivated pupils exhibit apathy and a reluctance to speak up during mathematics classes. They sag in their seats and fail to fully participate in discussions (Jones, 2008). To counteract this potential threat, Boadu et al. (2023) opined that student's impetus is critical. Teachers should strategically enhance learners' mathematical enthusiasm through instructional tactics that allows learners comprehension of the relationship between mathematics and their everyday lives, actual events, and other disciplines (Arthur, 2019; Iyer, 2022). Such mathematics connections should be tied to the historical context of topics, as this has been shown to improve student interest and motivation growth (Arthur, Appiah, et al., 2022; Chorlay et al., 2022; Jankvist, 2009; Liu, 2003; Marshall, 2000). Consistently, literatures concluded that inspiring students to engage and perform significantly in mathematics is the duty of teachers (Herges et al., 2017; Klanderman et al., 2019; Nyman & Sumpter, 2019; Saadati & Celis, 2023). Hence, Nessipbayeva (2019) asserted that the arousal of learners' motivation depends on competent and effective mathematics instructors.

Studies of the relationship between mathematics connection and students' mathematics achievement motivation exist (Arthur et al., 2018; Durmus & Karakirik, 2006; Gainsburg, 2008), however, such studies failed to build robust empirical model that incorporated the contributions of important teacher-related traits, which are, teaching quality, teaching competence, and history of mathematics concepts. In consequence, the mediating and moderating effects of these constructs are only weakly empirically proved in Ghana. Among the literatures reviewed, this is a recognized gap, which should be filled. In light of this, the present study intended expanding literatures of the mediating and moderating effects of teaching quality, teaching competence, and history of mathematics concepts on the relationship between mathematics connection and achievement motivation at the Ghanaian senior high school level.

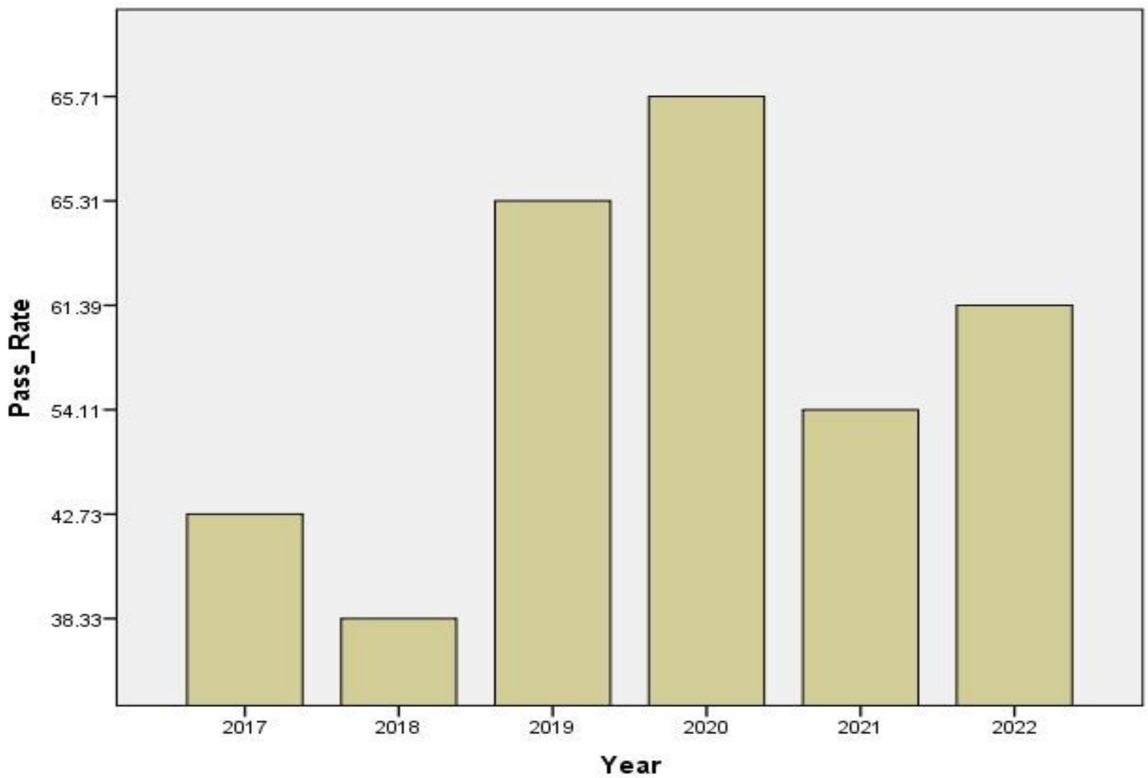


Figure 1: WASSCE Core Mathematics Performance from 2017 to 2022 (WAEC, 2017, 2018, 2019, 2020, 2021, 2022)

Purpose of the Study

The purpose of this study was to examine the mediation and moderation effects of teaching quality, teaching competence, and history of mathematics concepts on the relationship between mathematics connection and students' mathematics achievement motivation.

Objectives of the Study

The study seeks to;

i. determine the direct impact of mathematics connection on student achievement motivation.
ii. identify the mediating effect of teaching quality on the relationship between mathematics connection and student achievement motivation in mathematics.
iii. find out the moderating effect of teaching competence on the relationship between mathematics connection and student achievement motivation in mathematics.
iv. asses the moderating effect of history of mathematics concepts on the second half of the path of the indirect relationship between mathematics connection and achievement motivation.

Hypotheses

The study seeks to test the following hypotheses;

i. **H1:** Teacher's ability to make mathematics connections positively affect senior high students' achievement motivation.
ii. **H2:** The positive correlation of mathematics connection with achievement motivation is mediated by teaching quality.

iii. **H3:** The direct relationship between mathematics connection and achievement motivation is moderated by teaching competence.

iv. **H4:** History of mathematics concepts moderates the second half of the path of the indirect relationship between mathematics connection and achievement motivation.

Significance of the Study

The study contributes to the body of knowledge about teacher-related variables that influence students' achievement motivation in mathematics. The study's findings provided empirical insights into teaching techniques that inspire pupils to learn and perform in mathematics. Teachers and teacher educators can create and implement techniques to increase senior high students' motivation in mathematics teaching-learning activities based on this. Furthermore, empirical knowledge to address challenges in mathematics motivation and performance is made available to policymakers and the National Teaching Council.

Limitation of the Study

First and foremost, senior high school students were chosen as the study's sample. The findings of this study may not be applicable to students who do not fall within this category. In addition, descriptive survey is strictly quantitative. Thus, pupils' experiences and concerns were not taken into account beyond the questionnaire (Arthur, Appiah, et al., 2022). It may be particularly necessary if imminent studies include mixed approaches, which allow for a deeper exploration of pupils' knowledge and experiences. Furthermore, the study was a survey that collected data on perceived constructs without actual manipulations or experiments. The data was merely evaluated to predict potential relationships. As a result, the outcomes may be insufficient to draw conclusions for decision making. Future studies should include action research or experimental studies in which factors are manipulated to obtain secondary data.

Delimitation of the Study

While motivation is important in mathematics learning for students of all ages, this study focused on the mathematics achievement motivation of senior high school students. The research was a survey restricted to senior high school students at Kumasi Senior High Technical School. The study's major goal was to predict students' mathematics achievement motivation using mathematics connection, teaching quality, teaching competence, and history of mathematics concepts. The study solely looked at these teacher-related characteristics, leaving out other motivators. Self-determination theory, expectancy-value theory, situated cognition theory, and social cognitive learning theory were all considered in the study.

Organization of the Study

The study was structured in five chapters. Chapter one dealt with the introduction including background to the study, statement of the problem, objectives, research questions, significance of the study, limitations, and delimitations. Chapter two concerned review of related literature based on study objectives. Chapter three talked about research methodology in the areas; research design, sampling technique and sample, instrumentation (with validity and reliability), and data analysis technique. Chapter four considered data analysis, results and discussion. Chapter five provided conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

Generally, several literatures are concerned with factors affecting mathematics learning motivation. This chapter presents comprehensive conceptual review of relevant literatures on teaching quality, teaching competence, mathematics connection and history of mathematics concepts. Also, empirical review of supportive studies is completely elaborated. In addition, theories that were pertinent to this study are analyzed and synthesized. Lastly, this chapter explains the conceptual framework for the present study.

2.1 Conceptual Review

2.1.1 Teaching Quality

The total efficacy of teaching approaches and their impact on student learning outcomes is referred to as teaching quality. It includes several aspects, such as teaching tactics, classroom management, evaluation and feedback, rapport building, and provision of inclusive learning environment (Hattie, 2009). Teaching quality highlights instructors' comprehensive approach to optimizing student learning experiences. The consequences and efficacy of teaching approaches in supporting student success and engagement are the focus of teaching quality. Moreover, scholars (e.g. Singh & Sarkar, 2012; Wenglinsky, 2000) have described teaching quality from various angles. Wenglinsky (2000) defines teaching quality as the value of a teacher's effective practice that is unique to him or her in the profession. According to Singh & Sarkar (2012), teaching quality is the combination of teacher attributes such as inputs (professional credentials, experience, location of residence, in-service training, etc.)

and practices, attitudes, content knowledge exhibited in class. In the perspective of GEIES (2003), teaching quality relates to aspects such as training qualification and a teacher's professional balance. Others (e.g. Boyd et al., 2007; Darling-hammond, 2000; Hanushek & Rivkin, 2006, 2007; Ingersoll, 2007), have linked teacher education, experience, and certification to teaching quality. The phrases "teaching quality" and "teacher quality" should be used separately but sometimes treated together (Singh & Sarkar, 2012). Teacher quality describes the characteristics of an effective instructor, and teaching quality addresses concerns about how to improve instructional growth and knowledge impartation (Fauth et al., 2019). Bonney et al. (2015) realized that quality varied from place to place and school to school. Teacher encounter with new syllabi, pupils, and school management members might result in significant disparities in quality practice.

Traditional criteria are used by educators and education bodies to assess teaching quality. The criteria are known as "indicators" or "proxies" of teacher quality (Boyd et al., 2007; Goe, 2007; Hanushek & Rivkin, 2006; Wenglinsky, 2000), which Azam & Kingdon (2014) refer to as credentials. They define credentials as measurable components of teaching quality that include teacher education, training, and experience. Wiswall (2011), on the other hand, categorized the proxies into two groups. First of the components, Wiswall (2011) defined accumulated teaching experience as "the number of years spent on the field." The classification's second component included "unobserved factors" such as degrees, licensing status, and licensing exam score. Goldhaber et al. (2015), like Wiswall (2011) divided the proxies into input and output measures. Experience and teacher qualifications are input variables (Azam & Kingdon, 2014) whereas output measures show the level of teacher performance (Ochieng et al., 2016). According to Atiah, (2023), Wiswall (2011) categorization is inadequate. Apart from license and licensing examinations, he believes that direct measurements (tests, conferences, seminars, portfolios etc.) assess teaching quality. Hanushek & Rivkin (2006) and Rothstein (2014) argued with certification and experience. To them, certification and experience do not represent quality in the early years of teacher deployment, but standardized examinations do (Angrist & Guryan, 2004). Aside from the aforementioned indicators , Hanushek & Rivkin (2006) opined that high pay did not represent a superior index of teaching quality. Rather, they conjecture that communication tactics (Connell, 2009) and sustaining rapport in class improve teacher effectiveness. In this view, salary and allowance incentives, as many teachers regard, have little to do with teacher effectiveness (Hanushek & Rivkin, 2007). Regardless, educators in China have distinct ideas about what constitutes good teaching. They feel that quality teaching includes motivation, enthusiasm, respect, innovativeness, confidence, dedication, tolerance, and so on (Wang et al., 2010), as quoted in (Peng et al., 2014).

Wenglinsky (2000) identified three dimensions of teaching quality. These include instructor inputs, classroom procedures, instructional strategies, and professional development (Azam & Kingdon, 2014). Similarly, Goe (2007) emphasized the qualities of teaching. These are as follows: instructor experience and qualification relevant to the field of practice; social learning (willingness to encourage learners to succeed in mathematics); motivation skills; mentorship skills; assiduousness; integrity, reality and choice, self-control and assertive discipline. Quality teaching maintain a high level of student understanding, which accelerates student performance in mathematics (Sulaiman et al., 2017). Ochieng et al. (2016) discovered a link between teaching quality and student mathematical output. They proposed that the quality of the teacher truly enhances performance. Empirical information (e.g. Chand et al., 2021; Ingersoll, 2007) shown that when high-quality instructors manage mathematics in even the most disadvantaged schools, overall school performance and individual student success improve. Furthermore, Sirait (2016) contends that teacher characteristics such as tenacity, preparedness, and leadership abilities are consistently lead to students' achievement in mathematics.

2.1.2 Teaching Competence

Teaching competence is centered on an individual teacher's knowledge, skills, and expertise. It focuses more on the technical components of teaching and an individual teacher's ability to impart knowledge. Goe et al. (2008) define teaching competence as a teacher's subject matter understanding, pedagogical abilities, instructional planning, and capacity to successfully involve students in learning activities. It stresses the individual teacher's strengths and experience in delivering effective teaching. Teaching competence reflects the quality of a teacher's instruction (Panggabean & Himawan, 2016). It is a broad concept (Bagus et al., 2018). However, the nature of teaching makes it challenging to measure competence (Caena, 2014; Caena & Redecker, 2019; Hollins, 2011; Wahyuddin, 2016). Teaching competence is also defined as the balance of a teacher's fundamental knowledge, abilities, and psychological potentials (Nessipbayeva, 2019). The nature of teaching competence is proven by the teacher's teaching abilities and measured against the teacher's conduct and the learning of the students. Furthermore, Subject matter knowledge is a key indicator of teaching quality (Koomson et al., 2005; Rowe, 2008; Temin, 2002). The capacity to grasp content and achieve a greater degree of comprehension in a subject is relevant to the teaching profession.

Teacher effectiveness is synonymous with competence, although competence does not always imply effectiveness (Roelofs & Sanders, 2007). Teaching competence is a mix of personality traits, acquaintances, abilities, and attitudes required for effective teacher practice. Knowledge, skills, beliefs, and individual characteristics are examples of these (Pantić et al., 2011; Sulaiman & Ismail, 2020). In preschool education, Lillvist et al. (2014) established three levels of competence. Teachers' content knowledge and the capacity to reflect on classroom activities and their understanding of the 'what and why' of teaching. The instructors' ability to lead and organize demonstrates his expertise. Teachers' ability to communicate and transact ideas is described by their communicative, social, and moral competencies (Bagus et al., 2018). Personal competence, pedagogic competence, professional competence (Cubukcu, 2010), and social competence are components of teaching competence, according to Bagus et al. (2018). Knowledge and awareness of students and their learning, topic knowledge, curriculum, the education system, and the teacher's position are all examples of professional competencies. Bisschoff et al. (2006) studied instructors' assessments of their own teaching abilities. Teaching competence was classified as educative competence and collaborative competence based on factor analysis of 108 responses (Panggabean & Himawan, 2016).

Subject matter knowledge, pedagogical knowledge, and social knowledge are all crucial competencies that any teacher should cultivate. Teachers must integrate pedagogical and sociocultural information in order to recognize their students, the learning process, classroom climate, curriculum, and teaching-learning materials (De Clercq, 2008). Teaching competence is concerned with topic understanding (De Clercq, 2008) as well as instructional delivery approaches available to teachers in order to accomplish desired outcomes. Sulistiyo (2016) argued that professional development should be enhanced to continually improve teachers' professional practices in order to improve these teacher traits. Nations should standardize their staffing criteria in order to hire instructors with professional features who will boost students' learning. Teachers should be competent (Fleming et al., 2007) enough to give competitive skills to students in order for them to thrive in our modern world (Sulistiyo, 2016). As a result, there is a high need for specially trained teachers who can help pupils achieve the mathematical knowledge and abilities they need for life (Darling-hammond, 2000)

Understanding the nuances of teaching competence leads our conceptual knowledge of teaching and learning in order to plan teacher training and advancement programs. A survey found that teachers regard understanding and growth less than self-evaluation and professional development, subject knowledge, pedagogy and curriculum, values, and child raising (Pantić et al., 2011). Siri et al. (2020) investigated the impact of teaching competence and commitment on the performance of Madrasah instructors in Bali, Malaysia. Teachers that are highly skilled and devoted did better.

2.1.3 Mathematics Connection

Reforms in mathematics teaching and learning exponentiated in 1989 (Babbitt, 1993). A great deal of emphasis was placed on problem solving, mathematical reasoning, and mathematics connections to strengthen active student learning, cooperative learning, mathematical idea communication, and technology usage in instructional delivery and student learning. The concept of mathematics connection relates to the idea that mathematics is not a stand-alone discipline, but is linked to and connects with other fields of study and the actual world. It highlights the significance of comprehending the relevance and applications of mathematics in daily life and across disciplines (Kenedi et al., 2019). The ability of teachers to link mathematical principles to other fields and students' daily lives is referred to as mathematics connection. Mathematics connection takes several forms; real-word connections, interdisciplinary connections, and historical connections. The interdisciplinary connection is concerned with relating mathematics to other fields such as physics, engineering, social sciences, and so on (Sriraman et al., 2008). Understanding the mathematical concepts and applications in these disciplines can help students realize the value of mathematics outside of the classroom. Mathematics has several applications in everyday life, including business, health, sports, and technology. Teaching mathematics in the context of real-world situations and scenarios can assist students understand the usefulness of mathematics in their daily lives (Clair, 2018). Math has a lengthy history and has evolved over time. Understanding the historical context and history of mathematical concepts and ideas can help students appreciate the importance and usefulness of mathematics in society (Katz & Michalowiz, 2020).

Students may recognize the relationship between topics with the use of mathematics connections (Kenedi et al., 2019; Wijayanti & Abadi, 2020). Mathematics connection assists students in identifying interconnections between mathematical ideas and real-life events in order to solve problems (Selvianiresa & Prabawanto, 2017). According to NCTM (2000), mathematics connections have the potential to broaden students' knowledge, integrate mathematics in a holistic manner, and make mathematics relevant in schools and the wider world.

The capacity of mathematics teachers to relate mathematical ideas to real-world and real-life events has been investigated to improve student interest growth (Arthur et al., 2018). (Arthur et al., 2017b, 2017a, 2018; Karakoç & Alacacı, 2015). Ndiung and Nendi (2018) investigated the effect of mathematics connection on learning achievement of 35 pupils at Watu Weri state elementary school. The relationship between mathematics connection and learning performance explained 21.9% of the diversity in students' learning accomplishment.

Therefore, mathematics connection had a major impact on pupils' learning success. A study conducted on a random sample of 1,263 students from ten (10) Ghanaian high schools to identify teacher-factors that promote students' interest in mathematics found that teachers' ability to connect mathematics to real-life problems is critical (Arthur et al., 2017a, 2018). This improves students' ability to study and grasp mathematics topics by encouraging them to connect new concepts to prior ones. Arthur et al. (2018) examined a successful mathematics pedagogical strategy used in Australia to assist students learn via mathematical linkages between different disciplines. The effort aimed to promote the connection of mathematical ideas to students' diverse knowledge and life experiences (Arthur, 2019; Hasbi et al., 2019).

According to Hasbi et al. (2019), the ability to establish mathematical connections are critical, yet good math students lack them. Mathematics connection bridges the gap between mathematical principles and their application in future careers and studies. Suominen (2015) classified mathematical connections as "the connection of comprehension, the connection of equivalent representations, and the connection of justification procedures." Additionally, Kusaeri et al. (2019) investigated 350 students' culture-based learning to identify their mathematics connections. The findings classified mathematics connection into three stages: comprehension, representation, and justification. Ariyani et al. (2020) classified mathematics connections into three major taxa: connections among mathematical ideas, connections to the sciences, and connections to the actual world. Teachers' capacity to connect conventional concepts in mathematics to science addresses multiculturalism issues in teaching and learning (Zohar, 2006). According to Latif (2017) pupils with sufficient ability might complete a mathematics problem solving test using information gained via mathematics connections.

2.1.4 History of Mathematics Concepts

Mathematics has undoubtedly played a significant part in the history of science (Mann, 2011). The phrase "history of mathematics concepts" is, in reality, an old idea in the field of mathematics education. It has been a frequently debated topic, and as a result, there is a growing interest among researchers worldwide (Charalambous et al., 2008). The record or narrative accounts of events that contributed to the formation of distinct mathematical notions are referred to as the history of mathematics concepts. According to the literature (eg. Fried, 2001; Goktepe & Ozdemir, 2021), history of mathematics has been included in mathematics teaching.

Fried (2001) underlined that between 1960 and 1970, teachers practiced using history of mathematics concepts in classrooms. Therefore, throughout the previous decades, the application of history of mathematics concepts in mathematics teaching and learning has been quite incremental (Schubring et al., 2012). In 1995, an establishment concerning the history of mathematics and its application in teaching was evoked to promote the pedagogical practice of employing history of mathematics in teaching (Goktepe & Ozdemir, 2021). The institute encouraged the incorporation of historical pieces into lesson delivery and student learning. Marshall (2000) discovered that the next year's (1996) gathering of the International Congress on Mathematics Education contended the use of mathematics history to engage students in teaching and learning activities. During the second ICTM International Teaching Mathematics Conference (ICTM-2) in 2002, a panel was convened on "The Role of Mathematics History in Mathematics Education." They spoke about the best topic areas for incorporating history of mathematics into teaching (Goktepe & Ozdemir, 2021).

Learners develop totally new belief systems by incorporating the history of mathematical concepts into instruction. The introduction of understudies to the history of mathematical concepts helps them to perceive mathematics knowledge as an interconnected body of evolutionary processes rather than a structured entity comprised of absolute infallible age-old facts (Barbin et al., 2020; Jahnke et al., 2002). As a result of the origins of mathematical ideas in human thinking and cultures, teachers were encouraged to show to students the stages of growth of mathematics in an interesting manner (NCTM , 2011 as cited in Tsanwani, 2011). Teachers should prioritize history of mathematics as a vital component of mathematics, according to Chorlay et al. (2022), in order to enhance teaching practice and stay current on historical components of mathematics concepts.

Liu (2003) expounded on the whys and wherefores of the pedagogical integration of mathematical historical themes. First, he discussed motivation in mathematics learning, stating that historical knowledge motivates pupils and leaves them with a favorable attitude toward mathematics. Second, pupils would be aware of the defects in mathematical idea creation, which would assist them in dealing with any challenges that may arise. In addition, solving historical questions aids in the development of students' mathematical thinking. Moreover, history reveals the human aspect of mathematical knowledge and serves as a guidance for teachers. Also, by studying history, students can gain an understanding of which significant breakthroughs has occurred in mathematics disciplines that are of importance to them. They can realize that mathematics is a science that individuals constructed to meet their requirements. They may be more eager to study since the history of mathematics displays old traditions, many cultures, people's sentiments, and developments. Furthermore, learners may understand why they need to learn mathematics as well as the source of mathematics. Numerous studies (e.g. Carter, 2006; Goktepe & Ozdemir, 2021; Liu, 2003;

Marshall, 2000) also support the idea that incorporating the history of mathematics into lessons has a positive impact on students' achievement, interests, and attitudes, little evidence support the moderating effects of historical themes on students' mathematics achievement motivation.

While historical context can improve the quality of mathematics instruction, it is not a magic bullet. Teachers must continue to use caution to ensure that the historical background is relevant and accessible to their pupils, and that the emphasis on historical context does not detract from the basic mathematical principles being taught. Furthermore, it is critical to understand that historical context is not a one-size-fits-all solution, and that different students may respond differently to different historical contexts. Teachers may be better able to construct problem-based courses that engage and encourage students, to increase their own pedagogical content knowledge, and to design more effective evaluations if they investigate the historical evolution of mathematical concepts and their applications.

2.2 Theoretical Framework

2.2.1 Situated Cognition Theory

Brown et al. (1989) are generally regarded as the proponents of situated cognition theory. According to situated cognition theory, learning requires the development of complicated cognitive processes and techniques embedded in genuine situations rather than the acquisition of isolated abilities and knowledge (Brown et al., 1989). Learning is intrinsically social and physical, and knowledge and skills are gained by active engagement in actual activities in real-world situations (Woolley & Jarvis, 2007).

Contextual learning is underpinned on this theory. Johnson (2002) opined that contextual learning fosters the acquisition of knowledge and skills in real-life circumstances. The theory emphasizes the importance of providing students with opportunities to engage in authentic mathematical activities in real-world contexts to improve their understanding of mathematical concepts and motivation to learn mathematics (Kelley & Knowles, 2016). Therefore, the theory urges educators to immerse students in learning relevant to their context (Herrington & Herrington, 2005). In mathematics classrooms, students should be given opportunity to participate in problem-solving activities that are relevant to their lives and allow them to apply mathematics concepts in meaningful ways (Arthur et al., 2018; Crawford, 2001).

The theory emphasizes social interaction and collaboration in the learning process. Learning, according to this theory, is a social activity involving contact with others, and knowledge is co-constructed via social interaction (Jaworski, 2002). This points to the fact that students must be given the opportunity to work in collaborative groups, debate their thinking, and share their ideas and techniques with others (Li & Lam, 2013).

Several research in the area of mathematics education have offered support for situated cognition theory. Yackel et al. (1991) discovered that students who were given opportunities to engage in authentic problem-solving activities in small groups shown considerable gains in their grasp of mathematical concepts and willingness to learn the subject. Situated cognition theory is utilized to create instructional techniques that increase students' mathematical engagement and accomplishment. Teachers, for example, might provide students opportunity to participate in problem-solving activities that are relevant to their lives and allow them to apply mathematical ideas and abilities in meaningful ways. Teachers should also encourage cooperation and social interaction by arranging group work activities and allowing students to debate their ideas and techniques with others (Bowers et al., 1999).

