

# PRE-SERVICE MATHEMATICS TEACHERS' SELF-EFFICACY AND PERFORMANCE: A CASE STUDY OF EDUCATION COLLEGES IN KWARA STATE, NIGERIA

(Kecekapan Kendiri dan Prestasi Guru Matematik Pra-Perkhidmatan: Satu Kajian Kes Kolej Pendidikan di Daerah Kwara, Nigeria)

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## Abstract

This study examined the relationship between pre-service mathematics teachers' self-efficacy and their performance in Colleges of Education in Kwara State, Nigeria. The objectives of the study were to ascertain the connection between the respondents' beliefs, motivation, mastery experience, and performance. The research design utilized in this study was a correlational design. The population consisted of 322 pre-service mathematics teachers selected from the six Colleges of Education in Kwara State, Nigeria. A multi-stage sampling technique was employed to select 250 respondents. The instrument used for data collection was an adapted questionnaire titled "Mathematics Self-Efficacy Questionnaire," while the students' mathematics performance was assessed using the existing Cumulative Grade Points Average (CGPA). The questionnaire demonstrated a Cronbach Alpha reliability index of 0.87. Out of the 250 questionnaires distributed, 232 responses were deemed adequate and included in the data analysis. To test the formulated hypotheses at a 0.05 level of significance, Pearson's Product Moment Correlation ( $r$ ) and Multiple Regression Analysis were employed. The findings of this study revealed that there is a positive and independent relationship between pre-service mathematics teachers' belief ( $r = 0.25$ ;  $p = 0.000 < 0.05$ ), motivation ( $r = 0.22$ ;  $p = 0.000 < 0.05$ ), mastery experience ( $r = 0.23$ ;  $p = 0.000 < 0.05$ ), and their performance. Additionally, there is no joint correlation between pre-service mathematics teachers' belief, motivation, mastery experience, and their performance ( $F = 5.363$ ;  $p = 0.159$ ;  $0.714$  &  $0.461 > 0.05$ ). Based on these findings, it can be concluded that self-efficacy is a significant determinant factor in evaluating the academic performance of pre-service mathematics teachers. In light of these conclusions, relevant recommendations were made.

**Keywords:** Pre-service Mathematics Teachers, Self-efficacy, Performance, Colleges of Education

## Abstrak

Kajian ini mengkaji hubungan antara kendiri diri guru matematik pra-perkhidmatan dan prestasi mereka di Kolej Pendidikan di Daerah Kwara, Nigeria. Objektif kajian ini adalah untuk memastikan hubungan antara kepercayaan, motivasi, pengalaman masteri, dan prestasi responden. Reka bentuk penyelidikan yang digunakan dalam kajian ini adalah reka bentuk korelasi. Populasi kajian terdiri daripada 322 guru matematik pra-perkhidmatan yang dipilih dari enam Kolej Pendidikan di Daerah Kwara, Nigeria. Teknik pensampelan pelbagai peringkat telah digunakan untuk memilih 250 responden. Instrumen yang digunakan untuk pengumpulan data ialah soal selidik yang diadaptasi dari soal selidik yang bertajuk "Soal Selidik Kendiri Matematik," manakala prestasi matematik

pelajar dinilai menggunakan Purata Nilai Gred Kumulatif (PNGK) sedia ada. Soal selidik menunjukkan indeks kebolehpercayaan Cronbach Alpha 0.87. Daripada 250 soal selidik yang diedarkan, 232 respons dianggap mencukupi dan dimasukkan ke dalam analisis data. Untuk menguji hipotesis yang dirumuskan pada tahap kepentingan 0.05, Korelasi Momen Produk Pearson ( $r$ ) dan Analisis Regresi Pelbagai telah digunakan. Dapatan kajian ini mendedahkan bahawa terdapat hubungan positif dan bebas antara kepercayaan guru matematik pra-perkhidmatan ( $r = 0.25$ ;  $p = 0.000 < 0.05$ ), motivasi ( $r = 0.22$ ;  $p = 0.000 < 0.05$ ), pengalaman masteri ( $r = 0.23$ ;  $p = 0.000 < 0.05$ ), dan prestasi mereka. Selain itu, tidak ada korelasi bersama antara kepercayaan guru matematik pra-perkhidmatan, motivasi, pengalaman penguasaan, dan prestasi mereka ( $F = 5.363$ ;  $p = 0.159$ ;  $0.714$  &  $0.461 > 0.05$ ). Berdasarkan penemuan ini, dapat disimpulkan bahawa keberkesanan diri adalah faktor penentu yang signifikan dalam menilai prestasi akademik guru matematik pra-perkhidmatan. Berdasarkan kesimpulan ini, cadangan yang relevan telah dicadangkan.

**Kata Kunci:** Guru Matematik Pra-perkhidmatan, Kendiri, Prestasi, Kolej Pendidikan

## 1.0 INTRODUCTION

Teachers are a crucial human resource in every nation due to their role in the development of human capital. The significance and efficacy of teachers play a pivotal role in this process (Bekic & Zlatic, 2010). The academic performance of students in the classroom is greatly influenced by the sensitivity, motivation, and competence of the teacher. Moreover, the quality of teachers is closely linked to their educational program. Teacher education encompasses a wide range of procedures and policies aimed at equipping prospective teachers with the necessary skills, knowledge, behaviors, and attitudes to effectively fulfill their responsibilities in the classroom, school, and wider community (Allen, 2011). The ultimate objective is to cultivate teacher proficiency and competence, enabling them to meet the demands of the profession and overcome any challenges they may encounter (Darling-Hammond & Bransford, 2005).

Teacher education is comprised of two main components: in-service teacher education and pre-service teacher education (Allen, 2011). In-service teacher education refers to programs or learning opportunities designed for practicing teachers, whereas pre-service teacher education aims to provide prospective teachers with the pedagogical skills and knowledge required for effective content delivery in their respective areas of specialization. This study specifically focuses on pre-service teachers, as defined by Goulette and Swanson (2018) as student teachers enrolled in a teacher education program working towards teacher certification. These pre-service teachers receive training in universities or colleges of education to become professional teachers, yet they often lack actual classroom teaching experience.

One of the integral elements of teacher education programs is mathematics courses, which aim to equip pre-service teachers with the necessary skills and knowledge for effective, standards-based mathematics instruction (Zibit & Gibson, 2005). However, concerns have been raised regarding the quality of teachers, both in terms of completing their teacher education courses and in relation to pre-service teachers in general. Additionally, teacher education has faced criticism for its failure to adequately prepare graduates with the requisite knowledge and skills to effectively teach mathematics and bring about educational reform in the classroom (Allen, 2011). Ochieng, Kiplagat, and Nyongesa (2017) argue that many mathematics teachers entering the profession lack sufficient content knowledge, as well as pedagogical knowledge on how to effectively teach the subject to learners. Self-

efficacy, one of the factors influencing teachers' knowledge and performance, serves as the focal point of this study.

Self-efficacy refers to not only an individual's natural abilities but also their self-confidence and self-assurance that they can accomplish their goals with the resources at their disposal. Highly self-efficacious individuals have a high level of confidence that they can overcome obstacles that may prevent them from accomplishing their goals. Luszczynska and Schwarzer (2005) argue that an individual's sense of self-efficacy significantly influences their approach to challenges, tasks, and goal attainment. When teachers experience success and subsequently gain or maintain self-efficacy, they are generally motivated to continue their learning and progress in a specific area of study (Mayer, 2010).

The efficacy of mathematics teachers in the subject of mathematics holds great importance in enabling effective functioning in everyday life and fostering well-rounded development in our ever-evolving technological society. According to Kurumeh (2007), the role of mathematics in science, technology, and national development is so multifaceted that no nation can advance scientifically and technologically without a strong foundation in mathematics. (2012) states, "Mathematics plays a vital role in the development of science, technology and national development." Without a solid foundation in mathematics, no nation can progress in science and technology. Therefore, the development of mathematical education is essential for a nation's economic growth. In addition to the government's efforts to fight corruption and improve bilateral trade between nations, there is a need to focus on the development of effective science, technology, and mathematics education (STM). Only by effectively applying mathematical knowledge can a nation progress in industrial and technological development.