To conclude, situated cognition theory provides a valuable framework for understanding the multiple elements that impact students' mathematical engagement and accomplishment. Teachers may boost students' interest and success in the topic by giving them opportunity to engage in genuine problem-solving activities and boosting teamwork and social engagement.

2.2.2 Expectancy-Value Theory

The expectancy-value theory (EVT) is a commonly used motivational theory that outlines how individuals make choices and engage in activities based on their views about their capacity to achieve (expectancy) and the worth they place on the activity (value) (Eccles & Wigfield, 2020; Wigfield & Eccles, 2000a). In the milieu of mathematics education, EVT point toward that students' motivation and engagement in mathematics can be anticipated by their expectancy and value beliefs in the subject.

Expectancy beliefs refer to students' feelings about their capacity to excel in the subject (Muenks et al., 2018). Previous mathematical experiences, feedback from teachers and peers, and self-perception can all influence these feelings (Eccles et al., 1998). Students who have strong mathematics expectancy beliefs are more likely to engage in mathematics-related activities and persevere in difficult situations. Students who have low expectancy beliefs in mathematics, on the other hand, may lack confidence and feel stranded, which can lead to disengagement and poor performance. Value beliefs in mathematics, pertain to students' perceptions of the significance of mathematics. Personal interest, societal expectations, and prospective rewards or repercussions can all have an impact on this (Hidi et al., 2002). Students who believe mathematics is worthwhile or gratifying are more likely to participate in mathematics-related activities and put in more effort. Students who do not see the importance of mathematics, conversely, may lack motivation to participate in mathematics-related activities and may not put up the effort required to get ahead.

According to EVT, the following equation can predict the desire to participate in mathematics: Motivation = Expectancy x Value (Wigfield & Eccles, 2000a). This suggests that pupils who have strong expectation views and high value beliefs in mathematics are more likely to be motivated to succeed in the subject. Thus, students who feel they can succeed in mathematics and perceive the significance of mathematics are more likely to participate in mathematics-related activities and attain better levels of mathematics competence.

Studies have discovered EVT is effective in explaining mathematics achievement motivation. Conley (2012) revealed, for example, that students who reported higher levels of intrinsic motivation and success in mathematics also reported higher levels of expectancy beliefs and value views in the subject. Furthermore, Kim & Park (2018) found that students' expectation and value views in mathematics were positively related to their academic success in mathematics. Teachers can utilize a variety of EVT-aligned tactics to increase students' motivation and engagement in mathematics. Teachers, for example, might create possibilities for success by assigning difficult but manageable assignments and providing feedback that stresses growth and progress (Bruning & Horn, 2000). Teachers can also stress the importance and applicability of mathematics by demonstrating to students how mathematics can be applied in real-world circumstances (Arthur et al., 2017a). The educational implications of EVT offers a valuable framework for comprehending the various aspects that impact students' motivation and involvement in mathematics. Teachers may improve students' motivation and success in mathematics by instilling high expectations and value beliefs in them.

2.2.3 Self-Determination Theory

Self-determination theory (SDT) is a popular motivation theory that analyzes how people are driven to engage in activities that meet their core psychological requirements for autonomy, competence, and relatedness (Deci & Ryan, 2012; Ryan & Deci, 2000). SDT argues that the level to which students' basic psychological needs are met might predict their motivation and involvement in mathematics teaching-learning context.

The urge to be in control of one's own life and to have a feeling of choice in one's activities is referred to as autonomy (Ryan & Deci, 2000). Students' autonomy may be encouraged by providing options in how they approach mathematical challenges and encouraging them to take responsibility of their learning (Vansteenkiste et al., 2004). The desire to feel capable and effective in one's actions is referred to as competence (Ryan & Deci, 2012). Students' competence in mathematics may be developed by giving pupils opportunities to succeed and have a sense of mastery over their mathematics learning (Vansteenkiste et al., 2004). Relatedness is defined as the desire to feel linked to people, thus, to have a sense of belonging (Ryan & Deci, 2000). Relatedness may be enhanced in mathematics class by developing a supportive climate that enhances positive interactions among students and between students and teachers (Wigfield & Wentzel, 2007).

Students who have their fundamental psychological needs met, according to SDT, are more likely to be intrinsically motivated to participate in mathematics teaching- learning activities (Niemiec & Ryan, 2009). Intrinsic motivation is the desire to engage in an activity just for the purpose of doing so because it is fun, intriguing, or gratifying (Oudeyer et al., 2013).

Extrinsic motivation, on the other hand, refers to the desire to engage in an activity in order to earn some external benefit or avoid some bad consequence (Locke & Schattke, 2019). Although extrinsic motivation might be beneficial in the short term, it is often less successful in generating sustained engagement and accomplishment in mathematics than intrinsic motivation (Trevino & DeFreitas, 2014).

Several studies have found SDT to be beneficial in the context of mathematics achievement motivation. According Meece et al. (1988), students who reported higher degrees of autonomy, competence, and relatedness in mathematics classrooms also reported higher levels of intrinsic interest and engagement. Furthermore, Cheon et al. (2018) discovered that students' views of autonomy-supportive mathematics instruction were favorably connected with their intrinsic desire and success.

Teachers can implement various strategies proposed by SDT to maintain students' motivation and engagement in mathematics. Teachers, for example, might provide students options in how they approach mathematical activities, encourage students to take ownership of their learning, and create possibilities for success and mastery (Paris & Winograd, 2003). Teachers can also develop healthy relationships among students and between students and teachers by creating a supportive classroom atmosphere (Dörnyei & Muir, 2019).In conclusion, SDT implies that mathematics teachers can improve students' intrinsic motivation and achievement through the nurture of basic psychological needs for autonomy, competence, and relatedness.

2.2.4 Social Cognitive Theory

The social cognitive theory (SCT) was developed by Albert Bandura. It is a well-established theory of human behavior that highlights the effects of cognitive, behavioral, and environmental elements in forming people' ideas, attitudes, and actions (Bandura, 1991, 2012). SCT reveals that students' beliefs about their own mathematical ability, as well as their perceptions of the classroom environment, are major drivers of their engagement and performance in mathematics. According to Bandura (2012) and Schunk (2013), people acquire new behaviors and attitudes through observation and analysis of the results of their actions. This type of observational learning is also known as vicarious learning, an effective technique in mathematics education for increasing students' engagement and performance.

Teachers, classmates, and other role models may build successful mathematical problem-solving techniques, provide feedback on students' performance, and provide encouragement and support (Schunk & Pajares, 2002).The theory highlights the significance of self-efficacy, which refers to people's conviction in their own capacity to complete a task (Bandura, 1977). Students who believe they have high self-efficacy in mathematics are more likely to persevere in challenging math problems, set higher objectives for themselves, and participate in more effortful learning practices (Schunk & Pajares, 2001).

Social cognitive theory posits that a variety of cognitive and contextual variables impact self-efficacy beliefs. Students' prior experiences with mathematics, judgments of their own skill level, and interactions with instructors and classmates, for example, can all have effects on their self-efficacy beliefs (Loo & Choy, 2013; Schunk & Pajares, 2001). The discussion of elaborated on the facilitative effectiveness of self-efficacy beliefs on behavioral, cognitive, and motivational engagement in the classroom. Linnenbrink and Pintrich (2003) expanded on the role of self-efficacy beliefs in facilitating behavioral, cognitive, and motivational engagement in the classroom.

Furthermore, students' impressions of the classroom environment, such as the level of challenge and assistance supplied by the instructor, might influence their self-efficacy beliefs and mathematical engagement (Martin & Rimm-Kaufman, 2015; Pajares & Miller, 1994; Schunk & Mullen, 2012). Self-efficacy beliefs were found to be major determinants of students' engagement and achievement in mathematics in research by Azar et al. (2010). Similarly, Hulleman et al. (2008) discovered that students' contemplations of mathematics' relevance and value were positively related to their self-efficacy beliefs.

The implication of SCT is that teachers, for example, might model good problem-solving techniques, provide feedback to students, and provide encouragement and support (Schunk & Pajares, 2009). Teachers may also help students believe in their own abilities by giving opportunities for achievement, providing positive feedback, and building a supportive classroom climate that develops positive interactions among students and between students and teachers (Hulleman et al., 2008). Teachers may improve students' motivation in mathematics by supporting effective modeling, strengthening students' self-efficacy beliefs, and establishing a supportive classroom atmosphere.

2.3 Empirical Review

The methodical and objective-based analysis of previous research studies, experiments, and observations to detect trends, patterns, or discrepancies in data is referred to as an empirical review (Kitchenham et al., 2009). The goal of an empirical review is to synthesize and analyze the body of evidence on a certain topic or research issue, and to develop conclusions based on information that is available. This section reviews studies on various aspects of the relationship between mathematics connection and achievement motivation, such as the mediation role of teaching quality, moderation role of teaching competence, and moderated-mediation role of history of mathematics concepts.

2.3.1 Mathematics Connection and Achievement Motivation

Connecting mathematics to real-world situations has been found to encourage understudies' interests and motivation growth. In one study, Arthur et al. (2018) discovered that students who were taught using real-life analogies were more interested in mathematical activities, resulting in a deeper comprehension of mathematical ideas and greater performance on mathematical tasks. Wilensky (1993) conducted in-depth interviews with adult learners to build a "connected mathematics" method to studying mathematics. "Connected mathematics" stresses learners' ability to make sense of mathematical concepts. The findings revealed that learners in the "connected mathematics" are motivated to investigate and develop interpretations for mathematical concepts, as well as to establish explicit links between mathematical ideas and mathematics expertise and other disciplines. According to the interviews, mathematics connections offer an enabling environment for learners to play the role of mathematics by connecting parts of information that do not have relationships on a normal scale. Cejka et al. (2006) studied the implementation of robots in engineering education in K-12 classes. Participants learned mathematics concepts through real-world applications using robotics. Robotics in Math, Science, and Engineering classes engaged pupils, according to the findings. The method inspires students by piquing their interest in connecting concepts to real-world experiences.

An et al. (2008) did an exploratory study on the integration of pop music in statistics lessons as an intervention to boost students' attitudes, reinforce and expand their views about mathematics. From 189 6th grade primary school kids in Southeast China, 35 were chosen at random. A 90-minute maths class was combined with a music-embedded exercise. Pre and post-questionnaires with closed-ended and open-ended questions about students' attitudes and beliefs about mathematics were administered to collect data. The findings showed that mathematics instructions combined with music had a favorable influence on students' attitudes and perceptions about mathematics. Weinberg et al. (2011) utilized a mixed methods methodology to assess the impact of four experiential learning programs on middle school students' interest and motivation in mathematics and science. 336 middle school students participated in the research. The study found that overall interest and motivation in mathematics rose with experiential learning programs.

Rooch et al. (2012) reported on research regarding MathePraxis, an initiative that improves the link of mathematics to real-life problems. The research consisted of three projects: an inverted pendulum regarded as a model for automated control within a Segway, a study on the optimal design of a ribbed cooler, and a study on the best design of a ribbed cooler. The approach enhanced engineering students' motivation and retention by linking first-year mathematical coursework with practical applications. Moore (2012) verified the best teaching approaches of games, manipulatives, real-world application, differentiated instruction, and using technology in mathematics training. The finest approaches, which instructors may begin to use in their own classrooms, are capable of improving learners' mathematics motivation and success across America.

Rohendi and Dulpaja (2013) did quasi-experimental study with 7th grade students from Junior High School Ujungjaya 2 in the Sumedang area of Indonesia. Pre-test and post-test data were obtained. The results demonstrated that the student's mathematical connection ability was superior than the conventional model while employing the Connected Mathematics Project (CMP) model based on presentation media. Students' participation in the learning process increased significantly when they used the Connected Mathematics Project (CMP) based on presentation media. Calder (2013) examined learners' mathematical understandings through student-centered inquiry that positioned mathematics within genuine problem-solving situations using a mixed methods methodology. The experiment was carried out with a Year 10 class in a purpose-built secondary school in New Zealand. According to the findings, mathematics focusing on real-life learning was extremely interesting.

Kim and Aktan (2014) presented a theoretical model for curricular integration of mathematics and science (CIMAS) and investigated experts' perceptions on its educational perspectives among 23 mathematics educators in Ankara, Turkey. It was decided that topics in the Turkish mathematics curriculum can be connected with physics, chemistry, or biology (for example, derivative with linear velocity, ratio with chemical mixture, and probability with genetics), with physics providing the most instances. The expert comments repeatedly said that CIMAS will improve mathematics education for pedagogical, motivational, social, and other purposes.

An et al. (2014) conducted a pretest-posttest control group experiment with two classes of 56 third grade students from an elementary school on the western coast of the United States to compare mathematics achievement and dispositions, such as beliefs about success, attitude, confidence, motivation, and mathematics usefulness. The music students got music-mathematics integrated sessions, whereas the control students received typical lecture and textbook-based mathematics teaching. The results showed that, although having statistically equal pretest scores prior to the intervention, the music group students had statistically substantially higher positive mathematics dispositions scores than their non-music group counterparts after the intervention. These findings give empirical evidence that instructors benefit from using music-themed activities to provide students with the chance to study mathematics in a tough yet fun learning environment.

Dass (2015) studied the concepts and practices of mathematics instructors and students' conceptual comprehension of contextualized Geometry lessons in STEM-oriented teaching. The study addressed issues surrounding students' realization that solutions to real-world problems or issues require the combined use of knowledge, processes, and practices from all of these disciplines. As a result, effective STEM-oriented training must include a methodology that is based on real-life challenges, concerns, difficulties, or questions and allows students to use two or more STEM fields in an integrated manner. Ríordáin et al. (2015) performed a case study on the implementation of an integrated approach to distance, speed, and time learning in three second-level schools in Ireland. The research used a qualitative design to investigate the integration of mathematics and science teaching and learning. Teacher viewpoint, understanding of the 'other subject' and technology pedagogical content knowledge (TPACK), and teacher cooperation and support were all shown to have an influence on the implementation of an integrated approach to mathematics and science teaching. In addition, combining mathematics and science teaching and learning improves student learning, engagement, motivation, problem-solving, critical thinking, and real-world application.

Kwon (2016) studied the impact of 3D printing and design software on student motivation, interests, mathematics and real-world abilities. Students' motivation, interests, real-life abilities, and certain quantitative skills improved statistically significantly. Furthermore, favorable impact sizes demonstrated the study's practical value. Students were able to obtain motivation, interests, real-life skills, and some mathematics skills through 3D printing and design.

Bishara (2016) researched students' capacity to solve unique mathematical problems in the domains of numerical series, verbal and formal, and its impact on the motivation of junior high students with learning difficulties. Two instruments were used to gather data: "The Working Paper for Challenging Problem Solving in Mathematics" was used to assess mathematical series, and "The Student's Motivation for Learning" was used to examine motivation for learning. The study included 50 adolescents with learning difficulties from five junior high school regular education classrooms. According to the research, tackling practical challenges increases students' motivation to study mathematics.

Cahyono and Ludwig (2016) performed exploratory research with 272 students and nine instructors from nine secondary schools in the Indonesian city of Semarang. The research looked at the MathCityMap-Project, which was created by merging math trail program with advanced mobile technology. Students' motivation to participate in a math trail activity assisted by a mobile app was assessed. Observation, interviews, questionnaires, and student work analyses were used to collect data. The findings show that intrinsic motivation and recognized regulation had an important role in students' motivation to participate in this activity. The learning environment's design, the usage of a mobile app, and the importance of the mathematics problem all contributed to this outcome.

Trifunov (2017) investigated the use of web apps in mathematics teaching to motivate students and increase knowledge acquisition. The web application http://mathlabyrinth.azurewebsites.net was used in the study, which allowed students to explore, investigate, visualize, and solve real-life problems. The online application's contents are linked to real-life scenarios that may be explained using prior mathematical knowledge. Two surveys were administered to 146 students at the Gymnasium "Kocho Racin" in Veles. The first survey was conducted prior to the introduction of the online application to mathematics teaching-learning. The second survey was conducted a year later. The survey concentrated on problem-solving tasks based on students' daily experiences. Students used IT to solve problems, and their motivation arousal levels were investigated by asking, "Do you think you can increase the motivation for studying mathematics by solving practical exercises?". 67% of the students responded that they are always or frequently motivated to study mathematics. Furthermore, when asked if doing practical tasks boosted their enthusiasm to learn mathematics, 75% of students said yes. As a result, software and technologies that put real challenges in context have the potential to motivate mathematics learning.

Rodionov and Dedovets (2017) assessed the effect of practical issues in boosting students' interest and motivation, developing their global perspective, and orienting themselves in the modern world at various levels of secondary school mathematics study. Motivation was discovered to be driven by plausible mathematical reasoning. However, tackling real-world situations helps to improve such reasoning. Kusuma et al. (2019) surveyed 35 eighth-grade students from SMPN 1 Bojongsoang, Tegalluar Village, Kabupaten Bandung. The survey was conducted following an experiment with eighth-grade junior secondary school students that used ethnomathematics. Ethnomathematics is a method of teaching that ties mathematical principles to culture. According to the study, ethnomathematics increased student success more than direct teaching. Klanderman et al. (2019) polled 645 students from middle schools, high schools, colleges, and universities. Students agreed that mathematics is valuable, significant in everyday life, vital to learn, essential for the future, and beneficial in life. Simamora et al. (2019) investigated guided exploratory learning with a focus on local culture. The findings revealed that studying in a Batak Toba context greatly increased students' mathematics problem-solving abilities and self-efficacy. Therefore, mathematics teachers should make an effort to use quality learning resources and include local culture into mathematics instruction. Ukobizaba et al. (2019) conducted a study of 217 ordinary level secondary school students and 25 secondary school instructors who teach Mathematics from 5 schools in Rwanda's Karongi District, Western Province. The findings revealed that mathematics teaching was reduced to three components: preferred mathematics teaching techniques, desire to teach and learn mathematics, and the utilitarian value of mathematics in everyday life. Peer learning, group work, and expository strategies were shown to be the most often used teaching modalities. Respondents reported that mathematics improves students' critical thinking, problem-solving abilities, and creativity through connecting mathematical concepts to real-world situations.

In Geometry teaching-learning, Reyes et al. (2019) performed a case study with 25 instructors and 25 pupils in Philippino junior high public schools. Participants were interviewed in semi-structured interviews on how they learnt from their teacher's activities, with focus on the real-life application of Geometry. Thematic coding was used to examine the data, in which transcripts were put into phrases and relevant codes were grouped together. According to the data, math teachers have two perspectives on contextualization: concerning the student's life and employing local materials or information. Lessons may be taught successfully and quickly if math teachers make advantage of existing materials or information in the environment, resulting in a better knowledge of arithmetic ideas. The students' lives provided context for the session, which made it dynamic and fascinating.

Desai (2020) discussed the impact of WEM (Why Engineering Mathematics?), an audio-visual (AV) tool, on first-year engineering students' mathematics motivation. He carried out pre- and post-survey testing. According to the findings, WEM enhances students' motivation and a good attitude toward mathematics learning among engineering students. Cheng et al.

(2020) examined the impact of 3D printing integration on students' motivation in science, technology, engineering, and mathematics (STEM). The study comprised 26 teachers from six different states in the United States, as well as 1,501 students who engaged in STEM learning through 3D printing in the context of paleontology. Scales that had previously been validated were used to measure teachers' views and students' STEM motivation. Instructors' integration of 3D printing in STEM was revealed positively connected with students' motivation in mathematics.

Wijayanti and Abadi (2020) studied the impact of STEM Problem Based Learning instructions on lesson plans and student worksheets for Statistics in class VIII. The outcomes of instructor evaluations and student responses were analyzed. The study discovered that students' mathematics connection ability test was in the high category with an average score of 14.2, and students' learning motivation was in the high category with an average score of 81.7. Zhong and Xia (2020) examined empirical data on robotics applications in mathematics teaching. A keyword search and snowballing were employed to conduct a systematic search in an online database. Twenty empirical papers were examined to determine the nuances of robotics-assisted mathematics education. The analysis revealed that the majority of studies conducted among elementary and secondary school students used LEGO robots to teach and/or learn graphics, geometry, and algebra, and that nearly half of the studies taught mathematics by engaging students in game-like interactions with robot's connections between mathematics and real-life conditions. In mathematics education, robotics provides pupils with a highly engaging and hands-on learning experience that encourages a new generation of mathematical teaching-learning.

Yeo (2021) examined video recordings of 30 experienced and competent instructors from 23 different schools presenting a topic over the course of one to three weeks. 36.7% of teachers utilized real-life examples and/or applications to assist pupils understand the importance of mathematics. In the second phase of this study, 677 secondary school mathematics teachers from 108 secondary schools completed a survey to see how frequently they engage in the classroom activities of the 30 instructors filmed in the first phase. It was revealed that 70% of teachers often used real-life examples and/or applications to help their students grasp the importance of mathematics in the real world, and learners' motivation was increased as a result. Kohen et al. (2022) examined students' motivation to pursue mathematics using mathematics modeling with real-world applications. There were 771 9th grade Israeli students (44.5% girls), with the majority, 90.6%, participating. Pre-post survey data analysis revealed that mathematics modeling learning boosted student proficiency and enthusiasm to study mathematics. Abdulrahim et al. (2023) explored real-life applications for increasing mathematics motivation among grade eight (8) pupils. Structured interviews and checklist observation were used to obtain both qualitative and quantitative pre- and post-survey data. The findings revealed that the degree of mathematics appreciation had increased. There was also a substantial difference in the level of appreciation for mathematics before and after the intervention.

According to the empirical review, incorporating real-life applications, connecting mathematics to other subjects, employing technology in the classroom, and giving chances for collaborative learning results to mathematical connections establishment and increase in learners' motivation. Therefore, it is conceivable to hypothesize that mathematics connection and achievement motivation are positively correlated.

2.3.2 Mediating Effect of Teaching Quality

The quality of instruction has been widely considered to be an essential determining factor in students' mathematics achievement motivation (Boston, 2012; Scherer & Nilsen, 2016; Teig & Nilsen, 2022; Tongsilp, 2013). Studies have found that when teachers present lessons in sequential manner, and engages collaborative learning, students become willing to accept challenges in teaching and learning (Anwar et al., 2021). While poor teaching discourages learners to give up easily on tasks, effective instructions drive learners' abilities to solve difficult mathematics problems (Scherer & Nilsen, 2016). Boston (2012) evaluated features of a rigorous mathematics instruction, including the level of instructional tasks and task execution, chances for mathematical discourse, and instructors' expectations. The findings came from a survey of 13 middle school teachers in a medium-sized metropolitan district who had received professional development in standards-based mathematics programs. The instructional quality assessment (IQA) showed that high-quality assignments and student work, and cognitively demanding activities promote students critical thinking and motivation.

Teig and Nilsen (2022) investigated patterns, determinants, and relationships between instructional quality and student success and motivation in elementary and secondary school. The Norwegian data from the Trends in Mathematics and Science Study (TIMSS) 2015, Grades 5 and 9, from elementary and secondary school, were investigated making use of multi-level latent class analysis. Various profiles of instructional quality were found to be significantly related to motivation. Tongsilp (2013) performed path analysis to determine the elements influencing achievement motivation of students at Private Universities in Bangkok. The multi-stage approach was used to sample 840 pupils at random. The findings demonstrated direct and significant positive associations between classmate relationships, future expectations, and self-directed learning and achievement motivation. Teachers' technology expertise is necessary for quality mathematics teaching (Koehler et al., 2013). To justify, a systematic evaluation of 24 studies was conducted to identify the impact of technology use on motivation and attitudes (Higgins et al., 2019). The findings show that technology integration in mathematics lessons has a considerable overall influence on pupils' motivation and attitudes. Anwar et al. (2021) surveyed students to determine the relationships between their perceptions of collaborative teaching and learning and their learning motivation. Analysis of 50 respondents by Pearson correlation revealed a computed r of 0.568 and a significant value of 0.003, implying that students' perceptions of collaborative team teaching were considerably and strongly associated to learning motivation. A pre/posttest quasi-experimental design with matching control group was conducted on two groups of student teachers enrolled in an introductory physics course to study the influence of strategic instruction on student teachers’ physics achievement, attitude towards physics, and achievement motivation (Selçuk et al., 2009). Results showed positive effects on physics achievement motivation.

As teaching quality is an important factor affecting understudies’ achievement motivation (Ediger, n.d.), researchers have identified mathematics connections have external effects on the quality of teaching. For instance, Khotimah (2016) investigated the use of contextualized instructions in discovery-learning process to improve the quality of lecturers' course delivery in differential equations and learners' problem-solving skills. The study of 34 mathematics education students showed that lecturers' abilities to develop discovery-based contextual learning that included relevant real-world situations led to excellent teaching.

Papadakis et al. (2016) studied the effects of realistic mathematics instruction on the development of mathematical ability in 231 Greek kindergarten pupils. Children in the experimental group were taught realistic mathematics using realistic mathematics education concepts which includes real world applications that makes mathematics relevant. Realistic mathematic education made a substantial contribution to the development of young children's mathematical skills. A concurrent exploratory mixed methods study was carried out to investigate prospective middle school teachers' mathematics knowledge for teaching geometry, as well as the connections established while performing open and closed card sort activities designed to explore mathematical relationships (Eli et al., 2007). Despite having below-average mathematics expertise for teaching geometry, prospective middle school teachers were able to draw over 280 mathematical connections. Mathematics connection had a statistically significant favorable influence on mathematics knowledge for teaching geometry, according to the findings.