Recognizing the significant role that mathematics plays in a nation's development, the subject has been accorded high priority in the Nigerian school curriculum, particularly within the secondary school system. To assist students in recognizing their mathematical potential and its applicability to national development, it is essential to have trained and qualified mathematics teachers who possess comprehensive content knowledge, effective teaching skills, a positive attitude towards the subject, and a high level of self-efficacy.

According to Allinder (2016), teachers' self-efficacy is interconnected with various facets of their professional lives, encompassing beliefs concerning the teacher-student relationship, classroom management, and emotional elements such as job satisfaction. Consequently, teachers' mathematics self-efficacy signifies their assurance in their capacity to effectively resolve mathematical problems and tasks. It is of paramount importance for pre-service mathematics teachers to possess adequate self-efficacy in mathematics, as they serve as exemplars for students and must possess the ability to comprehend and solve both straightforward and intricate mathematical problems. Teachers who foster self-efficacy in struggling readers often discover that these students exhibit heightened enthusiasm and dedication to learning in comparison to those who have not received encouragement through incremental progress (Margolis & McCabe, 2006).

Teachers who possess diminished self-efficacy expectations are unable to inspire students to engage in mathematics and cultivate belief in their abilities. Consequently, this presents a fundamental obstacle to the advancement of mathematical education among prospective teachers. Conversely, teachers who demonstrate elevated self-efficacy exert enhanced effort and perseverance, thereby influencing student learning. In contrast, teachers with diminished self-efficacy are more inclined to employ teacher-directed strategies. In other words, these teachers are less likely to embrace significant teaching strategies that can effectively aid students, despite their awareness of such strategies. Teachers who

possess self-efficacy in mathematics exhibit confidence in the subject matter they teach and are more inclined to pose thought-provoking queries, take calculated risks, and establish vital conceptual connections in students' learning and comprehension. Consequently, students who are instructed by highly efficacious mathematics teachers have the highest probability of attaining superior mathematical performance.

Teaching is a vocation that necessitates a robust sense of self-efficacy for teachers to effectively manage the energy and enthusiasm of adolescent students in secondary schools. Pendergast, Garvis, and Keogh (2011) assert that high self-efficacy among teachers fosters persistence and resilience, enabling them to meet the learning needs of their students. Conversely, when students are placed in classrooms with teachers who possess low self-efficacy, their performance is detrimentally impacted. This can prove to be detrimental, particularly for students who are already struggling academically.

Research consistently indicates a positive correlation between an individual's belief in their ability to successfully perform mathematical tasks and their actual mathematical performance. In their study, Liu and Koirala (2009) uncover a notable connection between a teacher's level of confidence in their mathematical skills and their proficiency in solving mathematical problems. Furthermore, Holzberger, Philipp, and Kunter (2013) find evidence suggesting that a teacher's effectiveness and the quality of their instruction in the classroom are directly influenced by their belief in their ability to teach. Similarly, Lawrence and Sanders (2012) demonstrate that teachers who possess a high level of confidence in their instructional abilities are more successful in implementing and evaluating their teaching methods. These findings imply that a teacher's self-assurance can extend to their effectiveness as an educator.

The competence of mathematics teachers plays a crucial role in determining their performance in the subject. According to Weinert (2011), competence is a complex concept that encompasses cognitive abilities, motivation, volition, and the social readiness to apply solutions in job-related contexts. Passos (2009) further highlights the close connection between teacher competence and professional performance and emphasizes that it can be understood from both cognitive and operational perspectives. From a cognitive standpoint, teacher competence is seen as a cognitive structure that enables specific behaviors, while the operational perspective encompasses a wide range of higher-order skills, knowledge, metacognition, strategic thinking, attitudes, and behaviors that demonstrate a teacher's ability to navigate complex and unpredictable situations. In a study by Inan (2015), it was found that there were no significant differences in the competencies of pre-service teachers in relation to the acquisition of thinking skills related to simple-to-complex patterns. Similarly, Ochieng, Kiplagat, and Nyongesa (2017) discovered a significant positive correlation between pre-service teachers' competence and their performance in mathematics.

Teachers' self-confidence is part of the teacher's competency. According to Philipp and Skott (2015), self-confidence is said to be a mental understanding of basic thoughts, ideas, or individual propositions that are assumed to be true. It is the confidence an individual develops towards achieving a specific goal. Teachers' confidence and teacher's performance are inseparable (Fives, 2008). In other words, teachers' confidence also has a crucial role in student performance. Pre-service teachers are admitted into teacher education programs with pre-existing beliefs that are derived from their personal and everyday experiences in their immediate environment. These beliefs are resilient and resistant to change, acting as filters through which new knowledge is assimilated, accepting only what aligns with their current beliefs. Furthermore, these beliefs exist in a tacit or implicit form, making them challenging to articulate (Perry, Vistro-Yu, Howard, Wong & Fong, 2012). In a study

conducted by Schreiber (2012), it was revealed that students who strongly believe that success in mathematics is primarily determined by innate ability tend to achieve higher scores on tests. Additionally, Schuck and Grootenboer (2004) discovered that pre-service teachers often hold beliefs about mathematics that hinder their ability to effectively teach the subject in a way that empowers students.

Motivation is an integral aspect of mathematics teachers' self-efficacy. It encompasses the cultivation and stimulation of learners' interest in educational tasks, directing their internal energies toward various objectives within their environment (Borah, 2021). Motivation enhances the initiation and persistence of learning activities, resulting in increased time spent on tasks. Moreover, it is a crucial factor influencing students' learning and performance outcomes (Borah, 2021). The connection between motivation and the mathematics performance of pre-service teachers has also been established. For example, research studies conducted by Awofala and Falolu (2012) and Aziz, Purnomo, and Pramudiani (2017) have demonstrated statistically significant positive associations between mathematics teachers' motivation and their performance.

A relationship between mastery experience, which refers to prior mathematics performance, and teaching self-efficacy among Hispanic students was identified by Stevens, Olivarez, Lan, and Tallent-Runnels (2004). Additionally, Flores, Patterson, Shippen, Hinton, and Franklin (2010) observed a positive correlation between self-efficacy and the ability of both pre-service and practicing special education teachers to solve mathematical word problems. Their findings indicated that participants with higher self-efficacy beliefs in teaching mathematics also exhibited higher scores in mathematics problem-solving. According to Kahle (2008), teachers' mathematical teaching self-efficacy is linked to their knowledge, preparation, students' performance, personal efficacy, and vicarious experiences. Furthermore, Han, Liou-Mark, Yu, and Zeng (2015) reported in their study that teachers with a strong sense of self-efficacy displayed heightened motivation towards mathematics teaching and performance.

## 2.0 STATEMENT OF THE PROBLEM

In order to advance the economic growth and technological advancement of any nation, mathematics, and sciences has been recognized as important subject. Hence, basic mathematics is regarded as a supreme need for all children. Mathematics produces abilities and skills needed to succeed in other aspects of science and technology. This implies that basic mathematics and mathematics at any level in the Nigerian education system should be given ultimate attention and must be thoroughly taught and learned. Also, research has suggested that student's level of success and intelligence can be a result of the teachers teaching the subject content. Iji and Uka (2012) noted that the desired educational goals cannot be achieved without well-trained, qualified, and motivated teachers, even when the course curriculum content is at its best.

Table 1 Failure in SSCE Mathematics

Examination	Year	Pass	Fail
WASSCE	2016	52.8% have credit in mathematics	47.2% failed Mathematics
WASSCE	2017	58.9% have credit in mathematics	41.1% failed Mathematics
WASSCE	2018	47.6% have credit in mathematics	52.4% failed Mathematics
WASSCE	2019	26.08% five credits including Mathematics	73.92% failed Mathematics
WASSCE	2020	65.24% five credits including Mathematics	34.76% failed Mathematics

Source: Field Work

The significance of Mathematics to the development has led to intense scrutiny of Mathematics Education in Nigeria. Despite this, students' performance in the subject calls for concern (See Table 1), for example.