Therefore, empirical evidence consistently confirms that relating mathematics to real-world situations, other subjects or learners' lives improved the quality of teaching, resulting in enhanced student motivation. As a result, high-quality teaching practices that foster learners' engagement in real-life problem-solving supportive learning environments hypothetically mediate the relationship between mathematics connection and students' achievement motivation. Yet, the mediation role of teaching quality on the relationship between mathematics connection and students' achievement motivation is not perfectly established in previous studies.

2.3.3 Moderating Effect of Teaching Competence

Teaching competence refers to instructors' ability to deliver comprehensible lessons and facilitate learning. Student motivation and success is significantly influenced by worthy instruction and the teacher's ability to establish a good learning environment. As a result, the worth of mathematics connections may be dependent on the teacher's ability to apply this strategy. While mathematics connection has been consistently correlated with achievement motivation in literature (Kwon, 2016; Ríordáin et al., 2015; Rooch et al., 2012; Weinberg et al., 2011), the extent to which this relationship is moderated by the competent teaching has not been widely established. But evidence from empirical sources suggest that the interaction effects of mathematics connection and teaching competence is predictable.

Several studies investigated the impact of specific teaching interventions on student motivation and achievement, such as real-world problem-solving tasks, mathematical modeling, and interdisciplinary connections. However, because of teachers' ability to effectively implement these interventions, they had been more effective. In Cotič's and Zuljan's (2009) study, for example, the impact of real-life problem-solving activities on students' motivation and performance was related to teacher's ability in presenting these tasks. Similarly, the beneficial influence of mathematics connections on student motivation and success in the study by Su and Cheng (2015) was attributable to teacher's ability to effectively guide the implementation of activities and establish a pleasant learning environment. The same applies to Surya et al. (2017) study, in which the impact of mathematical modeling on student motivation and problem-solving abilities was influenced by the teaching competence in executing this technique.

It is vital to mention that the efficiency of making mathematics connections is also affected by the teacher's subject and pedagogical content expertise (An et al., 2004; Bonafini et al., 2021). The teacher's grasp of subject matter is referred to as content knowledge (Filgona et al., 2020), whilst the teacher's understanding of how to teach that subject matter is referred to as pedagogical content knowledge (Ball et al., 2008). Teachers who are well-versed in both content knowledge and pedagogical content knowledge are more likely to be successful in applying ways that relate mathematics to real-life phenomena. A teacher who understands the mathematics underlying a real-world situation, for example, is more suited to assist pupils through problem-solving processes. A teacher who understands how to teach mathematical modeling is also more likely to effectively enable this technique with students.

An et al. (2004) conducted research that compared content knowledge and pedagogical content knowledge among teachers in the United States and China. Teachers with greater levels of content knowledge and pedagogical content knowledge were revealed to be more effective in implementing real-world problem-solving activities and encouraging student motivation and performance. Similarly, Kelly (2006) discovered that instructor competence had a significant role in real-world problem-solving activities. According to the study, instructors who were more effective in making mathematics connections by using manipulatives had a higher impact on student motivation. Among the elements of competent teaching, teaching from experience cannot be excluded. Teaching experience may regulate the association between mathematics connection and student engagement and accomplishment. Experienced instructors are more likely to understand how to foster a pleasant learning environment and how to effectively execute instructional tactics that relate mathematics to real-world issues. As a result, they may be more suited to accommodate these techniques while also encouraging student achievement motivation and engagement. Gallagher et al. (2022) found that experienced teachers were more effective at implementing real-life problem-solving activities and encouraging student engagement. While experienced teaching is more effective at problem-solving tasks, they are also more resistant to change and less likely to adopt new approaches. When examining the influence of teaching experience on student outcomes, it is critical to evaluate the potential trade-offs between teaching experience and receptivity to new ideas.

Teachers' ability to provide instruction and facilitate learning, adopts experienced teaching, and create conducive teaching and learning environment had considerable impact on the effectiveness of creating mathematical connections to motivate students. However, the review found little empirical evidence to back up this claim.

2.3.4 Moderated-Mediating Effect of History of Mathematics Concepts

While several studies have been conducted to investigate the impact of mathematics connections on effective teaching (e.g., Eli et al., 2007; Khotimah, 2016; Papadakis et al., 2016), there has been less research on the moderating role of mathematical concepts history in this relationship. However, by looking at some studies (Arthur, Appiah, et al., 2022; Betül, 2012; Campuzano et al., 2018; Carter, 2006; Charalambous et al., 2008; K. Clark et al., 2016; Doz, 2021; Galante, 2014; Ho, 2008; Jankvist, 2009; Kapofu & Kapofu, 2020; Panasuk & Horton, 2013), one can start to think about the potential importance of historical context in mathematics instruction. One possible explanation is in Bütüner's and Baki's (2020) action research. Students participated in history-infused mathematics teaching and learning activities. The findings revealed that students' absolutist opinions had diminished. As a result, students regarded mathematics pleasant, engaging, and vital subject that helped them solve problems in their daily lives. Historical context gives a richer knowledge of mathematical concepts and their applications. Teachers, for example, may be capable to construct problem-based lessons that interest and encourage students if they consider the historical evolution of mathematical models for solving real-world problems (Arthur, Appiah, et al., 2022).

Panasuk and Horton (2013) stated that the history of mathematics is the basis upon which the teacher may build strong mathematical connections, which will assist the instructor's mathematical subject understanding and confidence. According to Ho (2008), including historical elements into mathematics instruction helps to sustain positive belief and tenacity. Arthur (2022) discovered that historical acknowledgements in mathematics education increased students' attention. Teachers' explanations of historical events underlying topics spark students' comprehension, leading to an increase in mathematical interest. Furthermore, students' skills in mathematics connections are influenced by previous concept advancements. Lit et al. (2001) taught eighth graders Pythagoras' theorem in a historical context. According to the study, using the history of mathematics favorably and significantly influenced students' attitudes about mathematics.

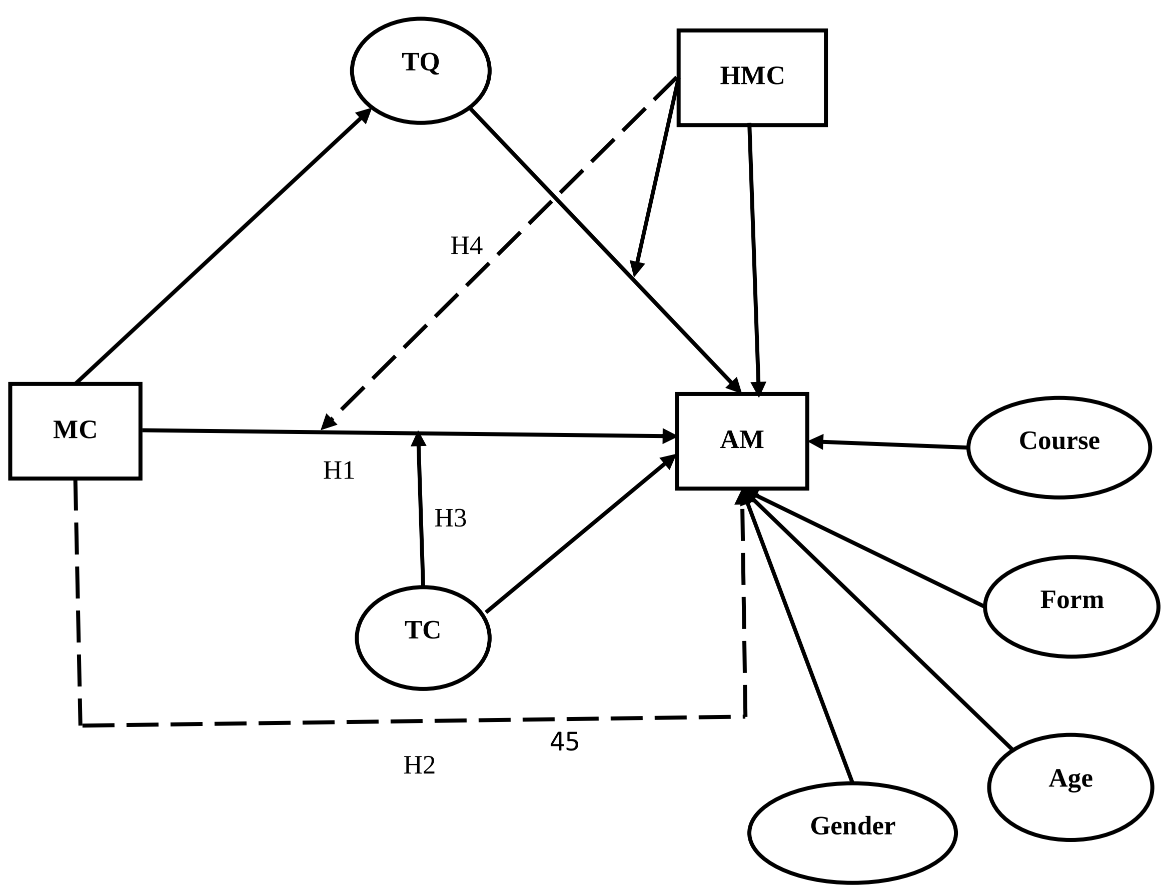
Teaching the history of mathematical concepts according to Marshall (2000), enables pupils to recognize the significance that humans have put on knowing and performing mathematics across time. The strategy increases the enjoyment of teaching and the incentive of students to learn. History-rich instruction has a favorable influence on learners' motivation and attitudes about mathematics (Doz, 2021). While introducing the history of mathematics, Betül (2012) noticed that students' enthusiasm for active learning participation increased as history served as an antidote to mathematics anxiety. Galante (2014) conducted research on the use of mathematics history to improve pre-service teachers' comprehension of mathematics subject knowledge and pedagogical content knowledge. Per the findings, participants stated that knowing about the history of mathematics provided them with fresh ideas for developing lessons and instructional tools. Aligning education to the historical context of Pythagoras' theorem, according to Kapofu and Kapofu (2020), stimulated favorably student attitudes of the theorem and mathematics in general. Notable changes in student perspectives included confirmations of greater motivation and admitted improvement in grade eleven learners' willingness to tackle tough assignments utilizing Pythagoras theorem. Learners declared feeling more confident while dealing with proofs, as well as enjoying creating their own discoveries and solving math problems.

Goktepe and Ozdemir (2021) researched twenty-one eighth graders who used ancient techniques to solve square roots in a historical setting. Pupils’ logs revealed that by teaching mathematics through history, students developed positive attitudes toward the subject: "I am motivated by Rene Descartes because every science derives from maths"; "Besides mathematics, I learned something special: I learned to be passionate and (to) love something and put it into action"; "History of mathematics very interesting"; "I am motivated by the way the teacher presents the material along with some interesting things about past mathematicians"; "I'm looking forward to the next lesson because I'm motivated and want to learn more," and "This is a mental image of my impression of today's lesson: Very motivating." Campuzano and colleagues (2018) investigated the influence of a mathematical thinking practice on undergraduates. Galileo's experiments were carried out in the effort to investigate the parameters of falling bodies. Geometric interpretation of Galileo's conclusions was accomplished using simple dynamic geometric applets created in GeoGebra. The activity encouraged actual mathematical thinking.

Overall, including historical context into real-life mathematics instructions appears to strengthen the quality of mathematics teaching, and subsequent increase in understudies’ achievement motivation.

2.4 Conceptual Framework

Conceptual framework is a pictorial view of the relationships among constructs involved in a study. Diagrammatically, it describes the association among variables as perceived by theories. Figure 1 displays the conceptual framework of the present study. The framework was developed from review of supportive literature including theoretical and empirical sources. Situated cognition theory, expectancy-value theory, self-determination theory, and social cognitive theory were consulted in framing this conceptual model. Figure 1 shows that the conceptual framework comprises of four independent variables and a dependent variable. The independent variables were presented in acronyms as TQ, TC, MC, and HMC for Teaching Quality, Teaching Competence, Mathematics Connection, and History of Mathematics Concepts respectively. Achievement Motivation represented the dependent variable as AM. According to the framework, TQ serves as the mediator between MC and AM. TC serves as the moderator of the path from MC to AM. In addition, HMC serves as the moderator of the indirect path from MC to AM through TQ. The dashed lines represent indirect effects while the undashed lines stand for direct effects. The conceptual framework also comprised of four hypotheses represented by H1, H2, H3, and H4 with respect to the study's objectives.



Direct Effect
Indirect Effect

Figure 2: ***Conceptual Framework***

(Source: Author's Construct, 2023)

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter provides an outline of the methodology the study adopted. The chapter highlights the study area, research paradigm, research method, research design, population, sample and sampling techniques, data collection instrument, data analysis, and ethical considerations.

3.1 Study Area/Setting

The study was conducted at Kumasi Senior High Technical School (SHTS)-a co-educational public school in Kumasi, Ghana. Mathematics, and mathematics-related subjects such as physics, chemistry, accounting, and vocational and technical skills are among the academic and technical disciplines available at the institution. Mathematics is an important subject in molding a student's academic and career success. Kumasi SHTS places a strong focus on mathematics education and provides a variety of extracurricular activities to help pupils enhance their maths abilities and increase their motivation. Kumasi SHTS aspires to establish a conducive learning atmosphere that inspires and pushes students to thrive in mathematics and related subjects via initiatives such as math clubs, math contests, and mentoring programs. Many Kumasi SHTS students have gone on to pursue careers in mathematics, engineering, and related fields as a result of these efforts. Kumasi SHTS is also in an economically vibrant location, with important economic activity including trading, and industry. This gives students several possibilities to apply their technical and vocational abilities in real-world circumstances and contribute to the region's growth. Furthermore, the school has a library, sports facilities, and students center, all of which help to improve the learning experience and create an environment conducive to academic and personal development.

3.2 Research Philosophy

Positivism, objectivism, or empiricism is a research philosophy that seeks to comprehend the social world via empirical observation and measurement (Leedy & Ormrod, 2015). The concept that the social world is objective and can be investigated in the same manner as the natural world is one of the paradigm's key pillars (Bryman, 2016). This implies that researchers use standardized measuring techniques and statistical analysis to identify generalizable rules and patterns in social events. Positivists emphasizes observable and quantitative evidence above subjective perceptions or interpretations (Park & Artino, 2020). Another important characteristic of positivism is its focus on impartiality and distance from the subjects of study (Stahl, 2007). Researchers are supposed to be fair and unbiased in their observations and measurements, with no personal biases or subjective interpretations. This may be accomplished by employing standardized measuring instruments, stringent data processing methodologies, and systematic observation processes.

Positivists claim that knowledge without empirical evidence is unscientific (Fox, 2014). In other words, positivism without empiricism is meaningless. Hence, positivism provides reliable and valid data that can be utilized to evaluate hypotheses and theories (Fox, 2014). Researchers can gather objective and precise knowledge about social phenomena by employing standardized measuring techniques and statistical analysis. This can result in a better knowledge of social reality and the creation of evidence-based policies and practices. However, there are a number of drawbacks to positivism (Clark, 1998). One of the most common objections is reductionist view of the social world, in which complex social phenomena are reduced to simple categories and variables (Dupré, 2000). As a result, vital contextual information may be lost, and one's awareness of the social environment may be limited. Furthermore, positivism may not be appropriate for studying subjective experiences or difficult-to-quantify or measure social phenomena (Fox, 2014).

Despite these limitations, positivism continues to be popular and widely accepted philosophy in social science research. It is especially well-suited to examining large-scale social phenomena and resolving research issues requiring empirical evidence (Park & Artino, 2020). Practically, positivist research approaches begin with the development of research questions or hypotheses, which are then answered or tested using standardized measuring techniques and statistical analysis. Surveys, experiments, and other quantitative instrumentations are frequently adopted for data collection. The data is then subjected to analysis with statistical software. Interpretation of findings takes place with respect to the research questions and hypotheses, and conclusions are drawn.

In summary, positivism unfolds the social world by empirical observation and measurement. Its capabilities include the generation of trustworthy and valid data as well as the testing of hypotheses and answering research questions. However, it has several flaws, one of which is the tendency to oversimplify complex social phenomena. Overall, this paradigm is still an important and useful approach to social research, especially when it comes to studies that require statistical analysis or empirical evidence.

3.3 Research Method

This study was quantitative research. Quantitative research is a research approach that is extensively utilized in social science domains such as psychology, education, sociology, and healthcare. The basic feature of quantitative research is the collection and analysis of numerical data in order to describe and explain phenomena (Creswell, 2009). To gather data, quantitative research often utilizes structured surveys, questionnaires, or experiments (Kasim & Antwi, 2015). These instruments are intended to elicit responses from participants that can be quantified and statistically analyzed. A survey, for example, can ask participants to score their degree of satisfaction with a certain product or service on a scale of 1 to 5. Following the collection of data, quantitative researchers employ statistical analysis to find patterns, correlations, or associations between variables (Roni et al., 2020). This approach assists researchers in testing hypotheses, answering research questions, and drawing empirically supported conclusions.

One advantage of quantitative research is that it is often more objective and replicable than qualitative research (Zyphur & Pierides, 2017). Because the data are numerical, it is easy to quantify and evaluate differences across populations or time periods. Furthermore, the use of statistical analysis reduces the possibility of researcher bias or subjectivity. Quantitative research has a wide range of applications. It is used, for example, to investigate the relationship between two variables, such as the association between stress and academic achievement in college students. It may also be used to assess the efficacy of an intervention, such as a new medical therapy (Allen & Babbie, 2013).

In conclusion, quantitative research is a powerful tool for researchers in a variety of disciplines to gather and evaluate numerical data in order to answer research questions or test hypotheses. It offers a systematic and rigorous technique to generate empirical data that is utilized to influence decision-making in a variety of sectors (Depaoli et al., 2018).

3.4 Research Design

The study adopted descriptive survey to explore respondents' views and opinions about the variables under study. A descriptive survey is a study design that uses surveys or questionnaires to describe and quantify certain characteristics of a population or phenomena (Mathers et al., 2007). A descriptive survey's goal is to collect information on a population or phenomenon that could possibly be used to define its features, assess its prevalence, or provide a baseline for future studies. Descriptive surveys are increasingly used in a variety of fields, including healthcare, social sciences, education, and marketing. They are frequently used to investigate issues including attitudes, beliefs, habits, preferences, and demographics (Koh & Owen, 2000). Descriptive surveys often entail asking a standardized set of questions to a sample of participants in person, over the phone, by mail, or online. The items are often closed-ended, which means they offer a restricted number of response alternatives. This enables the answers to be readily measured and statistically analyzed. Frequencies, percentages, averages, and other descriptive statistics are computed from survey responses. Descriptive survey is conducted quickly and inexpensively. Furthermore, it enables researchers to collect enormity of data from a diverse sample, which is then be utilized to make generalizations about the population of interest.

3.5 Population

The population of a research study refers to the total number of individuals, or objects that the researcher is interested in investigating. It is the group to whom the study's findings are meant to be generalized. In other words, the population reflects the complete target group for whom the research question is posed. The study covered Kumasi Senior High Technical School's form 2 and form 3 students. The study targeted all students taking the courses;

Home Economics, Visual Arts, Business, General Arts, Technical and General Science. In all, about 3200 students were available for the study. The distribution of the population is displayed on Table 1. Table 1 shows that 3200 students were available for the study. The population distribution is: Visual Arts (583), General Science (415), Technical (523), Business (489), General Arts (610) and Home Economics (580). In total, 1691 males and 1509 females were considered for the study.

Table 1: Course and Gender Distribution of the Study Population
Source: School Administration (2023)

3.6 Sample Size

The Daniel Soper Sample Size Calculator for Structural Equation Modeling (SEM) was used

Course	Number of Male	Number of Females	Total
General Science	216	199	415
General Art	385	225	610
Visual Art	383	200	583
Home Economics	16	564	580
Technical	438	85	523
Business	253	236	489
Total	1691	1509	3200

to determine the minimum sample size to detect effects. This calculator is an online tool for calculating the minimal sample size necessary for SEM analysis and is based on the assumptions of normal distributions. The calculator relies on Monte Carlo simulations to produce synthetic data sets depending on user-specified criteria (such as effect size, significance level, statistical power, and other important factors). The calculator predicts the minimum sample size necessary to attain the specified power level through iterations of this process. Http://danielsoper.com/statcalc3/calc.aspx?id=89 was the webpage of the calculator. Upon numerous inputs, including the number of latent variables (5), the number of observed variables per latent variable (20), the anticipated population effect size (0.8), and the required degree of statistical power (0.8), the minimum sample size for the present study was 100. However, the researcher selected the sample size of 400 greater than this minimum for better results.

3.7 Sample and Sampling Technique

Convenience sampling and simple random sampling were applied to select participants. These strategies were used to guarantee that the sample was both representative and accessible. Convenience sampling is non-probability sampling in which participants are picked based on their availability. It is frequently utilized in research projects with minimum resources or time restrictions, such as those carried out in schools. Convenience sampling was used in this study to pick participants from certain classes depending on their availability and desire to participate in the study. While convenience sampling is easily undertaken, it contributes to selection bias and restrict the generalizability of findings. To guarantee that the sample is representative of the population, the researcher opted to follow it with simple random sampling. Simple random sampling is a probability sampling technique that ensures each student has an equal chance of being chosen. 400 students were randomly chosen using computer-generated random numbers. They were picked from a sample frame that included all Kumasi SHTS students. The sample frame was created using a database that had a list of all students.

3.8 Data Collection Instruments

The instrument for collecting data was structured questionnaires that consisted of standardized items meant to elicit information from respondents about the variables. Such instruments had been frequently used in survey research and are especially beneficial for gathering huge volumes of data in a methodical and efficient manner. The instrument comprised closed-ended questions which respondents choose from alternatives. The items were reviewed by the researcher's supervisor to ensure explicitness and clarity, and the response alternatives were well-defined and thorough. A pilot study was conducted and necessary additions or omissions were made. In the questionnaires design, the researcher ensured reliability and validity are maintained.

The questionnaires comprised close-ended items on Likert scale. The items were measured on an evaluative continuum ranging from strongly disagree to strongly agree. The instrument was divided into six sections. The first section covered demographic information of participants including age, gender, form, and course of study. The second part comprised of 5 items adapted from Arthur, Dogbe, et al. (2022) to measured teaching quality. They were; (TQ1) "A quality teacher presents mathematical concepts in an orderly manner"; (TQ3) "Teachers provide enough classroom tasks for me to do in order to assess my grasp of the idea being taught" ;(TQ4) "My maths instructor urges me to learn the subject"; (TQ5) "My maths teacher offers inspiring comments for improved understanding"; Teachers have cordial relationship with students. Also, teaching competence was measured by 4 items adapted from Swank et al. (2021). The items include; (TC7) "Teachers use teaching and learning materials to improve our understanding", (TC6) "Teachers stimulates students' attention", (TC4) "Teachers guide class discussions", and (TC9) "Teachers can tell when a pupil is having difficulty". Furthermore, the items; (MC9) "I can solve challenges in my daily life by thinking mathematically", (MC8) "I can see the parallels and contrasts between mathematical ideas", (MC7) "Teacher explains the role of mathematics in our lives", and (MC10) "I can explain the significance of maths in several areas were used to measure mathematics connection construct". These items were adapted from Arthur et al. (2018). Students' opinions on history of mathematics concepts were captured by the following items adapted from Arthur, Appiah, et al. (2022): (HMC 1) “My math teachers introduce new ideas by explaining the historical background”, (HMC2) “I appreciate learning about the history of the mathematics concepts we study”, and (HMC3) “I grasp mathematics concepts better when a teacher introduces topics by their history”. Lastly, the following items adapted from Lang and Fries (2006) were used to measure students’ mathematics achievement motivation: (AM1) “I enjoy maths situations in which I may test my abilities”, (AM2) “When I am presented with a mathematics problem that I believe I can solve, I am attracted to begin working on it right away”, and (AM3) “I appreciate maths questions in which I can put my skills to solve”.

3.9 Validity and Reliability Measures of the Instrument

To guarantee that the instrument was valid and reliable, the researcher carefully developed it, pilot tested it with a sample of participants, and utilized SPSS to determine its’ psychometric properties. By assessing validity and reliability, the researcher ensured that the questionnaire is an accurate and consistent measure of the constructs been studied. Reliability refers to the questionnaire's consistency and stability across time and across diverse samples (Sujati et al., 2020). Reliability measures include internal consistency and composite reliability. Internal consistency is the degree to which the items in a questionnaire are correlated and measure the same construct. Cronbach's alpha was computed to ascertain the internal consistency of the constructs. According to Taber (2018), Cronbach alpha of 0.70 and above is acceptable. Hair et al. (2019) define composite reliability as a measure that assesses how well the items in a questionnaire work together to measure the same construct. Composite reliability was computed from the factor loadings and residual variances of the questionnaire items (Bacon et al., 1995). Composite reliabilities were ensured above the required benchmark of .70.

According to DeVellis and Thorpe (2021) validity is the extent to which a questionnaire measures what it is designed to measure. This study assessed convergent validity, and discriminant validity of the constructs (Schumaher et al., 2019). The extent to which items correlate with other items of the same construct is referred to as convergent validity (Cheah et al., 2018). On the other hand, the extent to which items do not correlate with items of unrelated constructs is referred to as discriminant validity (Hair et al., 2019). Convergent validity was estimated using average variance extracted. AVE values were ensured above 0.5 (Mendes dos Santos & Cirillo, 2021). The study also assessed discriminant validity by Heterotriat-Monotrait ratio. Henseler et al. (2015) argued that to achieve discriminant validity, all HTMT ratios should be less than 0.85.