From Table 1, Adedigba (2020) from the Premium Time Paper reported that in 2019 and 2020, 64.18% and 65.24% respectively obtained credit passes in five subjects including Mathematics. This implies that 35.82% and 34.76% of all the students who sat for WASSCE failed Mathematics, which could be considered unsatisfactory. Similarly, in the Guardian Online News, Atueyi (2019) reported that, 3,102 representing 26.08% of 11,892 students who sat for WASSCE obtained five credits passes and above including Mathematics; indicating that, about 73.92% failed Mathematics in the year 2019. Also, the National Bureau of Statistics (2019) reports indicated that in Kwara State as of 2016, 47.2% of 37,712 students that sat for WASSCE failed Mathematics. In 2017, 41.1% of 37,549 students failed Mathematics; while 52.4% of 37,235 students failed the subject in 2018.

Many of these students who did not succeed in Mathematics may find themselves enrolled in Colleges of Education and ultimately become pre-service Mathematics instructors. There may be concerns regarding whether they would encounter difficulties in passing at the NCE level, considering that independent study is necessary despite having completed their secondary education. The probability of them achieving mastery of the subject is also worth considering. Furthermore, if they do attain mastery, would they possess the confidence, ability, and competence to effectively transmit this knowledge? If their Mathematics education at this stage is below standard, can these inadequately prepared pre-service Mathematics instructors effectively impart meaningful knowledge to their potential students at both primary and secondary levels? If the upcoming generation receives poor Mathematical knowledge, there is a potential risk of the country falling behind in producing talented, creative, and innovative individuals who can contribute to sustainable development through the application of Mathematical knowledge.

Moreover, self-efficacy has been observed as one of the contributing factors to the unsatisfactory performance of pre-service teachers in Mathematics. According to Tekkaya, Cakiroglu, and Ozkan (2004), a significant number of pre-service mathematics teachers possess a limited conceptual understanding of the subject. Some of them possess the necessary knowledge but struggle to effectively convey it to their students. Additionally, some teachers and students harbor negative attitudes towards the subject in secondary schools. Many pre-service teachers often underestimate the intricacy of teaching and their ability to manage lesson planning and subject content knowledge. Stoehr and Olson (2015) discovered that pre-service teachers experience high levels of anxiety pertaining to mathematics, which subsequently affects their learning and preference for teaching the subject matter. This anxiety also impacts the development of their self-efficacy and concepts of ideal teaching.

Despite the comprehensive teacher education programs in Nigerian universities, it is disconcerting to observe that some pre-service mathematics teachers still experience anxiety while instructing students, particularly during their teaching practice and peer teaching exercises. Many of these teachers become unnecessarily apprehensive when faced with mathematics-related tasks, even in the absence of their evaluators. In light of this, one must consider how a mathematics teacher who lacks confidence in providing solutions to basic mathematical problems can effectively impart knowledge to their students. Consequently, society would remain underdeveloped due to the inability of prospective teachers to apply mathematical approaches in solving societal problems, let alone transmitting knowledge to their students.

There exists a scarcity of scholarly investigations pertaining to the self-efficacy and performance of mathematics teachers. A substantial proportion of the accessible studies, namely those conducted by Zaya, Kwalat, and Attah (2016), Zee and Koomen (2016), and Gurefe and Bakalim (2018), were conducted outside the researcher's home country. Furthermore, the majority of these studies primarily examined the interplay between self-efficacy and various psychological constructs, including emotional intelligence, mathematics teaching self-efficacy, mathematics anxiety, demographic variables, and classroom management, among others. It is important to note that the present study specifically focuses on the context of Kwara state in Nigeria. Thus, the researcher is aware of only a limited number of studies related to the current research topic conducted within Nigeria, such as those carried out by Aremu and Tella (2009), Awofala, Fatade, and Udeani (2015), Ernest and Donwu (2016), Bala and Adamu (2019), and Woke, Agu, and Enemu (2021). However, it is worth mentioning that these aforementioned studies diverge from the specific focus of the present study and were not conducted in Kwara state. The researcher thus deems it imperative to investigate the relationship between pre-service teachers' mathematics self-efficacy and their performance in Colleges of Education in Kwara State.

### 3.0 RESEARCH HYPOTHESES

The following null hypotheses were tested in the study:

- a) There is no significant relationship between pre-service mathematics teachers' belief and their performance.
- b) There is no significant relationship between pre-service mathematics teachers' motivation and their performance.
- c) There is no significant relationship between pre-service mathematics teachers' mastery experience and their performance.
- d) There is no significant correlation between pre-service mathematics teachers' beliefs, motivation, and performance.

### 4.0 METHODOLOGY

The research design adopted for the study was the correlational survey design. It explains the relationship that exists between pre-service teachers' mathematics self-efficacy and their mathematics performance in Kwara State through the use of questionnaires entitled "Self-Efficacy Scale".

Table 2: Population of Pre-Service Teachers of Colleges of Education in Kwara State

S/N	Institution	NCE 1	NCE 2	NCE 3	Population	Sample
1	Kwara State College of Education, Ilorin	28	39	42	109	$109/322 * 250 = 85$
2	College of Education, Oro	11	10	9	30	$30/322 * 250 = 23$
3	College of Education (Technical), Lafagi	7	5	9	21	$21/322 * 250 = 16$
4	Muhyideen College of Education	25	42	39	106	$106/322 * 250 = 82$
5	Nana Aishat Memorial College of Education	7	5	13	25	$25/322 * 250 = 20$
6	Grand-Plus COED, Ilorin	9	10	12	31	$31/322 * 250 = 24$
	Total	87	111	124	322	250

Source: Colleges Registries (2021)

The population for this study comprised all Mathematics education students at Colleges of Education in Kwara State. The target population was estimated at 322 pre-service mathematics teachers from six Colleges of Education in Kwara State (both private and state-owned). The population breakdown is shown in Table 2.

Based on the population size of 322 individuals, the Research Advisor (2006) recommended a sample size of 250 based on the sample size determination table, with a confidence level of 99% and a margin of error of 0.05. The selection of respondents utilized a multi-stage sampling technique. In the first stage, a purposive sampling technique was employed to select the six Colleges of Education in Kwara State that offer mathematics education, as demonstrated in Table 1. In the second stage, a proportionate sampling technique was used to select respondents based on the contribution of each College of Education to the total population of the study. Consequently, 85, 23, 16, 82, 20, and 24 pre-service teachers were selected from the aforementioned six Colleges of Education, respectively, using a simple random sampling technique.

Two research instruments were utilized for data collection in this study. The measurement of Mathematics self-efficacy was conducted using an adapted Mathematics Self-Efficacy Questionnaire, while the mathematics performance of students was measured using their existing Cumulative Grade Point Average (CGPA). The Mathematics Self-Efficacy instrument was adapted from the work of Erickson and Noonan (2021), while the data on Mathematics Performance was collected from the relevant departments. The original Mathematics Self-Efficacy instrument consisted of twenty-four (24) items, covering the three major components of self-efficacy: belief, motivation, and mastery experience. However, for this study, the instrument was modified by adding six additional items, resulting in a total of thirty (30) items. Section A of the instruments focused on the demographic data of the respondents, while Section B contained thirty items (ten items for each of the three components of self-efficacy) pertaining to Mathematics Self-Efficacy. The original instrument employed a scoring format of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). However, the researcher modified it to a five-point Likert-type scoring format, with Always = 5, Often = 4, Sometimes = 3, Rarely = 2, and Never = 1 adopted for the scale.

The face and content validity of the instrument were assessed by experts in Educational Psychology and Measurement and Evaluation. Using the split-half method, the questionnaire yielded a Cronbach Alpha reliability index of 0.87, which falls within the acceptable range. The collected data were analyzed using Pearson's Product Moment Correlation ( $r$ ) and Multiple Regression Analysis. All hypotheses were tested at a significance level of 0.05.

## 5.0 RESULTS

HO1: There is no significant relationship between pre-service mathematics teachers' belief and their performance in mathematics.