3.10 Data Collection Procedure

In order to collect data, the researcher employed a structured questionnaires with close-ended items on Likert scale. In all, a total of 400 questionnaires were printed and administered to students in Kumasi SHTS. The surveys administration and collection were done personally by the researcher. Consent was sought from the school authority before the administration of the questionnaires. To do this, an introductory letter was submitted in person to the school after which the exact date was scheduled. The questionnaires were self-administered, hence participants independently completed them by their own interpretation and comprehension. A total of 390 questionnaires were returned. This value corresponds to 97.5 %, that is $\left(\frac{390}{400} \times 100\right)$ %. The researcher ensured data protection, confidentiality, and anonymity.

3.11 Ethical Consideration

Quantitative research is critical for producing empirical evidence and expanding knowledge in a variety of domains. However, researchers must follow specific ethics while undertaking quantitative research to guarantee that their study is done in an ethical and responsible manner. Informed consent, confidentiality and privacy, equitable treatment, transparency, and authorization were all considered. Firstly, the researcher informed participants about the study's goal, methods, potential risks, and benefits. Also, participants were free to withdraw from the research at any moment. Similarly, participants' privacy and confidentiality were protected. Data collection, storage, and analysis were all handled with extreme caution. Anonymization or de-identification procedures were used to safeguard participants' identity while reporting findings. Additionally, the study paid attention to diversity and cultural differences. Cultural, gender, and other types of diversity among participants were taken into account. Furthermore, the study guaranteed that the data collected is valid and reliable. To ensure this, appropriate data collection, storage, and analysis approaches were applied. Potential biases that might affected results were addressed. Finally, results were conveyed correctly, without distortion or manipulation.

3.12 Data Analysis

Data analysis involved preliminary exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and finally, structural equation modelling (SEM). The EFA involved principal component analysis undertaken to ascertain the required number of factors extracted. In the analysis, items that loaded either at multiple components or below 0.50 were iteratively exited to achieve better loadings. The EFA was done on SPSS to pave way for CFA on AMOS. CFA was used to validate or reject a hypothesized factor structure and to identify the best-fitting model (Hu & Bentler, 1999). Various goodness-of-fit indices, such as the chi-square statistic, the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR), are used to assess the model's fit.

To estimate direct effects, mediation and moderation effects as specified in the study objectives, SEM was utilized. SEM is a statistical technique used to assess and confirm large theoretical models that include several variables and interactions between them (Hair et al., 2011). It entails the estimation of a sequence of simultaneous equations that represent, both directly and indirectly, the relationships between variables in a model. Latent variables, observed variables, paths, and factor loadings are all key terms in SEM. Latent variables are unobservable variables that are represented by one or more observed variables. The observed variables are the latent variables' measured indicators. Factor loadings show the relationship between the observed variables and the latent variables they measure, whereas paths represent the direct correlations between the latent and observable variables.

SEM is frequently used to assess complex theoretical models that would be difficult to test using other statistical techniques like regression analysis or ANOVA. For example, to examine causal-effects relationships between many latent variables and their indicators, to assess the model's overall fit to the data, and to assess the relevance of specific paths in a model. This study utilized AMOS to perform SEM. AMOS is an acronym for Analysis of Moment Structure. AMOS is a statistical software that enables researchers to estimate models and assess the model's goodness of fit to the data using fit indices such as the chi-square statistic, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) (Kline, 2015).

CHAPTER FOUR

ANALYSIS, RESULTS AND DISCUSSION

4.0 Overview

The process of reviewing, cleaning, converting, and interpreting raw data in order to extract relevant insights and make conclusions is known as data analysis. Data analysis entails analyzing and comprehending data produced in a research project by utilizing various methodologies, tools, and statistical procedures. This chapter is focused with data analysis, interpretation, presentation, and discussion of results of the study.

4.1 Analysis and Results

4.1.1 Demographic Information of Participants

Table 2 presents the participants' background information. In all, 390 students successfully completed the questionnaire. This number comprised of 164 males, accounting for 42.1%, and 226 females, accounting for 57.9%. The number of students aged between 11-15 years, 16-20 years, 21-25 years, and above 25 years were 31, 352, 5, and 2 respectively. These values represent 7.9%, 90.3%, 1.3%, and 0.5% accordingly. The survey involved 353 form 2 and 37 form 3 students which accounts for 90.5% and 9.5% of the total number of participants. The results also show that 58 (14.9%) students offer Visual Arts, 67 (17.2%) students offer General Arts, 114 (29.2%) students offer Home Economics, 36 (9.2%) students offer Technical, 96 (24.6%) students offer General Science, and 19 (4.9%) students offer Business.

Table 2: Demographics of Students

Demographics	*Frequency (N)*	*Percentages (%)*
Gender	***390***	***100.0***
Male	164	42.1
Female	226	57.9
Age	***390***	***100.0***
11-15 years	31	7.9
16-20 years	352	90.3
21-25years	5	1.3
Above 25 years	2	0.5
Form	***390***	***100.0***
Form 2	353	90.5
Form 3	37	9.5
Course of Study	***390***	***100.0***
Visual Arts	58	14.9
General Arts	67	17.2
Home Economics	114	29.2
Technical	36	9.2
General Science	96	24.6
Business	19	4.9

Source: Field Data (2023)

4.1.2 Descriptive Statistics

Table 3 displays descriptive analysis of the items measuring Teaching Competence (TC), Teaching Quality (TQ), Mathematics Connection (MC), Achievement Motivation (AM), and History of Mathematics Concepts (HMC) Constructs respectively. The results indicate that TQ (Mean = 4.04, SD = 0.98) achieved the highest mean response followed by AM (Mean = 3.92, SD = 1.05), TC (Mean = 3.87, SD = 1.04), MC (Mean = 3.65, SD = 1.15), and HMC (M = 3.52, SD = 1.19) in that order. However, interpretation of the items' descriptive statistics was done relative to a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Descriptive analysis of the TQ scale yielded a mean of 4.04 and a standard deviation of 0.98. The mean responses of the individual items ranged from 4.10 to 3.96. TQ1 recorded the highest mean (M = 4.10, SD = 0.98) whilst TQ3 recorded the lowest mean (M = 3.96, SD = 1.00). The statistics shows that students believed quality teaching is necessary for building students achievement motivation (Ekmekci & Serrano, 2022). The descriptive results of the items measuring TC, that are; TC4, TC6, TC7, and TC9 produced mean responses of 3.86, 3.85, 3.84, and 3.93 respectively. The mean and standard deviation of the entire TC scale were 3.87 and 1.04 respectively. By comparison, TC9 had the highest mean whereas TC7 had the lowest. These results point to the fact that teaching competence, according to students', opinions affects mathematics achievement motivation (Zollman, 2009).

Analysis of the MC scale revealed a mean of 3.98 and standard deviation of 1.15. The scale consisted of the items; MC7, MC8, MC9, AND MC10. Their means and standard deviations were 3.64, 3.62, 3.70, 3.64 and 1.19, 1.07, 1.17, 1.17 respectively. These statistics show that teacher's ability to establish mathematics connections to real-life scenarios and other disciplines enhances motivation growth (Arthur et al., 2018; Trifunov, 2017). A mean of 3.52 and standard deviation of 1.19 were produced from the analysis of the HMC scale descriptively. The individual measurement items including HMC1, HMC2, and HMC3 yielded mean responses; 3.32, 3.59, 3.65 and standard deviations of 1.41, 1.10, and 1.05 respectively. According to the statistics, setting the stage for historical background of concepts arouses understudies' mathematics enthusiasm (Liu, 2003). The mathematics achievement motivation scale had a mean of 3.92 and a standard deviation of 1.05 based on descriptive analysis. The mean response varied from 4.01 to 3.75. AM4 had the lowest mean response (M = 3.79, SD = 1.08). AM2 had the highest mean response (M = 4.01, SD = 1.05).

Table 3: Descriptive Statistics

Variables	Mean	Std. Dev.
Teaching Competence (TC)	***3.87***	***1.04***
(TC4): Teachers guide class discussions.	3.86	0.97
(TC6): Teachers stimulates students' attention.	3.85	1.05
(TC7): Teachers use teaching and learning materials to improve our understanding.	3.84	1.09
(TC9): Teachers use different approaches in teaching.	3.93	1.04
Teaching Quality (TQ)	***4.04***	***0.98***
(TQ1): A quality teacher presents mathematical concepts in an orderly manner.	4.10	0.98
(TQ3): Teachers provide enough classroom tasks for me to do in order to assess my grasp of the idea being taught.	3.96	1.00
(TQ4): My maths instructor urges me to learn the subject.	4.01	1.02
(TQ5): My maths teacher offers inspiring comments for improved understanding.	4.17	0.95
(TQ8): Teachers have cordial relationship with students.	3.98	0.96
Mathematics Connection (MC)	***3.65***	***1.15***
(MC7): Teacher explains the role of mathematics in our lives.	3.64	1.19
(MC8): I can see the parallels and contrasts between mathematical	3.62	1.07
ideas.	3.70	1.17
(MC9): I can solve challenges in my daily life by thinking mathematically.	3.64	1.17
(MC10): I can explain the significance of maths in several areas.		
Achievement Motivation (AM)	***3.92***	***1.05***
(AM1): I enjoy maths situations in which I may test my abilities.	3.96	1.05
(AM2): When I am presented with a mathematics problem that I believe I can solve, I am attracted to begin working on it right away.	4.01	1.05
(AM3): I appreciate maths questions in which I can put my skills to	3.90	1.01
solve.	3.79	1.08
(AM4): Mathematics activities that allow me to put my skills to test		
attract me.	***3.52***	***1.19***
History of Mathematics Concepts (HMC)	3.32	1.41
(HMC1): My math teachers introduce new ideas by explaining the		
historical background.	3.59	1.10
(HMC2): I appreciate learning about the history of the mathematics		
concepts we study.	3.65	1.05
(HMC3): I grasp mathematics concepts better when a teacher introduces topics by their history.		

Source: Field Data (2023)

4.1.3 Construct Reliability Analysis

Reliability analysis is critical in determining the consistency and internal consistency of scales (Streiner, 2003). Reliability analysis aids scale refinement by identifying problematic items, resulting in better scales (Tavakol & Dennick, 2011). Cronbach's alpha coefficient is a commonly used reliability estimate because of its capacity to quantify the internal consistency of multi-item scales (Cronbach, 1951). Cronbach's alpha is a statistical measure of a scale's internal consistency. It evaluates how well various items on a scale measure the same constructs. Cronbach's alpha coefficient interpretation is based on its magnitude. The coefficient has a value between 0 and 1, with higher values indicating better internal consistency. A value of 0.70 or higher is generally deemed acceptable, indicating a high level of internal consistency. To guarantee that the questionnaires accurately measure the target constructs, analysis of the internal consistency was done. Cronbach alpha was computed on SPSS (version 23).

Table 4: Alpha-reliability

Constructs	**Cronbach Alpha**	**Number of Items**
Teaching Competence (TC)	0.820	4
Teaching Quality (TQ)	0.811	5
Mathematics Connection (MC	0.827	4
Achievement Motivation (AM)	0.814	4
History of Mathematics Concepts (HMC)	0.709	3

Source: Field Data (2023)

According to the reliability results reported on Table 4, Cronbach alpha for all unobserved variables were more than 0.7, indicating that internal consistency has been attained. Alpha-reliabilities of TC, TQ, MC, AM, and HMC were 0.820, 0.811, 0.827, 0.814, and 0.709

accordingly. Therefore, the reliability coefficients of the constructs met the 0.7 minimal requirement.

4.1.4 Preliminary Analysis

Field (2013) defined preliminary analysis as the examination and exploration of data prior to conducting in-depth statistical analyses. Preliminary analysis employs descriptive statistics, data cleaning, and data screening to get insight into dataset's features. Preliminary analysis involved Exploratory Factor Analysis (EFA), carried out to identify the number of items extracted under each construct. Also, to assess the model fitness, Confirmatory Factor Analysis (CFA), Discriminant Validity, Convergent Validity, and Composite Reliability were estimated.

4.1.5 Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a statistical technique for identifying the latent factors in a set of observed variables. EFA assists the identification of patterns of correlations and determining the number of factors required to explain observed variance in data (Costello & Osborne, 2005). EFA was performed on SPSS (version 23) by principal component method and varimax rotation with Kaiser Normalization. Factor loadings, which represent the degree and direction of the association between each observed variable and the extracted factors were examined. Higher loadings (≥ 0.5) indicated a stronger relationship between a variable and a factor. Similarly, eigenvalues larger than 1 or a clear break in the scree plot were considered. Eigenvalues show the amount of the variation explained by each factor.

4.1.6 Confirmatory Factor Analysis (CFA)

Table 5: Results of Exploratory Factor Analysis

KMO and Bartlett's Test					
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.					.836
Bartlett's Test of Sphericity	Approx. Chi-Square				2887.548
	df				190
	Sig.				.000
Measurement Items	Component				
	1	2	3	4	5
TQ5	.749				
TQ8	.739				
TQ4	.737				
TQ3	.735				
TQ1	.686				
MC9		.811			
MC10		.799			
MC8		.788			
MC7		.785			
TC6			.813		
TC7			.802		
TC9			.775		
TC4			.724		
AM3				.779	
AM2				.767	
AM4				.761	
AM1				.724	
HMC1					.804
HMC2					.784
HMC3					.709

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.
Source: Field Data (2023)

CFA was conducted to evaluate the goodness-of-fit between the hypothesized model and the observed data. It entailed defining priori factor loadings, which represent the expected correlations of the latent factors with the observable variables. CFA was performed in Amos to determine the measurement model's fitness. In the CFA, items which loaded below 0.50

were excluded. As a results, the initial 50 items on the scale were reduced to 20; 5 for TQ, 4 for TC, 4 for AM and 4 for MC, as well as 3 for HMC. In addition, model fit indices were also maintained at their respective benchmarks, according to Hu's and Bentler's (1999) criteria, to ensure overall fitness of the measurement model. Comparative Fit Index (CFI) compares the fit of the hypothesized model to a null or independence model. It ranges from 0 to 1, with values closer to 1 indicating better fit. A CFI value of 0.952 ($> .90$) was attained, which typically indicates a good fit. Goodness-of-Fit Index (GFI) assesses the proportion of variance and covariance that the hypothesized model accounts for. A GFI value of 0.933 ($> .90$) was attained, which is frequently seen as satisfactory. PCLOSE is the probability of obtaining a chi-square statistic equal to or greater than the one observed. A PCLOSE value of 0.776 ($> .05$) indicated that there is a substantial difference between the observed and expected models. The chi-square to degrees of freedom ratio (CMIN/DF) is the ratio of the chi-square statistic (CMIN = 290.073) to its degrees of freedom (DF = 159). CMIN/DF of 1.824 (between 1 and 3) indicated good fit. Tucker-Lewis Index (TLI) compares the hypothesized model's fit to a baseline model, such as the null or independence model. TLI of 0.947 ($> .90$) was obtained indicating a good fit. RMSEA (Root Mean Square Error of Approximation) is a measure of difference between the hypothesized model and the population

covariance structure. RMSEA of 0.046 ($< .08$) was deemed acceptable. RMR (Root Mean Square Residual) is the average difference between observed and expected covariance or correlations. RMR reading of 0.055 indicated a good fit.

Table 6: Table of Confirmatory Factor Analysis
Source: Field Data (2023)

Model Fit Indices: *CMIN =290.073; DF = 159; CMIN/DF = 1.82; CFI = .952; TLI = .943; RMR = .055; RMSEA = .046; PCLOSE = .776; GFI=.933; AGFI=.911*	**Std. Factor Loading**
TEACHING COMPETENCE (TC): CA=0.820; CR=0.860; AVE=0.607	
(TC4): Teachers guide class discussions.	.69
(TC6): Teachers stimulates students' attention.	.74
(TC7): Teachers use teaching and learning materials to improve our understanding.	.77
(TC9): Teachers use different approaches in teaching.	.72
TEACHING QUALITY (TQ): CA=0.758; CR=0.851; AVE=0.532	
(TQ1): A quality teacher presents mathematical concepts in an orderly manner.	.67
(TQ3): Teachers provide enough classroom tasks for me to do in order to assess my grasp of the idea being taught.	.72
(TQ4): My maths instructor urges me to learn the subject.	.69
(TQ5): My maths teacher offers inspiring comments for improved understanding.	.73
(TQ8): Teachers have cordial relationship with students.	.61
MATHEMATICS CONNECTION (MC): CA=0.827; CR=0.874; AVE=0.633	
(MC7): Teacher explains the role of mathematics in our lives.	.83
(MC8): I can see the parallels and contrasts between mathematical ideas.	.62
(MC9): I can solve challenges in my daily life by thinking mathematically.	.79
(MC10): I can explain the significance of maths in several areas.	.62
ACHIEVEMENT MOTIVATION (AM): CA=0.814; CR=0.844; AVE=0.575	
(AM1): I enjoy maths situations in which I may test my abilities.	.69
(AM2): When I am presented with a mathematics problem that I believe I can solve, I am attracted to begin working on it right away.	.73
(AM3): I appreciate maths questions in which I can put my skills to solve.	.75
(AM4): Mathematics activities that allow me to put my skills to test attract me	.73
HISTORY OF MATHEMATICS CONCEPTS (HMC): CA=0.709; CR=0.702; AVE=0.588	
(HMC1): My math teachers introduce new ideas by explaining the historical background.	.62
(HMC2): I appreciate learning about the history of the mathematics concepts we study.	.81
(HMC3): I grasp mathematics concepts better when a teacher introduces topics by their history.	.62

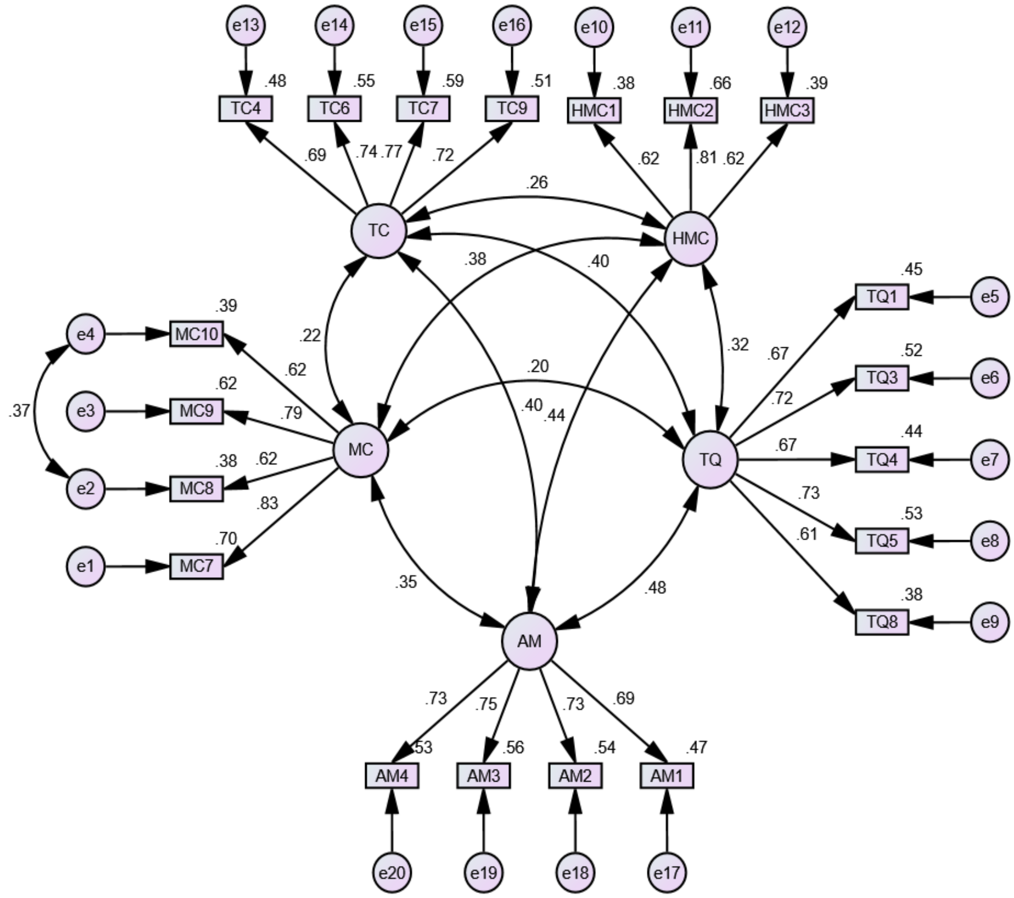


Figure 3: ***Diagrammatic Presentation of Confirmatory Factor Analysis***
Source: Field Data (2023)

4.1.7 Discriminant Validity

Discriminant validity assesses whether constructs or variables in a study differ from one another. It investigates the extent to which distinct indicators are uncorrelated or not substantially correlated with one another (Henseler et al., 2015). The Fornell and Larker Criterion has been used to assess discriminant validity in a number of studies (Hamid et al., 2017; Roemer et al., 2021). Recent criticisms of the Fornell and Larker Criterion includes stringent requirement, violation of AVE criterion, inflated AVE, and focus on manifest variables (Henseler et al., 2015). These criticisms had caused rapid utilization of the Heterotriat-Monotrait (HTMT) ratio which provide more robust and accurate measure of discriminant validity. The study utilized Heterotriat-Monotrait ratio to determine the discriminant validity. Assessment of discriminant validity by HTMT ratio requires that all values must be ensured less than 0.85 (Henseler et al., 2015; Roemer et al., 2021) as shown in Table 7.

Table 7: Heterotriat-Monotrait Ratios

	TQ	TC	MC	AM
TQ				
TC	.403			
MC	.198	.211		
AM	.485	.402	.338	
HMC	.320	.263	.365	.446

Source: Field Data (2023)

4.1.8 Convergent Validity

Convergent validity assesses the extent to which multiple indicators of the same construct are correlated or converge with one another (Cheah et al., 2018). It investigates if many measurements of a construct yield similar results, showing convergence on the underlying construct. Convergent validities of the constructs were identified using Average Variance Extracted (AVE) (Bornmann et al., 2009; Carlson & Herdman, 2012). Table 6 shows that the average variance extracted were above the minimum benchmark of 0.50 (Mendes dos Santos & Cirillo, 2021). Hence, the constructs in the study had the required convergent validity.

4.1.9 Composite Reliability

Composite reliability is a statistical metric computed to determine the internal consistency and reliability of a scale. It denotes how consistent and reliable the observed variables within a composite measure are in assessing the underlying construct. The McDonald's Omega coefficient (ω) was used to calculate the composite reliability. According to Raykov (2009), composite reliability (ω) is the ratio of the squared sum of the indicators' standardized loadings to the sum of the squared loadings plus the sum of the error variances. To be deemed satisfactory, composite reliability should exceed 0.70 (Hair et al., 2017). Table 6 shows that the constructs had the required composite reliabilities.

4.1.10 Path Analysis

Path analysis is a statistical approach used to investigate the relationships among variables and to assess direct and indirect impacts. This study applied structural equation modelling generated on AMOS (version 23) to examine the complicated causal paths between the variables (Kline, 2015). The path analysis allowed the evaluation of the extent and direction of relationships while taking into consideration interdependence. It entailed building a model with directed arrows, known as paths, that reflect the hypothesized causal relationships. The coefficients assigned to the paths represent the extent and direction of the association.

4.1.11 Analysis of Direct Effects

Table 8 shows the results of the direct effects of the control variables (age, gender, course, and form) and the independent variables (TQ, TC, MC, and HMC) on the dependent variable (AM). According to Table 8, the impact of age on AM was negative and insignificant (β = -0.084, t = -0.893, p = 0.372). The impact of gender on AM was negative and insignificant (β = -0.039, t = -0.513, p = 0.608). The impact of course on AM was positive and significant (β = 0.010, t = 0.453, p = 0.651). The impact of form on AM was positive and significant (β = 0.018, t = 0.208, p = 0.835). In addition, the impact of TQ on AM was positive and significant (β = 0.336, t = 4.574, p < .001). The impact of TC on AM was positive and significant (β = 0.198, t = 2.945, p = .003). The impact of HMC on AM was positive and significant (β =

0.200, t = 2.522, p < 0.001). These results suggested that gender, age, course, and form did not significantly affect the mathematics achievement motivation of students. On the other hand, TC, TQ, and HMC all produced positive and significant effects on the mathematics achievement motivation of students.

Moreover, to test H1, the direct impact of MC on AM was assessed. The results revealed that MC has positive and significant effect on AM (β = 0.112, t = 2.548, p = 0.011). The test was done at 5% significance level for which a p-value less than .001 far below .05 was revealed. This indicated that there is enough evidence to support H1. Therefore, H1 was accepted. According to students' responses, teachers' ability to connect mathematics to real-life situations and other disciplines accounts for about 16% increase in senior high school students' achievement motivation in mathematics.

Table 8: Summary of Direct Path Estimates

Direct Paths	UnStd. Estimate	C.R.\t	S.E.	p-value
AM←Age	-0.084	-0.893	0.094	0.372
AM←Gender	-0.036	-0.513	0.070	0.608
AM←Course	0.010	0.453	0.022	0.651
AM←Form	0.018	0.208	0.086	0.835
AM←TQ	0.336	4.574	0.074	***
AM←TC	0.198	2.945	0.067	0.003***
AM←MC	0.122	2.548	0.044	0.011**
AM←HMC	0.200	3.522	0.057	***
Model Fit Indices: ***CMIN = 462.715; DF = 241; CMIN/DF = 1.920; CFI = .922; TLI = .911; RMR = .058; RMSEA = .049; PCLOSE = .624***				

**** ~ P-value significant at 1% (0.01)*

*** ~ P-value significant at 5% (0.05)*

Source: Field Data (2023)

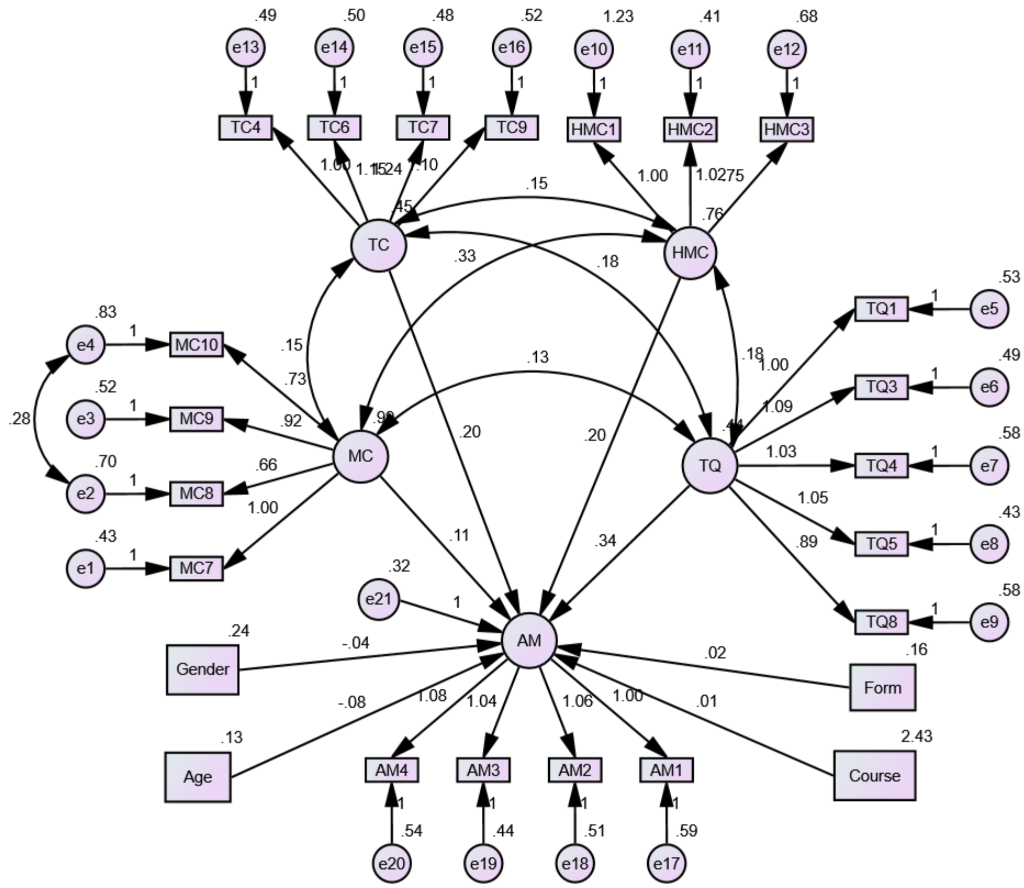


Figure 4: ***Diagrammatic Representation of Direct Paths***
Source: Field Data (2023)

4.1.12 Mediation Effects Analysis

The study assessed the mediation effect of TQ on the relationship between MC and AM. Bias-Corrected (BC) percentile bootstrap method with 5,000 bootstrap samples was utilized at 95% confidence level. The bias correction factor was used to adjust the point estimate of the indirect effect and to calculate bias-corrected confidence intervals. These adjusted estimates provide a more accurate reflection of the true indirect effect in the population and reduce the potential bias introduced by standard bootstrapping. Model fit indices were ensured at their respective benchmarks. The indirect effect of MC on AM was 0.067 ($a \times b = 0.141 \times 0.476$), which was positive and significant (p = 0.007), because the confidence interval (0.017, 0.142) did not cross zero. The direct effect of MC on AM in the presence of the mediator (TQ) was also revealed significant (β = 0.192, p <0.001). Hence, TQ partially mediated the relationship between MC and AM. Therefore, H2 was accepted.

Table 9: Summary of Mediation Analysis

Relationship	Direct Effects	Indirect Effects	Confidence Interval		P-value	Conclusion
			Lower Bound	Upper Bound		
AM←TQ←MC	0.192***	0.067	0.017	0.142	0.007***	Partial mediation

****Significant at 1%*

Source: Field Data (2023)

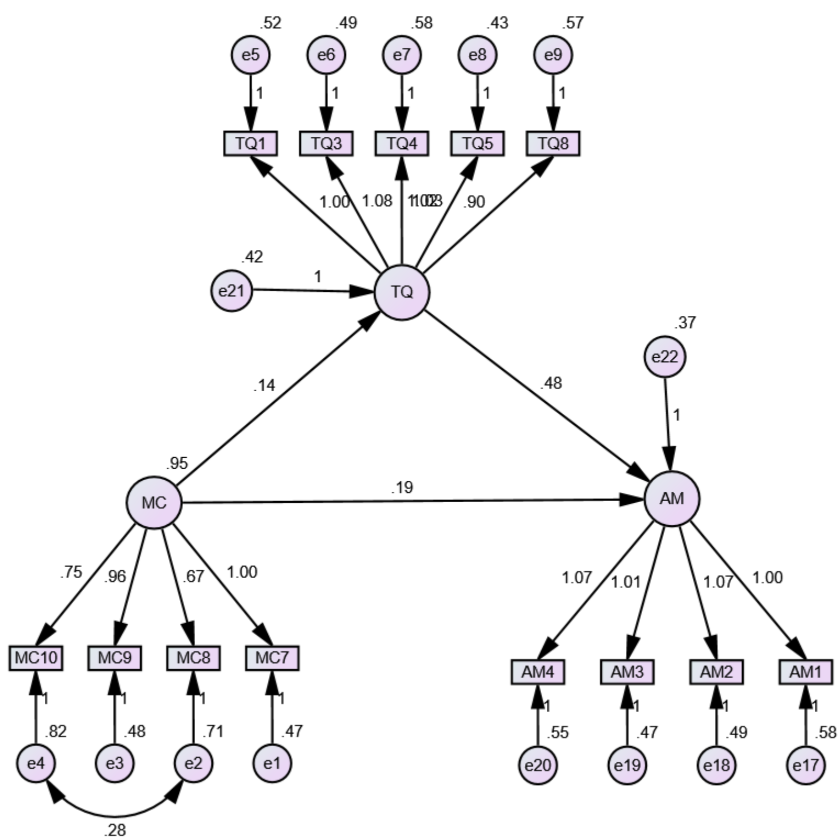


Figure 5*: Diagram of Mediation Effects*
Source: Field Data (2023)

4.1.13 Moderation Analysis

The study assessed the moderation effects of TC on the relationship between MC and AM. Table 10 shows negative and insignificant interaction effect of TC (β = -0.069, t = -1.611, p = 0.107). Therefore, H3 was rejected. This result was interpreted that the impact of MC on AM was neither weakened nor strengthened by TC.

Table 10: Summary of Moderation Analysis

Relationship	*β*	*C.R./t*	*P-Value*
AM←TC	0.362	5.282	***
AM←MCTC	-0.069	-1.611	0.107

***Significant at 1%*

Source: Field Data (2023)

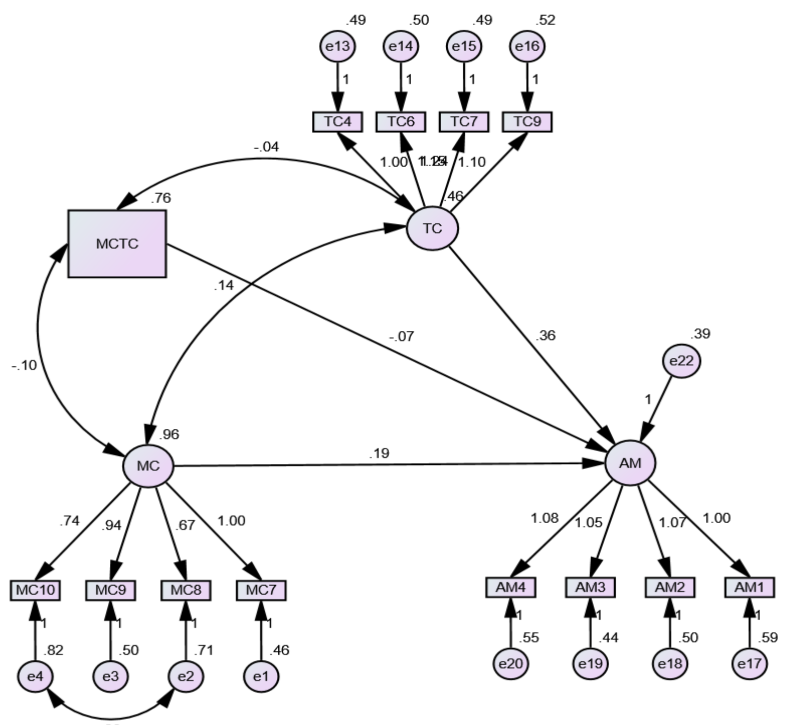


Figure 6: ***Diagram of Moderation Effects***
Source: Field Data (2023)

4.1.14 Moderated-Mediation Analysis

The study assessed the moderated-mediation effects of History of Mathematics Concepts (HMC) on the second half of the path of the indirect effect of Mathematics Connection (MC) on Achievement Motivation (AM) through Teaching Quality (TQ). Andrew Hayes process model 14 was utilized by Bias-Corrected (BC) percentile bootstrap technique with 5,000 bootstrap samples at 95% confidence level using the estimands function in AMOS. Table 11 shows that the moderated-mediation index value of HMC is significant (index = -0.011, p = 0.046) at 95% confidence interval (-0.029, 0.00). This value indicates the extent of conditional moderation. The results showed that in comparison to indirect effects at low HMC levels through TQ, the indirect effect of MC on AM through TQ is lower at higher HMC levels. The interpretation is that, with increase in HMC, the indirect effect of MC on AM through TQ is weakened. Therefore, H4 was rejected.

Table 11: Summary of Moderated-Mediation Analysis

Direct Relationships	Unstandardized β	C.R/t		P-Value
TQ←MC	0.143	3.61		***
AM←TQ	0.330	6.603		***
AM←HMC	0.168	6.671		***
AM←HMCTQ	-0.076	-1.983		0.048**
Moderated Indirect Relationships	Direct Effect	Indirect Effect	C. I	P-Value
AM←TQ←MC	0.168	0.047	(0.016, 0.093)	0.004**
Probing Moderated Indirect Relationships				
Low HMC Level		0.058	(0.018, 0.111)	0.005**
High HMC Level		0.037	(0.011, 0.083)	0.004**
Moderated-mediation Index		-0.011	(-0.029, 0.00)	0.046**

****Significant at 1% (0.01)*
***Significant at 5% (0.05)*
Source: Field Data (2023)

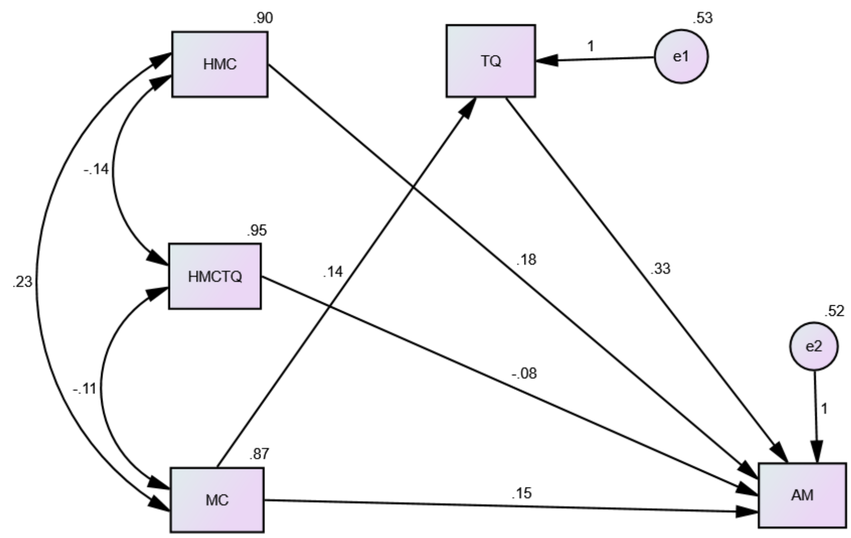


Figure 7: ***Diagram of Moderated-Mediation Effects***
Source: Field Data (2023)

4.2 Presentations and Discussion of Results

This section presents the discussion of the study's findings in comparison to earlier studies. The discussion was arranged around the study's objectives, which were as follows:

1. Direct effects of Mathematics Connection on Achievement Motivation.
2. Mediation effects of Teaching Quality on the relationship between Mathematics Connection and Achievement Motivation.
3. Moderation effects of Teaching Competence on the relationship between Mathematics Connection and Achievement Motivation.
4. Moderated-mediation effects of History of Mathematics Concepts on the first half of the path of the indirect effects of Mathematics Connection on Achievement Motivation.

4.2.1 Direct Effects of Mathematics Connection on Achievement Motivation

The study sought to identify the direct effect of Mathematics Connection (MC) on the Mathematics Achievement Motivation of senior high school students. The results revealed that Mathematics Connection has positive and significant effect on Achievement motivation (AM) ($\beta = 0.112$, $t = 2.548$, $p = 0.011$). The beta (β) coefficient denotes the predicted change in AM due to a percentage increase in MC. The beta coefficient in this situation is 0.112, suggesting that for every 1% rise in MC, AM is expected to increase by 11.2%. The significance of the beta coefficient is determined by the t-value. A t-value of 2.548 indicated that the effect of MC on AM is statistically significant. The probability of observing the effect of MC on AM was determined by the p-value. A p-value of 0.011, which was less than a significance level of 0.05. As a result, it was inferred that MC has a statistically significant influence on AM.

This results is consistent with previous research that emphasized the need of making connections between various mathematical concepts and real-world applications, and other disciplines (Abdulrahim et al., 2023; Cejka et al., 2006; Kwon, 2016; Rodionov & Dedovets, 2017; Rooch et al., 2012; Trifunov, 2017). When students see a clear connection between mathematics and its practical application, it increases their desire to engage and achieve in mathematics (Arthur et al., 2018). This beneficial effect of MC on AM has been seen in a variety of educational contexts and age groups (Abramovich et al., 2019). The relationship is supported by theories such as expectancy-value theory (Wigfield & Eccles, 2000b). The theory suggests that when students realize the usefulness and importance of mathematics in real-world circumstances, they are more likely to experience greater intrinsic motivation, task satisfaction, and a sense that their efforts will result in good outcomes. These motivators can then influence their achievement-related behaviors and performance (Hulleman et al., 2008). The present findings are in line with studies in which MC significantly improved students' self-efficacy beliefs and result expectations in mathematics (Ozgen, 2013). Eccles and Wigfield (2020) stressed the relevance of value and usefulness in driving students' engagement and accomplishment. Students gain better confidence in their skills to address real-world issues by demonstrating how mathematical principles are useful outside of the classroom, leading to increased motivation (Crawford, 2001).

Furthermore, the present findings agree with Pajares and Miller (1994), Groenendijk et al. (2013), and Hulleman & Harackiewicz (2009). Pajares and Miller (1994) investigated the influence of self-efficacy beliefs in the relationship between mathematics problem solving. Their findings revealed that when students see a strong relationship between mathematics and real-world settings, it improves their self-efficacy beliefs, which contribute to higher levels of motivation and achievement. According to Groenendijk et al. (2013), observing others effectively applying mathematical principles to real-life circumstances boost pupils' confidence in their own skills and inspire the determination to attain similar results. In addition, Hulleman & Harackiewicz (2009) investigated the impact of values-affirmation interventions on students' motivation and success in mathematics. By helping students reflect on their personal beliefs and how math corresponds with their lives, the treatments attempted to reaffirm the relevance and importance of mathematics. The results showed that the values-affirmation treatments enhanced motivation and performance, emphasizing the importance of meaningful relationships in developing Achievement Motivation. In conclusion, studies support the positive and significant influence of Mathematics Connection on Achievement Motivation. The research consistently shows that connecting mathematics to real-world applications improves students' motivation, self-efficacy views, and performance in the subject.

4.2.2 Mediation Effects of Teaching Quality on the Relationship between Mathematics Connection and Achievement Motivation

When a third variable, in this case Teaching Quality (TQ), plays a role in explaining the relationship between the independent variable, Mathematics Connection (MC) and the dependent variable, Achievement Motivation (AM), this is referred to as mediation. To get insight into how TQ impacts the relationship between MC and AM, mediation effects were investigated. The study's findings revealed that Mathematics Connection (MC) has a strong indirect effect on Achievement Motivation (AM) via Teaching Quality (TQ). The Bias-Corrected (BC) percentile bootstrap approach was used to examine the mediation effect with 5,000 bootstrap samples at a 95% confidence level. The indirect effect size, represented by the product of the path coefficients ($a \times b$), was found to be 0.067. This indicates that a unit increase in MC leads to a 0.067 increase in AM through the mediating variable TQ. The indirect effect was statistically significant ($p = 0.007$) as the confidence interval (0.017, 0.142) did not include zero. This suggests that MC has a positive and significant influence on AM through TQ. Additionally, the direct effect of MC on AM, even in the presence of the mediator TQ, was found to be significant ($\beta = 0.192$, $p < 0.001$). This implies that MC has a direct impact on AM, regardless of the mediating effect of TQ. Based on these results, TQ partially mediated the relationship between MC and AM. This means that TQ plays a role in explaining the relationship between the two variables, but it did not completely account for the relationship.

The findings align with Boston's (2012) survey of middle school teachers in a medium-sized metropolitan district. According to his results, high-quality assignments and exercises which includes cognitively demanding activities such as real-world problem-solving tasks promote students critical thinking and motivation. Additionally, several other studies support the findings that Teaching Quality mediates the relationship between Mathematics Connection and Achievement Motivation. For example, Khotimah's (2016) study of mathematics education students showed that lecturers' abilities to develop discovery-based contextual learning situations led to effective teaching which improved learning motivation of understudies. Similarly, research by Papadakis et al. (2016) identified positive influence of quality instructions that incorporate real world applications that makes mathematics relevant on early graders mathematics interest and their learning abilities. Also, the results were consistent with Bandura (1986) theoretical framework, which stressed the role of instructors as social models and their effect on students' motivation and self-efficacy beliefs. According to this viewpoint, when teachers effectively establish mathematics connections by offering real-world examples, and providing high-quality teaching, students' motivation and achievement improve.

Moderation Effects of Teaching Competence on the Relationship between Mathematics Connection and Achievement Motivation

The moderation effect of Teaching Competence (TC), as indicated by the coefficient of -0.069, suggests that TC did not significantly strengthen or weaken the relationship between Mathematics Connection (MC) and Achievement Motivation (AM). The t-value of -1.611 indicates that the coefficient is not statistically significant, with a p-value of 0.107, which is greater than the conventional threshold of 0.05. The interpretation was that TC has no interaction effect on the impact of MC on AM. In other words, the existence of TC had no discernible effect on the relationship between MC and AM. It is crucial to emphasize that the lack of substantial moderating effect does not mean that TC is inconsequential in the context of MC and AM. Simply put, in this study, the relationship between MC and AM did not vary significantly by TC.

Though several literatures asserted that teacher's competency to guide real-world problem-solving tasks, mathematical modeling, and interdisciplinary connections reinforce the development of students' achievement motivation in mathematics. However, the present finding contradicts existing literature. In Cotič's and Zuljan's (2009) study, for example, the impact of real-life problem-solving activities on students' motivation and performance was related to teacher's ability in presenting these tasks. Similarly, the beneficial influence of mathematics connections on student motivation and success in the study by Su and Cheng (2015) was attributable to teacher's ability to effectively guide the implementation of activities and establish a pleasant learning environment. The same applies to Surya et al. (2017) study, in which the impact of mathematical modeling on student motivation and problem-solving abilities was influenced by the teaching competence. Moreover, the present results are inconsistent with that of An et al. (2004) and Kelly (2006). An et al. (2004) found that teachers with greater levels of content knowledge and pedagogical content knowledge were more effective at real-world problem-solving activities and encouraging student motivation and performance. Kelly (2006) also discovered that instructor competence had a significant role in real-world problem-solving activities. According to him, instructors who exercise competence in making mathematics connections by using manipulatives highly impacted on student motivation.

4.2.3 Moderated-Mediation Effects of History of Mathematics Concepts on the Relationship between Mathematics Connection and Achievement Motivation

According to Hayes (2015), moderated mediation refers to a situation where the mediating effect of Teaching Quality (TQ) on the relationship between Mathematics Connection (MC) and Achievement Motivation (AM), is influenced by History of Mathematics Concepts (HMC). In other words, the indirect effect of MC on AM through TQ is contingent upon the levels or conditions of HMC. Per the findings, low HMC levels heightens the indirect effect of MC on AM through TQ whereas the indirect effect of MC on AM through TQ is lowered at higher HMC levels. This means that an increase in HMC weakens the indirect effect of MC on AM.

Extant studies revealed that historical context gives a richer knowledge of mathematical concepts and their applications. That is, history provides the basis to construct problem-based lessons that interest and encourage students. Arthur, Appiah, et al. (2022) opined that it is necessary to consider the historical evolution of mathematical models for solving real-world problems. The strategy increases the enjoyment of teaching and the incentive of students to learn. History-rich instruction has a favorable influence on learners' motivation and attitudes about mathematics (Doz, 2021). Betül (2012) noticed that students' enthusiasm for active learning participation increased as history served as an antidote to mathematics anxiety. Bütüner's and Baki's (2020) study found that students experienced the utilitarian value of mathematics as they engaged in history-rich lessons. Also, Arthur 2012 identified that teachers' explanations of historical events underlying topics spark students' comprehension, leading to increase in mathematics interest. However, the present discoveries are inconsistent with these findings.

Despite research demonstrating the worth of mathematics history in schools, there are serious and basic issues with history integration. In the notion of Fried (2001), while it is desirable to incorporate historical topics into instruction, the teaching of contemporary mathematical procedures required in the pure and applied sciences leads teachers to either belittle or misrepresent history. This dedication, in particular, compels teachers to take, what Fried (2001) referred to as "Whiggish" approach to teaching mathematics with historical themes. First, history of mathematics diverts education from the normal stream of instruction, and subsequently, it transforms mathematics study into the study of archaic mathematics texts. As a results, the level of students perceptions of mathematics caused by incorporating history of mathematics in instruction could not significant (Arthur, Appiah, et al., 2022) because teaching quality could be weakened by this approach.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter summarizes the salient points in the study. Also, conclusions were arrived at the major findings, and recommendations were suggested to stakeholders of Ghana education including teachers, teacher educators, Ghana Education Service, National Teaching Council and many more.

5.1 Summary of the Study

The study explored the mediating and moderating effects of teaching quality, teaching competence, and history of mathematics concepts on the relationship between mathematics connection and achievement motivation. A survey was undertaken in Kumasi senior high technical School in Kumasi of Ghana's Ashanti region. The study adopted descriptive survey design on a random sample of 400 form 2 and form 3 students selected from a population of about 3200 pupils offering the courses; General Arts, General Science, Visual Arts, Business, Home Economics, and Technical. The study captured data of students' opinions about the constructs using structured questionnaires which were then analyzed by structural equation modelling (SEM) on AMOS (version 23). Preliminary analyses involved exploratory factor analysis, and confirmatory factor analysis. Construct reliability metrics included computed alpha-reliabilities and composite reliabilities. Construct validity metrics were also determined by computing discriminant validity and convergent validity. To achieve the objectives of the study, estimations of direct effects, indirect effects and interaction effects were conducted.

5.2 Major Findings

The study made the following discoveries:

1. Demographic variables (age, gender, form, and course) were revealed to have insignificant effects on mathematics achievement motivation of students.
2. Mathematics connection, teaching quality, teaching competence, and history of mathematics concepts all positively and significantly predicted achievement motivation.
3. The indirect effect of mathematics connection on achievement was found to be positively mediated by teaching quality.
4. The association of mathematics connection with achievement motivation was shown insignificantly affected by the interaction effect of teaching competence.
5. The second half of the path of the indirect effect of mathematics connection on achievement motivation was identified negatively and significantly moderated by history of mathematics concepts.

5.3 Conclusions

The study assessed the mediation and moderation effects of teaching quality, teaching competence, and history of mathematics concepts on the relationship between mathematics connection and achievement motivation of senior high school students in Ghana. In conclusion, mathematics connection, teaching quality, teaching competence, and history of mathematics concepts all revealed substantial favorable influence on mathematics achievement motivation. Additionally, teaching quality mediated the effects of mathematics connection on achievement motivation. Also, teaching competence failed to moderate the direct effects of mathematics connection on achievement motivation. Lastly, the effects of mathematics connection on achievement motivation through teaching quality was moderated by history of mathematics concepts.