**Table 3:** Pearson's ( $r$ ) Statistics Showing the Relationship between Pre-service Mathematics Teachers' Belief and their Performance

Variables	N	Mean	SD	df	Cal. $r$	p-value
Belief	232	41.21	9.87	230	0.25*	0.000
Academic Performance	232	1.62	0.88			

\* Sig. at  $p < 0.05$

Table 3 shows that at a degree of freedom (df) of 230, the calculated r-value of 0.25 ( $p = 0.000 < 0.05$ ) was statistically significant. This indicates that the hypothesis, which stated that there is no significant relationship between pre-service mathematics teachers' belief and their performance was rejected. Hence, a positive relationship exists between pre-service mathematics teachers' belief and their performance.

**H<sub>02</sub>:** There is no significant relationship between pre-service mathematics teachers' motivation and their performance.

**Table 4:** Pearson's (r) Statistics Showing the Relationship between Pre-service Mathematics Teachers' Motivation and their Performance

Variables	N	Mean	SD	df	Cal. r	p-value
Motivation	232	42.53	10.29	230	0.22*	0.001
Academic Performance	232	1.62	0.88			

\* Sig. at  $p < 0.05$

Table 4 shows that at a degree of freedom (df) of 230, the calculated r-value of 0.22 ( $p = 0.000 < 0.05$ ) was statistically significant. This indicates that the hypothesis, which stated that there is no significant relationship between pre-service mathematics teachers' motivation and their performance was rejected. Hence, a positive relationship exists between pre-service mathematics teachers' motivation and their performance.

**H<sub>03</sub>:** There is no significant relationship between pre-service mathematics teachers' mastery experience and their performance.

**Table 5:** Pearson's (r) Statistics Showing the Relationship between Pre-service Mathematics Teachers' Mastery Experience and their Performance

Variables	N	Mean	SD	df	Cal. r	p-value
Belief	232	40.71	10.29	230	0.23*	0.000

\* Sig. at  $p < 0.05$

Table 5 shows that at a degree of freedom (df) of 230, the calculated r-value of 0.23 ( $p = 0.000 < 0.05$ ) is statistically significant. This indicates that the hypothesis, which stated that there is no significant relationship between pre-service mathematics teachers' mastery experience and their performance is rejected. Hence, a positive relationship exists between pre-service mathematics teachers' mastery experience and their performance.

**H<sub>04</sub>:** There is no significant correlation among pre-service mathematics teachers' beliefs, motivation, mastery experience, and performance.

In Table 7, the R is 0.257, which indicates a fairly strong linear relationship between the predictors, belief, motivation, and mastery experience, and the response variable, performance. The R-square is 0.066, which indicates that 6.60% of the variance in the performance can be explained by the belief, motivation, and mastery experience. The F-ratio is 5.363, which indicates that the regression model provides a better fit to the data set. The coefficient values 0.208, 0.057, and 0.110 (with a corresponding p-value of 0.159, 0.714, and 0.461 respectively) indicated that belief, motivation, and mastery experience did not jointly correlate or predict pre-service mathematics teachers' performance.

**Table 7:** Summary of Multiple Regression Analysis Results on Joint Correlation of Pre-Service Mathematics Teachers' Belief, Motivation, Mastery Experience, and their Performance

	Coefficients	SE	t-Stat.	p-value	R	R2	F-ratio
Constant	2.562	0.249	10.275	0.000			
Belief	0.208	0.013	1.412	0.159			
Motivation	0.057	0.013	0.367	0.714	0.257	0.066	5.363
Mastery experience	0.110	0.013	0.738	0.461			

## 6.0 DISCUSSION

The primary finding of this investigation has unveiled a correlation of a positive nature between the beliefs held by pre-service mathematics teachers and their level of performance. This implies that the stronger the beliefs held by pre-service mathematics teachers, the higher their level of performance in mathematics. Conversely, the weaker their beliefs, the lower their level of performance in mathematics. Previous studies, such as those conducted by White, Way, Perry, and Southwell (2006) and Dede and Uysal (2012), have also revealed similar findings to those of this current study. These studies have observed that the beliefs of pre-service mathematics teachers in elementary schools have a positive correlation with their performance in mathematics. In contrast, Lee and Choi (2013) have reported that there is no connection between the beliefs of pre-service mathematics teachers in secondary school and their performance in mathematics education. The differences observed from these previous studies could be attributed to the specific location in which the study was conducted. The findings of this study suggest that individuals who possess strong beliefs in themselves are more likely to invest all of their resources and time into achieving their educational goals, resulting in success in their endeavors.