5.4 Recommendations

According to the findings of the study, the following were proposed:

1. In mathematics teaching and learning, teachers should establish mathematics connections to real-life scenarios, other subjects, and students' lives. This technique is contingent upon the syllabus and mathematics textbooks inclusion of real-life problem-solving tasks for various topics. NaCCA should ensure that the mathematics syllabus and textbooks for senior high schools incorporate real-life scenarios, examples and activities that are motivating. In doing so, understudies nurture the desire and like for mathematics concepts.
2. Ghana Education Service should ensure that recruitment require mathematics instructors should be educated enough, possess the relevant credentials and certification from accredited institutions, and have better interpersonal relationships. Mathematics instructors should be in possession of the minimum academic qualifications to deliver effective lessons that incorporate relevant real-word examples.
3. National teaching Council should ensure that mathematics instructors had sufficient grasp of mathematics content as well as pedagogical skills necessary to strengthen the preparation and delivery of lessons that incorporate real-world problem-solving tasks. To do so, professional development programs should be planned and implemented regularly. These include workshops, seminars, symposiums, online discussions etc. that builds the professional competence of mathematics teachers.
4. Teachers should ensure that their inclusion of historical themes of concepts in instruction should not waste instructional time, and diverts students' attention from the topic at hand.

Because, telling too much history relates modern teaching to archaic ideas which confuses learner

REFERENCES

Abdulrahim, R., De Mesa, E., & Roxas, P. A. (2023). Real-life application and appreciation of mathematics of grade eight (8) students. *World Journal of Advanced Research and Reviews*, *17*(2), 619–625. https://doi.org/10.30574/wjarr.2023.17.2.0266

Abramovich, S., Grinshpan, A. Z., & Milligan, D. L. (2019). Teaching Mathematics through Concept Motivation and Action Learning. *Education Research International*, *2019*.

Adam, A., & Mahmoud, M. A. (2014). Market Positioning of Public and Private Universities in Ghana : Students Perspective. *Management Dynamics in the Knowledge Economy*, *2*(1), 123–154.

Aguilar, J. J. (2021). High School Students' Reasons for disliking Mathematics: The Intersection Between Teacher's Role and Student's Emotions, Belief and Self-efficacy. *International Electronic Journal of Mathematics Education*, *16*(3), em0658. https://doi.org/10.29333/iejme/11294

Allen, R., & Babbie, E. (2013). Essential Research Methods for Social Work. In *Cengage Learning*. https://pdfuni.com/sample/Science/SC101-200/SC580/sample－Essential Research Methods for Social Work 4th 4E.pdf

An, S. A., Kulm, G. O., & Ma, T. (2008). The Effects of a Music Composition Activity on Chinese Students' Attitudes and Beliefs towards Mathematics : An Exploratory Study. *Journal of Mathematics Education*, *1*(1), 96–113.

An, S. A., Tillman, D. A., Boren, R., & Wang, J. (2014). Fostering elementary students' mathematics disposition through music-mathematics integrated lessons. *International Journal for Mathematics Teaching & Learning*, 19.

An, S., Kulm, G., & Wu, Z. (2004). The Pedagogical Content Knowledge of Middle School, Mathematics Teachers in China and the U.S. *Journal of Mathematics Teacher Education*, *7*(2), 145–172. https://doi.org/10.1023/b:jmte.0000021943.35739.1c

Angrist, B. J. D., & Guryan, J. (2004). Teacher Testing , Teacher Education , and Teacher Characteristics. *The American Economic Review*, *94*(2), 241–246.

Anwar, K., Asari, S., Husniah, R., & Asmara, C. H. (2021). Students ' Perceptions of Collaborative Team Teaching and Student Achievement Motivation. *International Journal of Instruction*, *14*(1), 325–344.

Ariyani, W., Suyitno, H., & Junaedi, I. (2020). Mathematical Connection Ability and Students' Independence in Missouri Mathematics Project E-Learning. *Unnes Journal of Mathematics Education Research*, *9*(2), 185–189.

Arthur, Y. D. (2019). *Students Mathematics Interest in Senior High Schools : Empirical Evidence from Ashanti Region of Ghana*. *15*(3), 1–14. https://doi.org/10.9734/ARJOM/2019/v15i330147

Arthur, Y. D., Appiah, S. K., Amo-Asante, K., & Asare, B. (2022). Modeling student ' s interest in mathematics : Role of history of mathematics , peer- assisted learning , and student ' s perception. *EURASIA Journal of Mathematics, Science and Technology*

Education, *18*(10).

Arthur, Y. D., Asiedu-addo, S., & Assuah, C. (2017a). Connecting Mathematics to Real Life Problem using Instructor Quality and Availability , Mathematics Facility and Teacher Motivation for Prediction. *International Journal of Scientific Research in Education*, *10*(3), 311–324.

Arthur, Y. D., Asiedu-addo, S., & Assuah, C. (2017b). *Teacher-Student Variables as Predictor of Students ' Interest in Mathematics : The Use of Stepwise Multiple Linear Regression Analysis*. *4*(3), 1–11. https://doi.org/10.9734/ARJOM/2017/33544

Arthur, Y. D., Boadu, S. K., & Asare, B. (2022). Effects of Peer Tutoring, Teaching Quality and Motivation on Mathematics Achievement in Senior High Schools Examples of Projective Resolution of Lengths 3n/4n That Do Not Satisfy Homological Properties of Nakayama Algebra. View project Modeling mathematic. *Int J Edu Sci*, *37*(1–3), 35–43. https://doi.org/10.31901/24566322.2022/37.1-3.1221

Arthur, Y. D., Dogbe, C. S. K., & Asiedu-addo, S. K. (2022). Enhancing Performance in Mathematics Through Motivation , Peer Assisted Learning , And Teaching Quality : The Mediating Role of Student Interest. *EURASIA Journal of Mathematics, Science and Technology Education*, *18*(2).

Arthur, Y. D., Owusu, E. K., Asiedu-Addo, S., & Arhin, A. K. (2018). Connecting Mathematics To Real-Life Problems: A Teaching Quality That Improves Students' Mathematics Interest. *IOSR Journal of Research & Method in Education*, *8*(4), 65–71. https://doi.org/10.9790/7388-0804026571

Atiah, P. A. (2023). Newly qualified teachers' perceptions and experiences about portfolio assessment in Wa Municipality, Ghana. *African Journal of Teacher Education*, *11*(2), 140–163. https://doi.org/10.21083/ajote.v11i2.7043

Awoniyi, F. C. (2022). Motivation and Mathematics Achievement: A Case Study of Grade 11 students in Ghana. *Unnes Journal of Mathematics Education*, *11*(1), 102–117. https://doi.org/10.15294/ujme.v11i1.54578

Azam, M., & Kingdon, G. G. (2014). *Assessing Teacher Quality in India*.

Azar, H. K., Lavasani, M. G., Malahmadi, E., & Amani, J. (2010). The role of self-efficacy, task value, and achievement goals in predicting learning approaches and mathematics achievement. *Procedia - Social and Behavioral Sciences*, *5*, 942–947. https://doi.org/10.1016/j.sbspro.2010.07.214

Baah-Duodu, S., Borbye, S., Someah-Addae, E., Ennin, F. C., & Osei-Buabeng, V. (2021). Developing Female Pre-Service Teachers' Mathematics Self-Efficacy by Integrating History of Mathematics into Teaching During Lesson Study. *Social Education Research*, *3*(1), 91–102. https://doi.org/10.37256/ser.3120221011

Babbitt, B. C. (1993). HYPERMEDIA: MAKING THE MATHEMATICS CONNECTION. *INTERVENTION IN SCHOOL AND CLINIC*, *28*(5), 85–110. https://doi.org/10.4324/9781003330448-9

Bacon, D. R., Sauer, P. L., & Young, M. (1995). Composite Reliability in Structural Equations Modeling. *Educational and Psychological Measurement*, *55*(3), 394–406.

https://doi.org/10.1177/0013164495055003003

Bagus, I., Mantra, N., Maba, W., & Astawa, N. (2018). *Conducting Assessment Instrument Models for Teacher Competence , Teacher Welfare as an Effort to Enhance Education Quality*. *5*(3), 46–52.

Ball, L. D., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389–407. https://doi.org/10.1177/0022487108324554

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy, 1*(4), 139–161. https://doi.org/10.1016/0146-6402(78)90002-4

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

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, *50*(2), 248–287. https://doi.org/10.1016/0749-5978(91)90022-L

Bandura, A. (2012). Going global with social cognitive theory: From prospect to paydirt. *In Applied Psychology*, 65–92.

Barbin, E., Guillemette, D., & Tzanakis, C. (2020). History of mathematics and education. In *Encyclopedia of mathematics education* (pp. 333–342).

Betül, S. (2012). *THE VIEWS OF STUDENTS AGED 12 ABOUT ACTIVITIES FOR HISTORY OF MATHEMATICS INCLUDED IN MATHEMATICS*.

Bipp, T., Steinmayr, R., & Spinath, B. (2008). Personality and achievement motivation: Relationship among Big Five domain and facet scales, achievement goals, and intelligence. *Personality and Individual Differences, 44*(7), 1454–1464. https://doi.org/10.1016/j.paid.2008.01.001

Bishara, S. (2016). Creativity in unique problem-solving in mathematics and its influence on motivation for learning. *Cogent Education*, *3*(1). https://doi.org/10.1080/2331186X.2016.1202604

Bisschoff, T., Grobler, B., Bisschoff, T. O. M., & Grobler, B. (2006). *The management of teacher competence The Management of Teacher Competence*. *4587*(1998). https://doi.org/10.1080/13674589800200041

Boadu, S. K., Arthur, Y. D., & Bonyah, E. (2023). Mediation and moderation effects of motivation and teaching quality on the relationship between peer tutoring and mathematics achievement. *Journal of Mathematics and Science Teacher, 3*(2), 1–14.

Bonafini, F. C., Lee, Y., Kim, S., Bueno, R. W. da S., Lieban, D., Ballejo, C. C., 강용묵, You Eng, C., Choon Keong, T., Anderson, A., Barham, N., Northcote, M., Guerrero, S., Tay, M. G., Stapf, K., Martin, B., & Maszuraini Miswan; Hamedi Adenan. (2021). Pengetahuan Teknologi Pedagogi Kandungan di Malaysia : Pedagogical Technological Content Knowledge in Malaysia : *Journal of Digital Learning in Teacher Education*, *26*(4), 132–139.

http://www.ipbl.edu.my/portal/penyelidikan/jurnalpapers/jurnal2017/2 Tay MG.pdf

Bonney, E. A., Amoah, D. F., Micah, S. A., Ahiamenyo, C., & Lemaire, M. B. (2015). *The Relationship between the Quality of Teachers and Pupils Academic Performance in the STMA Junior High Schools of the Western Region of Ghana*. *6*(24).

Bornmann, L., Marx, W., Schier, H., Rahm, E., Thor, A., & Daniel, H. D. (2009). Convergent validity of bibliometric Google Scholar data in the field of chemistry-Citation counts for papers that were accepted by Angewandte Chemie International Edition or rejected but published elsewhere, using Google Scholar, Science Citation Index, S. *Journal of Informetrics*, *3*(1), 27–35. https://doi.org/10.1016/j.joi.2008.11.001

Boston, M. (2012). Assessing Instructional Quality in Mathematics. *The Elementary School Journal*, *113*(1), 76–104.

Bowers, J., Cobb, P., & McClain, K. (1999). The Evolution of Species Interactions Linked references are available on JSTOR for this article : The Evolution of Species Interactions. *COGNITION AND INSTRUCTION*, *284*(5423), 2116–2118.

Boyd, D., Goldhaber, D., & Lankford, H. (2007). *The Effect of Certification and Preparation on Teacher Quality*.

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

Bruning, R., & Horn, C. (2000). Developing motivation to write. *Educational Psychologist*, *35*(1), 25–37. https://doi.org/10.1207/S15326985EP3501_4

Bryman, A. (2016). Social Research Methods. In *Social Research Methodology* (5th ed.). Oxford University Press. https://doi.org/10.1007/978-0-230-22911-2

Bütüner, S. Ö., & Baki, A. (2020). The use of history of mathematics in the mathematics classroom: An action study. *International Journal of Education in Mathematics, Science and Technology*, *8*(1), 92–117. https://doi.org/10.46328/IJEMST.V8I2.843

Cabalsa, M. O. (n.d.). *Self-Efficacy Theory*.

Caena, F. (2014). *Teacher Competence Frameworks in Europe : policy-as-discourse and policy-as-practice*. *49*(3). https://doi.org/10.1111/ejed.12088

Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges : The case for the European Digital Competence Framework for Educators (D igcompedu). *European Journal of Education Published by John Wiley & Sons Ltd. 356*, *54*, 356–369. https://doi.org/10.1111/ejed.12345

Cahyono, A. N., & Ludwig, M. (2016). Examining motivation in mobile app-supported math trail environments. *Proc. ICMI-EARCOME 7*, *February*, 151–158.

Calder, N. (2013). MATHEMATICS IN STUDENT-?-CENTRED INQUIRY LEARNING: STUDENT ENGAGEMENT. *Teachers and Curriculum*, *113*, 76–82.

Campuzano, J. C. P., Matthews, K. E., & Adams, P. (2018). On the use of history of mathematics: an introduction to Galileo's study of free fall motion. *International*

Journal of Mathematical Education in Science and Technology, *49*(4), 517–529. https://doi.org/10.1080/0020739X.2017.1377301

Carlson, K. D., & Herdman, A. O. (2012). Understanding the impact of convergent validity on research results. *Organizational Research Methods*, *15*(1), 17–32. https://doi.org/10.1177/1094428110392383

Carter, D. B. (2006). *The Role of The History of Mathematics in Middle School*.

Cejka, E., Rogers, C., & Portsmore, M. (2006). Kindergarten robotics: Using robotics to motivate math, science, and engineering literacy in elementary school. *International Journal of Engineering Education*, *22*(4), 711–722.

Chand, S., Chaudhary, K., Prasad, A., & Chand, V. (2021). Perceived Causes of Students' Poor Performance in Mathematics: A Case Study at Ba and Tavua Secondary Schools. *Frontiers in Applied Mathematics and Statistics*, *7*(April), 1–13. https://doi.org/10.3389/fams.2021.614408

Charalambous, C. Y., Panaoura, A., & Philippou, G. (2008). Using the history of mathematics to induce changes in preservice teachers' beliefs and attitudes: insights from evaluating a teacher education program. *Educ Stud Math*, *71*, 161–180. https://doi.org/10.1007/s

Cheah, J. H., Sarstedt, M., Ringle, C. M., Ramayah, T., & Ting, H. (2018). Convergent validity assessment of formatively measured constructs in PLS-SEM: On using single-item versus multi-item measures in redundancy analyses. *International Journal of Contemporary Hospitality Management*, *30*(11), 3192–3210. https://doi.org/10.1108/IJCHM-10-2017-0649

Cheng, L., Antonenkoa, P., Ritzhaupta, A. D., Miller, D., MacFaddena, bruce, J., Dawsona, K., Granta, C., Shepparda, T. D., & Ziegler, M. (2020). 3D PRINTING INTEGRATION Exploring the Influence of Teachers' Beliefs and 3D Printing Integrated STEM Instruction on Students' STEM Motivation Li Cheng. *Elsevier*.

Cheon, S. H., Reeve, J., Lee, Y., & Lee, J. won. (2018). Why autonomy-supportive interventions work: Explaining the professional development of teachers' motivating style. *Teaching and Teacher Education*, *69*, 43–51. https://doi.org/10.1016/j.tate.2017.09.022

Chorlay, R., Clark, K. M., & Tzanakis, C. (2022). History of mathematics in mathematics education: Recent developments in the field. *ZDM - Mathematics Education*, *54*(7), 1407–1420. https://doi.org/10.1007/s11858-022-01442-7

Clair, J. S. (2018). *Using Cartoons to Make Connections and Enrich Mathematics*. *2*. https://doi.org/10.20429/stem.2018.020112

Clark, A. (1998). *The qualitative-quantitative debate : moving from positivism and confrontation to post-positivism and reconciliation*. 1242–1249.

Clark, K., Kjeldsen, T. H., Schorcht, S., & ... (2016). *History of mathematics in mathematics education. Recent developments*. *2000*. https://hal.archives-ouvertes.fr/hal-01349230/%0Ahttps://hal.archives-ouvertes.fr/hal-01349230/document

Comadena, M. E., Hunt, S. K., & Simonds, C. J. (2007). The Effects of Teacher Clarity , Nonverbal Immediacy , and Caring on Student Motivation , Affective and Cognitive Learning The Effects of Teacher Clarity , Nonverbal Immediacy , and Caring on Student Motivation , Affective and Cognitive Learning. *Communication Research Reports, 24*(3), 241–248. https://doi.org/10.1080/08824090701446617

Conley, A. M. M. (2012). Patterns of motivation beliefs: Combining achievement goal and expectancy-value perspectives. *Journal of Educational Psychology, 104*(1), 32–47. https://doi.org/10.1037/a0026042

Connell, R. (2009). *Critical Studies in Education Good teachers on dangerous ground : towards a new view of teacher quality and professionalism*. *8487*. https://doi.org/10.1080/17508480902998421

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation Volume, 10*(7).

Cotič, M., & Zuljan, M. V. (2009). Problem-based instruction in mathematics and its impact on the cognitive results of the students and on affective-motivational aspects. *Educational Studies, 35*(3), 297–310. https://doi.org/10.1080/03055690802648085

Crawford, M. L. (2001). *Teaching Contextually: Research, Rationale, and Techniques for Improving Student Motivation*. CCI Publishing, Inc.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). SAGE.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297–334. https://doi.org/10.1007/BF02310555

Cubukcu, F. (2010). STUDENT TEACHERS' PERCEPTIONS OF TEACHER COMPETENCE AND THEIR ATTRIBUTIONS FOR SUCCESS AND FAILURE IN LEARNING Feryal CUBUKCU *. *The Journal of International Social Research*, *3*(10), 213–217. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.496.493&rep=rep1&type=pdf

Darling-hammond, L. (2000). *Teacher Quality and Student Achievement : A Review of State Policy Evidence Previous Research*. *8*(1), 1–44.

Dass, P. M. (2015). Teaching STEM Effectively with the Learning Cycle Approach. *K-12 STEM Education, 1*(1), 5–12. https://doi.org/10.4018/978-1-5225-3832-5

De Clercq, F. (2008). *Teacher quality , appraisal and development : The flaws in the IQMS 1*. *26*(March), 7–18.

Deci, E., & Ryan, R. (2012). Self-determination theory. *SAGE Publications Ltd*, *1*(1). https://doi.org/https://doi.org/10.4135/9781446249215

Depaoli, S., Agtarap, S., Choi, A. Y., Coburn, K. M., & Yu, J. (2018). Advances in quantitative research within the psychological sciences. *Translational Issues in Psychological Science, 4*(4), 335–339. https://doi.org/10.1037/tps0000183

Desai, R. (2020). WEM : AN AV-TOOL FOR MOTIVATION IN ENGINEERING MATHEMATICS. *Homi Bhabha Centre for Science Education, TIFR, Mumbai*, 370–377.

DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications*. SAGE Publications Ltd.

Dörnyei, Z., & Muir, C. (2019). *Creating a Motivating Classroom Environment*. 1–18. https://doi.org/10.1007/978-3-319-58542-0_36-1

Dossel, S. (1993). Maths anxiety. *The Australian Mathematics Teacher*, *49*(1), 4–8.

Doz, D. (2021). Using the History of Mathematics as a Motivational Factor in Teaching Math. *Научни Скуп*, *22*, 471–482. https://doi.org/10.46793/NNU21.471D

Dupré, J. (2000). A Companion to the philosophy of science: In W. H. Newton-Smith (Ed.), *Choice Reviews Online* (Vol. 37, Issue 10, pp. 37-5599-37–5599). Blackwell Publishers Ltd. https://doi.org/10.5860/choice.37-5599

Durmus, S., & Karakirik, E. (2006). VIRTUAL MANIPULATIVES IN MATHEMATICS EDUCATION : A. *The Turkish Online Journal of Educational Technology*, *5*(1), 117–123.

Eccles, J. S., & Wigfield, A. (2020). From Expectancy-Value theory to Situated Expectancy-Value Theory: A Developmental, Social Cognitive, and Sociocultural Perspective on Motivation. *Contemporary Educational Psychology*, *6*(101859), 0–60.

Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation to succeed. *Handbook of Child Psychology: Social, Emotional, and Personality Development*, 1017–1095.

Ediger, M. (n.d.). Quality teaching in mathematics. *Education*, *133*(2), 235–239.

Ekmekci, A., & Serrano, D. M. (2022). education sciences The Impact of Teacher Quality on Student Motivation , Achievement , and Persistence in Science and Mathematics. *Education Sciences*, *12*(649).

Eli, J. A., Lee, C. W., & Mohr-schroeder, M. J. (2007). *Mathematical Connections and Their Relationship to Mathematics Knowledge for Teaching Geometry*. *113*(3).

Fauth, B., Decristan, J., Decker, A. T., Büttner, G., Hardy, I., Klieme, E., & Kunter, M. (2019). The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching quality. *Teaching and Teacher Education*, *86*(2019). https://doi.org/10.1016/j.tate.2019.102882

Field, A. (2013). *Discovering Statistics Using SPSS* (second edi). SAGE Publications Ltd.

Filgona, J., John, S., & Gwany, D. M. (2020). Teachers' Pedagogical Content Knowledge and Students' Academic Achievement: A Theoretical Overview. *Journal of Global Research in Education and Social Science*, *14*(2), 14–44. https://www.researchgate.net/publication/344199882

Fleming, L., Motamedi, V., & May, L. (2007). *Predicting Preservice Teacher Competence in Computer Technology : Modeling and Application in Training Environments*. *15*, 207–231.

Fox, N. J. (2014). *Post-positivism*. *July 2008*.

Fried, M. N. (2001). Can mathematics education and history of mathematics coexist? *Science and Education*, *10*(4), 391–408. https://doi.org/10.1023/A:1011205014608

Gainsburg, J. (2008). Real-world connections in secondary mathematics teaching. *Journal of Mathematics Teacher Education*, 2–5.

Galante, D. (2014). The Use of the History of Mathematics in the Teaching of Preservice Teachers. *Redimat*, *3*(2), 110–120. https://doi.org/10.4471/redimat.2014.45

Gallagher, M. A., Parsons, S. A., & Vaughn, M. (2022). Adaptive teaching in mathematics: a review of the literature. *Educational Review*, *74*(2), 298–320. https://doi.org/10.1080/00131911.2020.1722065

GEIES. (2003). Ghana Education Impact Evaluation Survey. *World Bank Economic Review*.

Goe, L. (2007). *The Link Between Teacher Quality and Student Outcomes : A Research Synthesis*. *October*.

Goe, L., Bell, C., & Little, O. (2008). Approaches to Evaluating Teacher Effectiveness : A Research Synthesis. In *National Comprehensive Center for Teacher Quality*.

Goktepe, S., & Ozdemir, A. S. (2021). An example of using history of mathematics in classes. *European Journal of Science and Mathematics Education*, *1*(3), 125–136. https://doi.org/10.30935/scimath/9392

Goldhaber, D., Lavery, L., & Theobald, R. (2015). Uneven Playing Field? Assessing the Teacher Quality Gap Between Advantaged and Disadvantaged Students. *Educational Researcher*, *44*(5), 293–307. https://doi.org/10.3102/0013189X15592622

Green, S. K. (2002). Using an expectancy-value approach to examine teachers ' motivational strategies. *Teaching and Teacher Education*, *18*(2002), 989–1005.

Groenendijk, T., Janssen, T., Rijlaarsdam, G., & van den Bergh, H. (2013). The effect of observational learning on students' performance, processes, and motivation in two creative domains. *British Journal of Educational Psychology*, *83*(1), 3–28. https://doi.org/10.1111/j.2044-8279.2011.02052.x

Guerrio, S. (n.d.). *Teachers ' Pedagogical Knowledge and the Teaching Profession*.

Habibullah, H., Durahim, Y., Pamungkas, T., Haryundari, M. L. I., & Rusnila, R. (2022). The Effect of Motivation on Students's Mathematics Learning Outcomes in the New Normal Era. *Jambura Journal of Mathematics Education*, *3*(2), 63–69. https://doi.org/10.34312/jmathedu.v3i2.15114

Hair, J. F., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: updated guidelines on which method to use. *International Journal of Multivariate Data Analysis*, *1*(2), 107. https://doi.org/10.1504/ijmda.2017.10008574

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: INDEED A SILVER BULLET. *Journal of Marketing Theory and Practice*, *19*(2), 139–151. https://doi.org/10.2753/MTP

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hall, A., & Miro, D. (2016). A Study of Student Engagement in Project-Based Learning Across Multiple Approaches to STEM Education Programs. *School Science and Mathematics*, *116*(6), 310–319. https://doi.org/10.1111/ssm.12182

Hamid, M. R. A., Sami, W., & Sidek, M. H. M. (2017). Discriminant Validity Assessment: Use of Fornell & Larcker criterion versus HTMT Criterion. *Journal of Physics: Conference Series*, *890*(1). https://doi.org/10.1088/1742-6596/890/1/012163

Hanushek, E. A., & Rivkin, S. G. (2006). *Teacher quality*. *2*(06). https://doi.org/10.1016/S1574-0692(06)02018-6

Hanushek, E. A., & Rivkin, S. G. (2007). *Pay, Working Conditions, and Teacher Quality*.

Hasbi, M., Lukito, A., Sulaiman, R., Muzaini, M., Negeri Surabaya, U., Lidah Wetan, K., & Lidah Wetan-Surabaya, J. (2019). Improving the Mathematical Connection Ability of Middle-School Students through Realistic Mathematics Approach. *Journal of Mathematical Pedagogy*, *1*(1), 37–46.

Hattie, J. (2009). The black box of tertiary assessment: An independent revolution. *Tertiary Assessment & Higher Education Student Outcomes: Policy, Practice & Research*, 259–275. https://akoaotearoa.ac.nz/ako-aotearoa/ako-aotearoa/resources/pages/black-box-tertiary-assessment-impending-revolution

Hayes, A. F. (2015). An Index and Test of Linear Moderated Mediation An Index and Test of Linear Moderated Mediation. *Multivariate Behavioral Research*, *3171*. https://doi.org/10.1080/00273171.2014.962683

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Herges, R. M., Duffield, S., Martin, W., & Wageman, J. (2017). Motivation and Achievement of Middle School Mathematics Students. *The Mathematics Educator*, *26*(1), 83–106.

Herrington, A. J., & Herrington, J. A. (2005). What is an authentic learning environment? *Authentic Learning Environments in Higher Education*, 1–13. https://doi.org/10.4018/978-1-59140-594-8.ch001

Hidi, S., Berndorff, D., & Ainley, M. (2002). Children’s argument writing, interest and self-efficacy: An intervention study. *Learning and Instruction*, *12*(4), 429–446. https://doi.org/10.1016/S0959-4752(01)00009-3

Higgins, K., Huscroft-D’Angelo, J., & Crawford, L. (2019). Effects of Technology in Mathematics on Achievement , Motivation , and Attitude : A. *Journal of Educational Computing*, *57*(2), 283–319. https://doi.org/10.1177/0735633117748416

Ho, W. K. (2008). Using history of mathematics in the teaching and learning of mathematics in Singapore. *International Conference on Education, Singapore*, *1*, 1–38. http://math.nie.edu.sg/wkho/Research/My publications/Math Education/hom.pdf

Hollins, E. R. (2011). Teacher preparation for quality teaching. *Journal of Teacher Education*, *62*(4), 395–407. https://doi.org/10.1177/0022487111409415

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hulleman, C. S., Durik, A. M., Schweigert, S. A., & Harackiewicz, J. M. (2008). Task Values, Achievement Goals, and Interest: An Integrative Analysis. *Journal of Educational Psychology*, *100*(2), 398–416. https://doi.org/10.1037/0022-0663.100.2.398

Hulleman, C. S., & Harackiewicz, J. M. (2009). Promoting interest and performance in high school science classes. *Science*, *326*(5958), 1410–1412. https://doi.org/10.1126/science.1177067

Ingersoll, R. (2007). *Misdiagnosing the Teacher Quality Problem*.

Iyer, R. (2022). *5 ways to motivate learners to learn math effectively*. Edutopia. https://www.edutopia.org/article/5-ways-motivate-students-learn-math-effectively/

Jahnke, H. N., Arcavi, A., Barbin, E., Bekken, O., Furinghetti, F., Idrissi, A. El, Mary, C., & Weeks, C. (2002). *History in Mathematics Education* (Vol. 6, Issue April). https://doi.org/10.1007/0-306-47220-1

Jankvist, U. T. (2009). *Using History as a ' Goal ' in Mathematics Education* (Issue 464). Roskilde University.

Jaworski, B. (2002). Social constructivism in Mathematics learning and teaching. *Teaching Mathematics in Secondary Schools: A Reader*, 67–81.

Jeschke, C., Kuhn, C., Heinze, A., Zlatkin-troitschanskaia, O., & Norton, M. (2021). Teachers ' Ability to Apply Their Subject-Speci fi c Knowledge in Instructional Settings — A Qualitative Comparative Study in the Subjects Mathematics and Economics. *Frontiers in Education*, *6*(July), 1–8. https://doi.org/10.3389/feduc.2021.683962

Johnson, E. B. (2002). *Contextual teaching and learning: What it is and why it's here to stay*. Corwin Press.

Jones, R. D. (2008). *Strengthening Student Engagement* (pp. 1–10). International Center for Leadership in Education.

Kapofu, L. K., & Kapofu, W. (2020). "This Maths is better than that Maths" – Exploring Learner Perceptions on the Integration of History of Mathematics in Teaching the Theorem of Pythagoras: A Case Study. *International Electronic Journal of Mathematics Education*, *15*(3), em0604. https://doi.org/10.29333/iejme/8446

Karakoç, G., & Alacacı, C. (2015). Real World Connections in High School Mathematics Curriculum and. *Turkish Journal of Computer and Mathematics Education*, *6*(1), 31–46. https://doi.org/10.16949/turcomat.76099

Kasim, H., & Antwi, S. K. (2015). Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European Journal of Business and ManagementOnline)*, *7*(3), 217–225. https://www.researchgate.net/profile/Hamza-Kasim/publication/295087782_Qualitative_and_Quantitative_Research_Paradigms_in_Business_Research_A_Philosophical_Reflection/links/56c7587108ae5488f0d2cd62/Qualitative-and-Quantitative-Research-Paradigms-in-Busine

Katz, V. J., & Michalowiz, K. D. (2020). (Eds.). (2020). Historical modules for the teaching and learning of mathematics (Vol. *American Mathematical Society*, *26*.

Keller, J. M. (1983). *Motivational design of instruction. Instructional design theories and models: An overview of their current status*. *1*, 383–434.

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education*, *3*(1). https://doi.org/10.1186/s40594-016-0046-z

Kelly, C. A. (2006). Using Manipulatives in Mathematical Problem Solving : A Performance-Based Analysis Let Us Know How Access to This Document Benefits You . *The Mathematics Enthusiast*, *3*(2), 184–193.

Kenedi, A. K., Helsa, Y., Ariani, Y., Zainil, M., & Hendri, S. (2019). Mathematical connection of elementary school students to solve mathematical problems. *Journal on Mathematics Education*, *10*(1), 69–79. https://doi.org/10.22342/jme.10.1.5416.69-80

Khotimah, R. P. (2016). *Improving Teaching Quality and Problem Solving Ability Through Contextual Teaching and Learning in Differential Equations : A Lesson Study Approach*. *1*(1), 1–13.

Kim, M., & Aktan, T. (2014). How to enlarge the scope of the curriculum integration of mathematics and science (CIMAS): A delphi study. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(5), 455–469. https://doi.org/10.12973/eurasia.2014.1115a

Kim, Y. R., & Park, M. S. (2018). Creating a Virtual World for Mathematics. *Journal of Education and Training Studies*, *6*(12), 172. https://doi.org/10.11114/jets.v6i12.3601

Kitchenham, B., Brereton, P., Turner, M., Niazi, M., Linkman, S., Pretorius, R., & Budgen, D. (2009). The impact of limited search procedures for systematic literature reviews - A participant-observer case study. *2009 3rd International Symposium on Empirical Software Engineering and Measurement, ESEM 2009*, 336–345. https://doi.org/10.1109/ESEM.2009.5314238

Klanderman, D., Klanderman, S., Gliesmann, B., Wilkerson, J., & Eggleton, P. (2019). Factors that Motivate Students to Learn Mathematics. *ACMS 22nd Biennial Conference Proceedings, Indiana Wesleyan University*, *2019*, 76–89.

Klang, N., Karlsson, N. L., Karlberg, M., Kilborn, W., & Eriksson, P. (2021). Mathematical Problem-Solving Through Cooperative Learning — The Importance of Peer Acceptance and Friendships. *Frontiers in Education*. https://doi.org/10.3389/feduc.2021.710296

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (Fourth).

Guilford Publications.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What Is Technological Pedagogical Content Knowledge (TPACK)? *Journal of Education*, *193*(2008).

Koh, E. T., & Owen, W. L. (2000). Descriptive research and qualitative definition of descriptive study. In *Introduction to Nutrition and Health Research* (pp. 219–248).

Kohen, Z., Nitzan, O., & Cohen-nissan, O. (2022). AN ONLINE CAMP DURING COVID-19 FOR PROMOTING STUDENTS ' MATHEMATICAL MODELLING AND MOTIVATION. *International Group for the Psychology of Mathematics Education, 4,* 248.

Koomson, J. A., Bosu, R. S., Oduro, G. K. T., & Ankomah, Y. A. (2005). *A REVIEW ON THE CONCEPT OF QUALITY IN EDUCATION : PERSPECTIVES FROM GHANA EdQual Working Paper No . 1. 1*.

Krpan, C. M. (2018). *Teaching Math with Meaning: Cultivating Self-efficacy Through Learning Competencies, Grades K-8*. Pearson Canada Incorporated.

Kusaeri, A., Pardi, H. H., & Quddus, A. (2019). Culture and mathematics learning: Identifying students' mathematics connection. *Beta: Jurnal Tadris Matematika*, *12*(1), 82–93. https://doi.org/10.20414/betajtm.v12i1.264

Kusuma, D. A., Suryadi, D., & Dahlan, J. A. (2019). Improving external mathematical connections and students' activity using ethnomathematics. *International Conference on Mathematics and Science Education (ICMScE 2018):IOP Conf. Series: Journal of Physics: Conf. Series 1157*, *1157*(3). https://doi.org/10.1088/1742-6596/1157/3/032120

Kwon, H. (2016). *THE EFFECT OF 3D PRINTING AND DESIGN ON STUDENT ' S MOTIVATION , INTERESTS , MATHEMATICAL AND REAL-LIFE SKILLS : AN INFORMAL STEM EDUCATION*. Texas A&M University.

Lang, J. W. B., & Fries, S. (2006). A revised 10-item version of the achievement motives scale: Psychometric properties in German-speaking samples. *European Journal of Psychological Assessment*, *22*(3), 216–224. https://doi.org/10.1027/1015-5759.22.3.216

Latif, S. (2017). Mathematical Connection Ability in Solving Mathematics Problem Based on Initial Abilities of Students At Smpn 10 Bulukumba. *Jurnal Daya Matematis*, *4*(2), 207. https://doi.org/10.26858/jds.v4i2.2899

Leedy, P. D., & Ormrod, J. E. (2015). *Practical Research: Planning and Design* (11th ed.). Pearson.

Li, M. P., & Lam, B. H. (2013). Cooperative Learning What. In *The Active Classroom* (pp. 1–33).

Lillvist, A., Sandberg, A., Sheridan, S., & Williams, P. (2014). Preschool teacher competence viewed from the perspective of students in early childhood teacher education. *Journal of Education for Teaching*, *40*(1), 3–19. https://doi.org/10.1080/02607476.2013.864014

Linnenbrink, E. A., & Pintrich, P. R. (2003). The role of self-efficacy beliefs instudent engagement and learning intheclassroom. *Reading and Writing Quarterly*, *19*(2), 119–137. https://doi.org/10.1080/10573560308223

Lippke, S. (2017). Self-Efficacy Theory. In *Encyclopedia of Personality and Individual Differences*.

Lit, C.-K., Siu, M.-K., & Wong, N.-Y. (2001). The Use of History in the Teaching of Mathematics: Theory, Practice and Evaluation of Effectiveness. *Education Journal*, *29*(1).

Liu, P. (2003). Do Teachers Need to Incorporate the History of Mathematics in Their Teaching? *Mathematics Teacher*, *96*(6), 416–421.

Locke, E. A., & Schattke, K. (2019). Intrinsic and extrinsic motivation: Time for expansion and clarification. *Motivation Science*, *5*(4), 277–290. https://doi.org/10.1037/mot0000116

Loo, C. W., & Choy, J. L. F. (2013). Sources of Self-Efficacy Influencing Academic Performance of Engineering Students. *American Journal of Educational Research*, *1*(3), 86–92. https://doi.org/10.12691/education-1-3-4

Maehr, M. L., & Sjogren, D. D. (1971). Atkinson's theory of achievement motivation: First step toward a theory of academic motivation? *Review of Educational Research*, *41*(2), 143–161.

Malouff, J., Rooke, S., Schutte, N., Foster, R., & Bhullar, N. (2008). *Methods of Motivational Teaching.* 1–9. https://www.researchgate.net/publication/216626152

Mann, T. (2011). History of mathematics and history of science. *Isis*, *102*(3), 518–526. https://doi.org/10.1086/661626

Marshall, G. L. (2000). *Using history of Mathematics to improve secondary Students' Attitudes Towards Mathematics*.

Martin, D. P., & Rimm-Kaufman, S. E. (2015). Do student self-efficacy and teacher-student interaction quality contribute to emotional and social engagement in fifth grade math? *Journal of School Psychology*, *53*(5), 359–373. https://doi.org/10.1016/j.jsp.2015.07.001

Mathers, N., Fox, N., & Hunn, A. (2007). Surveys and Questionnaires. In *Trent RDSU*. https://doi.org/10.4324/9781003222491-32

Mazana, M. Y., Montero, C. S., & Casmir, R. O. (2018). Investigating Students' Attitude towards Learning Mathematics. *International Electronic Journal of Mathematics Education*, *14*(1), 207–231. https://doi.org/10.29333/iejme/3997

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology*, *80*(4), 514–523. https://doi.org/10.1037//0022-0663.80.4.514

Mendes dos Santos, P., & Cirillo, M. Â. (2021). Construction of the average variance extracted index for construct validation in structural equation models with adaptive regressions. *Communications in Statistics: Simulation and Computation*.

https://doi.org/10.1080/03610918.2021.1888122

Moore, N. D. (2012). *Alternative Strategies for Teaching Mathematics*. The College at Brockport State University of New York.

Muenks, K., Wigfiled, A., & Eccles, J. S. (2018). I can do this! The development and calibration of children's expectations for succes and competence beliefs. *Developmental Review*.

NCTM. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Ndiung, S., & Nendi, F. (2018). Mathematics Connection Ability and Students Mathematics Learning Achievement at Elementary School. *SHS Web of Conferences, 42*, 00009. https://doi.org/10.1051/shsconf/20184200009

Nessipbayeva, O. (2019). The Competencies of the Modern Teacher. *Pre-Service and In-Service Teacher Training*, 148–154. http://bit.ly/2fRwNoY

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom:Applying self-determination theory to educational practice. *Theory and Research in Education*, *7*(2), 133–144. https://doi.org/10.1177/1477878509104318

Nyman, M., & Sumpter, L. (2019). The issue of ' proudliness ': Primary students ' motivation towards mathematics. *LUMAT*, *7*(2).

Obayemi, F., Obasuyi, T., & Omoniyi, O. B. (2022). Student ' s Happiness In Learning : The Literature Perspective Student ' s Happiness In Learning : The Literature Perspective. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *12*(2), 56–60. https://doi.org/10.9790/7388-1202045660

Ochieng, K. R., Kiplagat, P., & Nyongesa, S. (2016). *Influence of Teacher Competence on Mathematics Performance in KCSE Examinations Among Public Schools in Nyatike Subcounty , Migori County Kenya*. *4*(5), 44–57. https://doi.org/10.11648/j.ijsedu.20160405.11

Oudeyer, P., Hafner, V. V, & Kaplan, F. (2013). Intrinsic Motivation Systems for Autonomous Mental Development. *IEEE Transactions on Evolutionary Computation*, *11*(2), 265–286.

Owolabi, J., & Adaramati, T. F. A. (2015). Effects of Graphic Organiser on Students ' Achievement in Algebraic Word Problems. *Journal of Education and Practice*, *6*(5), 39–45.

Ozgen, K. (2013). Self-Efficacy Beliefs In Mathematical Literacy And Connections Between Mathematics And Real World: The Case Of High School Students. *International Journal of Education and Research*, *9*(4), 305–316.

Pajares, F., & Miller, M. D. (1994). Role of Self-Efficacy and Self-Concept Beliefs in Mathematical Problem Solving: A Path Analysis. *Journal of Educational Psychology*, *86*(2), 193–203. https://doi.org/10.1037/0022-0663.86.2.193

Panasuk, R. M., & Horton, L. B. (2013). Integrating History of Mathematics into the Classroom: Was Aristotle Wrong? *Journal of Curriculum and Teaching*, *2*(2), 37–46. https://doi.org/10.5430/jct.v2n2p37

Panggabean, M. S., & Himawan, K. K. (2016). The Development of Indonesian Teacher Competence Questionnaire. *Journal of Educational, Health and Community Psychology*, *5*(2), 1–15. https://doi.org/10.12928/jehcp.v5i2.5134

Pantić, N., Wubbels, T., & Mainhard, T. (2011). Teacher competence as a basis for teacher education: Comparing views of teachers and teacher educators in Five Western Balkan countries. *Comparative Education Review*, *55*(2), 165–188. https://doi.org/10.1086/657154

Papadakis, S., Kalogiannakiss, M., & Zaranis, N. (2016). Improving Mathematics Teaching in Kindergarten with Realistic Mathematical Education. *Early Childhood Educ J*. https://doi.org/10.1007/s10643-015-0768-4

Paris, S. G., & Winograd, P. (2003). The Role of Self-Regulated Learning in Contextual Teaching: In *A Commissioned Paper for the U.S. Department of Education Project Preparing Teachers to Use Contextual Teaching and Learning Strategies To Improve Student Success In and Beyond School*.

Park, Y. S., & Artino, A. R. (2020). *The Positivism Paradigm of Research . 95*. https://doi.org/10.1097/ACM.0000000000003093

Peng, W. J., McNess, E., Thomas, S., Wu, X. R., Zhang, C., Li, J. Z., & Tian, H. S. (2014). Emerging perceptions of teacher quality and teacher development in China. *International Journal of Educational Development*, *34*, 77–89.

Peteros, E., Gamboa, A., Etcuban, J. O., Dinauanao, A., Sitoy, R., & Arcadio, R. (2019). Factors Affecting Mathematics Performance of Junior High School Students. *International Electronic Journal of Mathematics Education*, *15*(1), 1–13. https://doi.org/10.29333/iejme/5938

Raykov, T. (2009). Evaluation of scale reliability for unidimensional measures using latent variable modeling. *Measurement and Evaluation in Counseling and Development*, *42*(3), 223–232. https://doi.org/10.1080/10705511003659417

Reyes, J. D., Insorio, A. O., Ingreso, M. L. V, Hilario, F. F., & Gutierrez, C. R. (2019). Conception and Application of Contextualization in Mathematics Education. *International Journal of Education Studies in Mathematics*, *6*(1), 1–18.

Ríordáin, M. N., Johnston, J., & Walshe, G. (2015). Making mathematics and science integration happen: key aspects of practice. *International Journal of Mathematical Education in Science and Technology*, *47*(2), 233–255. https://doi.org/10.1080/0020739X.2015.1078001

Rodionov, M., & Dedovets, Z. (2017). Practical Problems as Tools for the Development of Secondary School Students ' Motivation to Learn Mathematics. *International Journal of Educational and Pedagogical Sciences*, *11*(10), 22–23.

Roelofs, E. C., & Sanders, P. (2007). Towards a framework for assessing teacher competence. *European Journal of Vaocational Training*, *40*(1), 123–139.

Roemer, E., Schuberth, F., & Henseler, J. (2021). HTMT2–an improved criterion for assessing discriminant validity in structural equation modeling. *Industrial Management and Data Systems*, *121*(12), 2637–2650. https://doi.org/10.1108/IMDS-

02-2021-0082

Rohendi, D., & Dulpaja, J. (2013). Connected Mathematics Project (CMP) Model Based on Presentation Media to the Mathematical Connection Ability of Junior High School Student. *Journal of Education and Practice, 4*(4), 17–22.

Roni, S. M., Merga, M. K., & Morris, J. E. (2020). Conducting Quantitative Research in Education. In *Conducting Quantitative Research in Education*. https://doi.org/10.1007/978-981-13-9132-3

Rooch, A., Junker, P., Harterich, J., & Hackl, K. (2012). *Making maths more attractive – how real applications increase first year students ' motivation*. 1–18.

Rothstein, J. (2014). *Teacher Quality Policy When Supply Matters*. *June*, 1–59.

Rowe, K. (2008). *ACEReSearch The Importance of Teacher Quality As A Key Determinant of Students ' Experiences and Outcomes of Schooling The importance of Teacher Quality as a key determinant of students ' experiences and outcomes of schooling*. *2003*.

Ruiz-alfonso, Z., León, J., Santana-vega, L. E., & González, C. (2021). Teaching Quality : An Explanatory Model of Learning in Secondary Education. *Psicología Educativa (2021)*, *27*(1), 67–76.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/cou0000340

Saadati, F., & Celis, S. (2023). Student Motivation in Learning Mathematics in Technical and Vocational Higher Education : Development of an Instrument To cite this article : Saadati , F ., & Celis , S . (2023). Student motivation in learning mathematics in technical and Student Motiva. *International Journal of Education in Mathematics, Science and Technology, 11*(1), 156–178.

Scherer, R., & Nilsen, T. (2016). Teacher Quality , Instructional Quality and Student Outcomes. *International Association for the Evaluation of Educational Achievement (IEA)*, *2*.

Schiefele, U., & Csikszentmihalyi, M. (1995). Motivation and Ability as Factors in Mathematics Experience and Achievement Author (s): Ulrich Schiefele and Mihaly Csikszentmihalyi Source : Journal for Research in Mathematics Education , Vol . 26 , No . 2 (Mar ., 1995), pp . Published by : National. *Journal for Research in Mathematics Education*, *26*(2), 163–181.

Schubring, G., Furinghetti, F., & Siu, M. K. (2012). Introduction: The history of mathematics teaching. Indicators for modernization processes in societies. *ZDM - Mathematics Education*, *44*(4), 457–459. https://doi.org/10.1007/s11858-012-0445-7

Schumaher, M. L. N., Milani, D., & Alexandre, N. M. C. (2019). Psychometric properties evaluation of the Psychological Empowerment Instrument in a Brazilian context. *Journal of Nursing Management*, *27*(2), 404–413. https://doi.org/10.1111/jonm.12701

Schunk, D. H. (2013). Social Cognitive Theory and Self-Regulated Learning. *Self-*

Regulated Learning and Academic Achievement: Theoretical Perspectives, Second Edition, 119–144. https://doi.org/10.4324/9781410601032-4

Schunk, D. H., & Mullen, C. A. (2012). Self-Efficacy as an Engaged Learner. *Handbook of Research on Student Engagement*, 1–840. https://doi.org/10.1007/978-1-4614-2018-7

Schunk, D. H., & Pajares, F. (2001). Development of Academic Self-Efficacy The Development of Academic Self-Efficacy. *Development of Achievement Motivation*, *7*, 1–27. https://pdfs.semanticscholar.org/f580/9944e9988646fbb58bbae6eb0366d2f61ff7.pdf

Schunk, D. H., & Pajares, F. (2002). The Development of Academic Self-Efficacy. In *The Development of Achievement motivation* (Vol. 8, Issue 1, pp. 11–28). Academic Press, Inc. https://doi.org/10.12930/0271-9517-8.1.11

Schunk, D. H., & Pajares, F. (2009). Self-Effi cacy Th eory. In *In Handbook of motivation at school* (pp. 49–68). Routledge.

Selçuk, G. S., Sahin, M., & Açıkgöz, K. Ü. (2009). The Effects of Learning Strategy Instruction on Achievement , Attitude , and Achievement Motivation in a Physics Course. *Res Sci Educ*. https://doi.org/10.1007/s11165-009-9145-x

Selvianiresa, D., & Prabawanto, S. (2017). Contextual Teaching and Learning Approach of Mathematics in Primary Schools. *Journal of Physics: Conference Series*, *895*(1). https://doi.org/10.1088/1742-6596/895/1/012171

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2019). Improving Students' Mathematical Problem Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context. *International Electronic Journal of Mathematics Education*, *14*(1), 61–72. https://doi.org/10.12973/iejme/3966

Singh, R., & Sarkar, S. (2012). Teaching Quality Counts : In *An International Study of Childhood Poverty*.

Sirait, S. (2016). Does Teacher Quality Affect Student Achievement ? An Empirical Study in Indonesia. *Journal of Education and Practice*, *7*(27), 34–41.

Siri, A., Supartha, I. W. G., Sukaatmadja, I. P. G., & Ganesha, A. (2020). Does teacher competence and commitment improve teacher ' s professionalism Does teacher competence and commitment improve teacher ' s professionalism. *Cogent Business & Management*, *7*(1). https://doi.org/10.1080/23311975.2020.1781993

Sriraman, B., Michelsen, C., Beckmann, A., & Freiman, V. (2008). INTERDISCIPLINARITY IN MATHEMATICS, SCIENCE AND ARTS: STATE OF THE ART. *Proceedings of the 2nd International Symposium on Mathematics and Its Connections to the Arts and Sciences (MACAS2), Odense*, *4*.

Stahl, B. C. (2007). Positivism or non-positivism—tertium non datur: A critique of ontological syncretism in IS research. *Ontologies: A Handbook of Principles, Concepts and Applications in Information Systems*, 115–142.

Streiner, D. L. (2003). Being Inconsistent About Consistency: When Coefficient Alpha Does and Doesn't Matter. *Journal of Personality Assessment*, *80*(3), 217–222.

https://www.rotman-baycrest.on.ca/files/publicationmodule/@random45f5724eba2f8/JPersAssess03_80_217_222.pdf

Su, C. H., & Cheng, C. H. (2015). A mobile gamification learning system for improving the learning motivation and achievements. *Journal of Computer Assisted Learning*, *31*(3), 268–286. https://doi.org/10.1111/jcal.12088

Sujati, H., Sajidan, Akhyar, M., & Gunarhadi. (2020). Testing the construct validity and reliability of curiosity scale using confirmatory factor analysis. *Journal of Educational and Social Research*, *10*(4), 229–237. https://doi.org/10.36941/JESR-2020-0080

Sulaiman, J., & Ismail, S. N. (2020). Teacher competence and 21st century skills in transformation schools 2025 (TS25). *Universal Journal of Educational Research*, *8*(8), 3536–3544. https://doi.org/10.13189/ujer.2020.080829

Sulaiman, T., Muniyan, V., Madhvan, D., Hasan, R., & Rahim, S. S. A. (2017). Implementing higher order thinking skills in teaching and learning of design and technology education. *International Seminar on Technology and Vocational Education*, *1*(1), 1–3.