There exists a positive correlation between the motivation of pre-service mathematics teachers and their level of performance. This implies that the higher the level of motivation received by pre-service mathematics teachers, the higher their level of performance in mathematics, and vice versa. This finding aligns with the findings of Afzal, Ali, Khan, and Hamid (2010), Fletcher and Alhassan (2016), and Orhan-Ozen (2017), which have also revealed a positive correlation between motivation and students' performance in mathematics. On the other hand, the findings of Areepattamannil, Freeman, and Klinger (2011) and Cetin (2015) have established that motivation does not correlate with the academic performance of students. The disagreement from these previous findings could be attributed to differences in age and level among the respondents who participated in the study. However, this current finding implies that motivation plays a significant role in students' performance in mathematics.

There exists a positive correlation between the mastery experience of pre-service mathematics teachers and their level of performance. This means that the stronger the level of mastery experience of pre-service mathematics teachers, the higher their performance in mathematics. Conversely, if their level of mastery experience is lower, their performance in mathematics is likely to be lower as well. The finding of this study is in line with the findings of Elias and MacDonald (2007) and Loo and Choy (2013), which have indicated a positive relationship between students' mastery experience and their performance in mathematics. The setting and age group in which this current study was conducted may be similar to those of the previous research, thus explaining the similarity in their findings. The finding of this study suggests that if pre-service teachers interpret their previous experience in mathematics positively, they are more likely to have a positive attitude toward the

study of mathematics and consequently perform well in the course. Therefore, the mastery experience of students with mathematical concepts may contribute to the effectiveness of classroom teaching and learning processes.

The results of the multiple regression analysis revealed that the three elements of self-efficacy, namely belief, motivation, and mastery experience, did not exhibit a collective correlation or forecast the performance of pre-service mathematics teachers. Consequently, the existence of these three components in a teacher may not necessarily result in an enhanced performance level in mathematics among pre-service mathematics teachers due to potential external factors that may have disrupted the individual's circumstances. However, it is plausible that one of the components of self-efficacy may contribute to an individual's performance in mathematics. The outcome of this investigation contradicts the findings of prior research conducted by Elias and MacDonald (2007) as well as Yurt (2014), both of which indicated that the components of self-efficacy mutually predict students' performance in mathematics. It is conceivable that the disparities in demographic characteristics among the participants in this study and those in the aforementioned studies played a role in the observed discrepancy in their findings.

## 7.0 CONCLUSION

It was concluded based on the findings of this study that there is a positive relationship between pre-service mathematics teachers' self-efficacy and their performance in mathematics. However, the three components of self-efficacy (belief, motivation, and mastery experience) did not jointly correlate or predict pre-service mathematics teachers' performance in mathematics. Hence, self-efficacy is a significant determinant factor in evaluating pre-service mathematics teachers' academic performance.

## 8.0 RECOMMENDATIONS

Based on the findings of this study, it was concluded that:

- a) In order to perform proficiently in the mathematics examination, students must enhance their self-efficacy, particularly their belief in their capability to learn and comprehend mathematical topics or concepts.
- b) To augment the self-efficacy of pre-service mathematics teachers, Mathematics lecturers and individuals involved in college affairs should collaborate to provide them with motivational resources such as adequate teaching and learning facilities, regular workshops and training, and encouragement from lecturers to the students.
- c) Mathematics lecturers should collaborate with their students to elevate their level of self-efficacy by assisting them in perceiving their prior failures in mathematics as opportunities for further efforts, thereby enabling them to exploit present prospects to study diligently and improve their performance in mathematics.
- d) It is necessary to provide training and re-training on each facet of self-efficacy to pre-service mathematics teachers to ensure their proficiency in the mathematics examination and their ability to effectively disseminate such knowledge to their pupils when they commence teaching.

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