Sulistiyo, U. (2016). *ENGLISH LANGUAGE TEACHING AND EFL TEACHER*. *1994*, 396–406.

Suominen, A. L. (2015). *ABSTRACT ALGEBRA AND SECONDARY SCHOOL MATHEMATICS: IDENTIFYING AND CLASSIFYING MATHEMATICAL CONNECTIONS*. University of Georgia.

Surya, E., Putri, F. A., & Mukhtar. (2017). Improving mathematical problem-solving ability and self-confidence of high school students through contextual learning model. *Journal on Mathematics Education*, *8*(1), 85–94. https://doi.org/10.22342/jme.8.1.3324.85-94

Swank, J. M., Houseknecht, A., & Liu, R. (2021). Development of the teaching competencies scale. *Assessment and Evaluation in Higher Education*, *46*(3), 483–493. https://doi.org/10.1080/02602938.2020.1778634

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Teig, N., & Nilsen, T. (2022). Studies in Educational Evaluation Profiles of instructional quality in primary and secondary education : Patterns , predictors , and relations to student achievement and motivation in science. *Studies in Educational Evaluation*, *74*(May), 101170. https://doi.org/10.1016/j.stueduc.2022.101170

Temin, P. (2002). *TEACHER QUALITY AND THE FUTURE OF AMERICA*.

Tongsilp, A. (2013). A Path Analysis of Relationships between Factors with Achievement Motivation of Students of Private Universities in Bangkok , Thailand. *Procedia -*

Social and Behavioral Sciences, *88*, 229–238. https://doi.org/10.1016/j.sbspro.2013.08.501

Tran, L. T., & Nguyen, T. S. (2021). MOTIVATION AND MATHEMATICS ACHIEVEMENT: A VIETNAMESE CASE STUDY. *Journal on Mathematics Education*, *12*(3), 449–468. https://doi.org/10.1016/B978-0-12-813347-7.00001-7

Trevino, N. N., & DeFreitas, S. C. (2014). The relationship between intrinsic motivation and academic achievement for first generation Latino college students. *Social Psychology of Education*, *17*(2), 293–306. https://doi.org/10.1007/s11218-013-9245-3

Trifunov, Z. (2017). Increasing the motivation of the students to learn mathematics. *International Journal of Mathematics Trends and Technology (IJMTT)*, *48*(1), 1–5.

Tsanwani, A. R. (2011). *CONNECTING MATHEMATICS WITH ITS HISTORY A*.

Ukobizaba, F., Ndihokubwayo, K., Mukuka, A., & Uwamahoro, J. (2019). Insights of teachers and students on mathematics teaching and learning in selected Rwandan secondary schools. *African Journal of Educational Studies in Mathematics and Sciences*, *15*(2), 93–106. https://doi.org/10.4314/ajesms.v15i2.8

Uyen, B. P., Tong, D. H., & Lien, N. B. (2022). The Effectiveness of Experiential Learning in Teaching Arithmetic and Geometry in Sixth Grade. *Frontiers in Education*, *7*, 1–13. https://doi.org/10.3389/feduc.2022.858631

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology*, *87*(2), 246–260. https://doi.org/10.1037/0022-3514.87.2.246

WAEC. (2022). Release of Provisional Results for the West African Senior School Certificate Examination (WASSCE) for School Candidates, 2022. In *WAEC/PRO.PRESS* (Vol. 3, Issue 106). https://doi.org/10.1007/BF01421115

Wahyuddin, W. (2016). *The Relationship between of Teacher Competence , Emotional Intelligence and Teacher Performance Madrasah Tsanawiyah at District of Serang Banten*. *6*(1), 128–135. https://doi.org/10.5539/hes.v6n1p128

Weinberg, A. E., Basile, C. G., & Albright, L. (2011). The Effect of an Experiential Learning Program on Middle School Students’ Motivation Toward Mathematics and Science. *RMLE Online*, *35*(3), 1–12. https://doi.org/10.1080/19404476.2011.11462086

Wenglinsky, H. (2000). *How Teaching Matters Bringing the Classroom Back Into Discussions of Teacher Quality*.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, *6*(1), 49–78.

Wigfield, A., & Eccles, J. S. (2000a). expectancy_value_eccles_.pdf. *Contemporary Educational Psychology*, *25*, 68–81.

Wigfield, A., & Eccles, J. S. (2000b). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68–81.

https://doi.org/10.1006/ceps.1999.1015

Wigfield, A., & Wentzel, K. R. (2007). Introduction to motivation at school: Interventions that work. *Educational Psychologist*, *42*(4), 191–196. https://doi.org/10.1080/00461520701621038

Wijayanti, I. K., & Abadi, A. M. (2020). Developing Learning Set with STEM-PBL Approach to Mathematics Connection Ability and Student ' s Learning Motivation. *Advances in Social Science, Education and Humanities Research*, *528*(Icriems 2020), 352–361.

Wilensky, U. J. (1993). Connected Mathematics - Building Concrete Relationships with Mathematical Knowledge [Massachusetts Institute of Technology]. In *Technology*. http://www.ccl.sesp.northwestern.edu/papers/download/Wilensky-thesis.pdf

Wiswall, M. (2011). *The Dynamics of Teacher Quality Matthew Wiswall*. *January 2011*.

Wittmann, E. C. (2021). Connecting Mathematics and Mathematics Education. In *Connecting Mathematics and Mathematics Education*. https://doi.org/10.1007/978-3-030-61570-3

Woolley, N. N., & Jarvis, Y. (2007). Situated cognition and cognitive apprenticeship: A model for teaching and learning clinical skills in a technologically rich and authentic learning environment. *Nurse Education Today*, *27*(1), 73–79. https://doi.org/10.1016/j.nedt.2006.02.010

Xia, Q., Yin, H., Hu, R., Li, X., & Shang, J. (2022). Motivation, Engagement, and Mathematics Achievement: An Exploratory Study Among Chinese Primary Students. *SAGE Open*, *12*(4), 1–15. https://doi.org/10.1177/21582440221134609

Yackel, E., Cobb, P., & Wood, T. (1991). Small-Group Interactions as a Source of Learning Opportunities in Second-Grade Mathematics Author (s): Erna Yackel , Paul Cobb and Terry Wood Source : Journal for Research in Mathematics Education , Nov ., 1991 , Vol . 22 , No . 5 Published by : Nationa. *Journal for Research in Mathematics Education*, *22*(5), 390–408.

Yaman, H., Dündar, S., & Ayvaz, Ü. (2015). Achievement motivation of primary mathematics education teacher candidates according to their cognitive styles and motivation styles. *International Electronic Journal of Elementary Education*, *7*(2), 125–142.

Yeo, J. B. W. (2021). Mathematics Instructional Practices in Singapore Secondary Schools. *Mathematics Instructional Practices in Singapore Secondary Schools*. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib,uid&db=edsebk&AN=2723205&site=eds-live&scope=site

Zhong, B., & Xia, L. (2020). A Systematic Review on Exploring the Potential of Educational Robotics in Mathematics Education. *International Journal of Science and Mathematics Education*, *18*(1), 79–101. https://doi.org/10.1007/s10763-018-09939-y

Zohar, A. (2006). Connected knowledge in science and mathematics education. *International Journal of Science Education*, *28*(13), 1579–1599. https://doi.org/10.1080/09500690500439199

Zollman, A. (2009). Students Use of Graphic Organizers to Improve mathematical Problem-Solving Communications. *Middle School Journal*.

Zyphur, M. J., & Pierides, D. C. (2017). Is Quantitative Research Ethical? Tools for Ethically Practicing, Evaluating, and Using Quantitative Research. *J Bus Ethics, 143*(1), 1–16. https://doi.org/10.1007/sl0551-017-3549-8

APPENDIX A1

QUESTIONNAIRE

A survey information on "Predicting students achievement motivation using mathematics connection: mediation and moderation role of teaching quality, teaching competence and history of Mathematics concepts".

Dear student, this survey is for academic purposes only. Your response will be kept confident and anonymous.

Background Information

Please tick [√] where appropriate.

1. Gender: Male [ ] Female [ ]
2. Age: 11-15 [ ] 16-20 [ ] 20-25 [ ] Above 20 [ ]
3. Form: Form 1 [ ] Form 2 [ ] Form 3 [ ]
4. Course: General Arts [ ] Visual Arts [ ] General Science [ ] Technical [ ] Home Economics [ ] Business [ ]

Rank the following factors that may contribute to your acceptance or rejection on Teaching Quality

***SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree Table* I**

SN	Teaching Quality	SD	D	N	A	SA
1	A quality teacher presents mathematical concepts in an orderly manner.					
2	Teachers assigning students in their spare time increase the quality of mathematics instruction and learning.					
3	Teachers provide enough classroom tasks for me to do in order to assess my grasp of the idea being taught.					
4	My maths instructor urges me to learn the subject.					
5	My maths teacher offers inspiring comments for improved understanding.					
6	Poor learners are guided to learn better.					
7	Students are allowed to participate in class.					
8	Teachers have cordial relationship with students					
9	Teachers can tell when a pupil is having difficulty					
10	Teachers summarize lessons for pupils to remember it better					

Rank the following factors that may contribute to your acceptance or rejection on Teaching Competence

SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree Table II

SN	Teaching Competence	SD	D	N	A	SA
1	Teachers encourage pupils to think critically.					
2	Teachers effectively ask questions.					
3	Teachers teach mathematical ideas in a straightforward and related manner.					
4	Teachers guide class discussions.					
5	Teachers are well-versed in mathematics concepts.					

6	Teachers stimulates students' attention.					
7	Teachers use teaching and learning materials to improve our understanding.					
8	Teachers dictates learning objectives for lesson.					
9	Teachers use different approaches in teaching.					
10	Teachers demonstrate in-depth knowledge apart from textbooks.					

Rank the following factors that may contribute to your acceptance or rejection on Achievement Motivation
SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree Table III

SN	Achievement Motivation	SD	D	N	A	SA
1	I enjoy maths situations in which I may test my abilities.					
2	When I am presented with a mathematics problem that I believe I can solve, I am attracted to begin working on it right away.					
3	I appreciate maths questions in which I can put my skills to solve.					
4	Mathematics activities that allow me to put my skills to test attract me.					
5	I enjoy maths problems in which I challenge my abilities.					
6	When I don't understand mathematics problem, I don't give up easily.					
7	Even if I make a lot of mistakes in solving questions, I like maths.					
8	I enjoy learning new concepts in mathematics.					
9	I enjoy working difficult mathematics assignments.					
10	If I do not understand a problem immediately, I start feeling worried.					

Rank the following factors that may contribute to your acceptance or rejection on History of Mathematics Concepts
SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree Table IV

SN	History of Mathematics Concepts	SD	D	N	A	SA
1	My math teachers introduce new ideas by explaining the historical background.					
2	I appreciate learning about the history of the mathematics concepts we study.					
3	I grasp mathematics concepts better when a teacher introduces topics by their history.					
4	The history of mathematics adds significance to mathematics learning.					
5	Explaining history of topics makes maths learning exciting					
6	I am encouraged to learn history of mathematics concepts					
7	History helps me develop better understanding of how formulae and concepts developed.					
8	I could see how mathematics has been used to solve real-life problems in the past.					
9	History keeps me awake during math class.					
10	Lessons that included the history of mathematics are not boring					

Rank the following factors that may contribute to your acceptance or rejection on Mathematics Connection
SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree Table V

SN	Mathematics Connection	SD	D	N	A	SA
1	Teachers relate mathematical concepts to real-world issues.					
2	Teachers connect Mathematics to other subjects.					
3	Teachers present examples and case studies.					
4	Teachers set aside time each week to practice class exercises.					
5	There is coordination between class work and the assignment supplied by the mathematics teachers.					
6	Teachers teach topics in concrete form.					
7	Teacher explains the role of mathematics in our lives.					
8	I can see the parallels and contrasts between mathematical ideas.					
9	I can solve challenges in my daily life by thinking mathematically.					
10	I can explain the significance of maths in several areas.					

APPENDIX B2

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.836
Bartlett's Test of Sphericity	Approx. Chi-Square	2887.548
	df	190
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.434	27.172	27.172	5.434	27.172	27.172	2.872	14.358	14.358
2	2.341	11.706	38.878	2.341	11.706	38.878	2.671	13.355	27.713
3	1.917	9.585	48.464	1.917	9.585	48.464	2.661	13.303	41.016
4	1.672	8.358	56.821	1.672	8.358	56.821	2.639	13.197	54.213
5	1.442	7.210	64.032	1.442	7.210	64.032	1.964	9.818	64.032
6	.729	3.644	67.676						
7	.678	3.391	71.067						
8	.654	3.270	74.337						
9	.601	3.006	77.343						
10	.553	2.763	80.106						
11	.501	2.506	82.612						
12	.477	2.385	84.997						
13	.469	2.347	87.344						
14	.459	2.294	89.638						
15	.403	2.015	91.654						
16	.383	1.914	93.567						
17	.363	1.817	95.384						
18	.339	1.695	97.079						
19	.334	1.671	98.750						
20	.250	1.250	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component				
	1	2	3	4	5
TQ5	.749				
TQ8	.739				
TQ4	.737				
TQ3	.735				
TQ1	.686				
MC9		.811			
MC10		.799			
MC8		.788			
MC7		.785			
TC6			.813		
TC7			.802		
TC9			.775		
TC4			.724		
AM3				.779	
AM2				.767	
AM4				.761	
AM1				.724	
HMC1					.804
HMC2					.784
HMC3					.709

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 5 iterations.

Statistics

		Gender	Age	Form	Course
N	Valid	390	390	390	390
	Missing	0	0	0	0
Sum		616	761	828	1299

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	164	42.1	42.1	42.1
	female	226	57.9	57.9	100.0
	Total	390	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11-15	31	7.9	7.9	7.9
	16-20	351	90.0	90.0	97.9
	20-25	5	1.3	1.3	99.2
	Above 25	2	.5	.5	100.0
	Total	390	100.0	100.0	

Form

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Form 2	349	89.5	89.5	89.5
	Form 3	37	9.5	9.5	100.0
	Total	390	100.0	100.0	

Course

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General Arts	67	17.2	17.2	17.2
	Visual Arts	58	14.9	14.9	32.1
	General Science	96	24.6	24.6	56.7
	Technical	36	9.2	9.2	65.9
	Home Economics	114	29.2	29.2	95.1
	Business	19	4.9	4.9	100.0
	Total	390	100.0	100.0	

Reliability Statistics

Cronbach's Alpha	N of Items
.811	5

Reliability Statistics

Cronbach's Alpha	N of Items
.820	4

Reliability Statistics

Cronbach's Alpha	N of Items
.814	4

Reliability Statistics

Cronbach's Alpha	N of Items
.709	3

Reliability Statistics

Cronbach's Alpha	N of Items
.827	4

APPENDIX C3

ORIGINALITY REPORT

Thesis

ORIGINALITY REPORT

14%	11%	7%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.researchgate.net Internet Source	2%
2	www.science.gov Internet Source	<1%
3	hdl.handle.net Internet Source	<1%
4	Submitted to University of Birmingham Student Paper	<1%
5	New ICMI Study Series, 2002. Publication	<1%
6	es.scribd.com Internet Source	<1%
7	Máire Ní Ríordáin, Jennifer Johnston, Gráinne Walshe. "Making mathematics and science integration happen: key aspects of practice", International Journal of Mathematical Education in Science and Technology, 2015 Publication	<1%
8	Submitted to HOLY TRINITY COLLEGE Student Paper	

		<1%
9	erepository.uonbi.ac.ke Internet Source	<1%
10	www.saibw.co.za Internet Source	<1%
11	ife.ens-lyon.fr Internet Source	<1%
12	www.grin.com Internet Source	<1%
13	www.mathsciteacher.com Internet Source	<1%
14	Eli, Jennifer A., Margaret J. Mohr-Schroeder, and Carl W. Lee. "Mathematical Connections and Their Relationship to Mathematics Knowledge for Teaching Geometry : Mathematical Connections and MKT Geometry", School Science and Mathematics, 2013. Publication	<1%
15	Submitted to Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development Student Paper	<1%
16	edepositireland.ie Internet Source	<1%

17	uir.unisa.ac.za Internet Source	<1 %
18	"Explore Business, Technology Opportunities and Challenges After the Covid-19 Pandemic", Springer Science and Business Media LLC, 2023 Publication	<1 %
19	core.ac.uk Internet Source	<1 %
20	s3-ap-southeast-1.amazonaws.com Internet Source	<1 %
21	www.apta.asia Internet Source	<1 %
22	Boston, Melissa. "Assessing Instructional Quality in Mathematics", The Elementary School Journal, 2012. Publication	<1 %
23	Jörg Härterich, Christine Kiss, Aeneas Rooch, Martin Mönnigmann, Moritz Schulze Darup, Roland Span. " – connecting first-year mathematics with engineering applications ", European Journal of Engineering Education, 2012 Publication	<1 %
24	repository.nwu.ac.za Internet Source	<1 %

25	Submitted to Unicaf University Student Paper	<1 %
26	Submitted to Bataan Peninsula State University Student Paper	<1 %
27	Saied Bishara. "Creativity in unique problem-solving in mathematics and its influence on motivation for learning", Cogent Education, 2016 Publication	<1 %
28	d-nb.info Internet Source	<1 %
29	europub.co.uk Internet Source	<1 %
30	etd.aau.edu.et Internet Source	<1 %
31	jyx.jyu.fi Internet Source	<1 %
32	www.diva-portal.org Internet Source	<1 %
33	Bismark Mensah. "Pre-Service Geography Teachers' Pedagogical Competence in Their Minor Subjects: Implications for Teacher Education", Research Square Platform LLC, 2022 Publication	<1 %

34	Submitted to Heriot-Watt University Student Paper	<1 %
35	ir.csuc.edu.gh:8080 Internet Source	<1 %
36	Baichang Zhong, Liying Xia. "A Systematic Review on Exploring the Potential of Educational Robotics in Mathematics Education", International Journal of Science and Mathematics Education, 2018 Publication	<1 %
37	connectedmath.msu.edu Internet Source	<1 %
38	1library.net Internet Source	<1 %
39	ir.jkuat.ac.ke Internet Source	<1 %
40	Submitted to North West University Student Paper	<1 %
41	repository.gij.edu.gh Internet Source	<1 %
42	James Kaconco, Betty Nabuuma, Jude Thaddeo Mugarura, John Baptist Kirabira. "Investigating relationship of master production scheduling on blood transfusion sustainability in Uganda", Social Sciences & Humanities Open, 2023	<1 %

Publication

43	journals.plos.org Internet Source	<1%
44	researchspace.ukzn.ac.za Internet Source	<1%
45	www.escholar.manchester.ac.uk Internet Source	<1%
46	Submitted to University of Witwatersrand Student Paper	<1%
47	ir.ucc.edu.gh Internet Source	<1%
48	shstrendz.com Internet Source	<1%
49	stemeducationjournal.springeropen.com Internet Source	<1%
50	athlos.pssjd.org Internet Source	<1%
51	irepository.aua.ac.ke:8080 Internet Source	<1%
52	origin-www.ifla.org Internet Source	<1%
53	www.frontiersin.org Internet Source	<1%

54	Boniwell, Ilona, Tunariu, Aneta D.. "Positive Psychology: Theory, Research and Applications", Positive Psychology: Theory, Research and Applications, 2019 Publication	<1 %
55	Heerah Jose, Vijay Kuriakose, Moli P. Koshy. "What motivates Indian consumers' to buy organic food in an emerging market?", Asia-Pacific Journal of Business Administration, 2020 Publication	<1 %
56	Submitted to Sheffield Hallam University Student Paper	<1 %
57	Submitted to The Robert Gordon University Student Paper	<1 %
58	edocs.maseno.ac.ke Internet Source	<1 %
59	repository.out.ac.tz Internet Source	<1 %
60	www.researchsquare.com Internet Source	<1 %
61	Submitted to Navitas Professional Institute Pty Ltd Student Paper	<1 %
62	Submitted to University of Southern California Student Paper	<1 %

63	ecdcpublishing.com Internet Source	<1%
64	Anne-Marie Aish, Inga-Lill Ramberg, Danuta Wasserman. "Measuring Attitudes of Mental Health Care Staff Toward Suicidal Patients", Archives of Suicide Research, 2002 Publication	<1%
65	Submitted to The University of Manchester Student Paper	<1%
66	Submitted to University of Northumbria at Newcastle Student Paper	<1%
67	Submitted to University of Wales central institutions Student Paper	<1%
68	www.coursehero.com Internet Source	<1%
69	Submitted to Jyväskyla University Student Paper	<1%
70	Submitted to Liberty University Student Paper	<1%
71	Samuel Kwaku Boadu, Yarhands Dissou Arthur, Ebenezer Bonyah. "Mediation and moderation effects of motivation and teaching quality on the relationship between peer tutoring and mathematics achievement",	<1%

Journal of Mathematics and Science Teacher, 2023
Publication

72	ir.knust.edu.gh Internet Source	<1 %
73	pdfslide.us Internet Source	<1 %
74	Kim Beswick, Olive Chapman. "International Handbook of Mathematics Teacher Education: Volume 4", Brill, 2020 Publication	<1 %
75	Submitted to Laureate Higher Education Group Student Paper	<1 %
76	Submitted to University of Plymouth Student Paper	<1 %
77	Submitted to University of Wales Institute, Cardiff Student Paper	<1 %
78	Submitted to Vels University Student Paper	<1 %
79	erepository.uonbi.ac.ke:8080 Internet Source	<1 %
80	A. Bhattacherjee. "Acceptance of e-commerce services: the case of electronic brokerages", IEEE Transactions on Systems, Man, and	<1 %

Cybernetics - Part A: Systems and Humans, 2000
Publication

81	Submitted to Oklahoma Wesleyan University Student Paper	<1 %
82	dspace.knust.edu.gh Internet Source	<1 %
83	publishingindia.com Internet Source	<1 %
84	thesis.eur.nl Internet Source	<1 %
85	www.iiste.org Internet Source	<1 %
86	Felipe Hernández Perlines, Manuel Alejandro Ibarra Cisneros. "Analysis of the moderating effect of entrepreneurial orientation on the influence of social responsibility on the performance of Mexican family companies", Cogent Business & Management, 2017 Publication	<1 %
87	Submitted to University of South Florida Student Paper	<1 %
88	ethesis.nitrkl.ac.in Internet Source	<1 %
89	flepublications.com Internet Source	<1 %

90	link.springer.com Internet Source	<1%
91	methods-sagepub-com-spjimrlibrary.knimbus.com Internet Source	<1%
92	repository.sustech.edu Internet Source	<1%
93	www.tandfonline.com Internet Source	<1%
94	D A Kusuma, D Suryadi, J A Dahlan. "Improving external mathematical connections and students' activity using ethnomathematics", Journal of Physics: Conference Series, 2019 Publication	<1%
95	Li Cheng, Pavlo D. Antonenko, Albert D. Ritzhaupt, Kara Dawson et al. "Exploring the influence of teachers' beliefs and 3D printing integrated STEM instruction on students' STEM motivation", Computers & Education, 2020 Publication	<1%
96	docplayer.net Internet Source	<1%
97	dokumen.pub Internet Source	<1%

98	ijbssnet.com Internet Source	<1 %
99	iskwiki.upd.edu.ph Internet Source	<1 %
100	mobt3ath.com Internet Source	<1 %
101	scholar.mzumbe.ac.tz Internet Source	<1 %
102	wrap.warwick.ac.uk Internet Source	<1 %
103	www.bartleby.com Internet Source	<1 %
104	Submitted to Higher Education Commission Pakistan Student Paper	<1 %
105	Mirna Kordab. "Measuring knowledge management processes in auditing and consultancy firms", Vilnius Gediminas Technical University, 2023 Publication	<1 %
106	activitytypes.wm.edu Internet Source	<1 %
107	aran.library.nuigalway.ie Internet Source	<1 %
	discol.umk.edu.my	

108	Internet Source	<1 %
109	dspace.muhas.ac.tz:8080 Internet Source	<1 %
110	ir.library.ui.edu.ng Internet Source	<1 %
111	ir.mu.ac.ke:8080 Internet Source	<1 %
112	journal.wima.ac.id Internet Source	<1 %
113	rvsim.ac.in Internet Source	<1 %
114	Emilie J. Prast, Eva Van de Weijer-Bergsma, Milica Miočević, Evelyn H. Kroesbergen, Johannes E.H. Van Luit. "Relations between mathematics achievement and motivation in students of diverse achievement levels", Contemporary Educational Psychology, 2018 Publication	<1 %
115	Nani Teig, Trude Nilsen. "Profiles of instructional quality in primary and secondary education: Patterns, predictors, and relations to student achievement and motivation in science", Studies in Educational Evaluation, 2022 Publication	<1 %

116	ZIA HAQ, Mohsina Dawood. "Does FinTech promote entrepreneurial intention among women? Studying the mediating role of financial inclusion.", Research Square Platform LLC, 2023 Publication	<1 %
117	www.pure.ed.ac.uk Internet Source	<1 %