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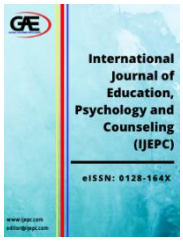

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MATHEMATICS TRAINEE TEACHERS' CONFIDENCE AND SELF-EFFICACY: A CORRELATIONAL STUDY

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Abstract:

Self-efficacy among mathematics trainee teachers is often influenced by their confidence level. Thus, the aim of this study is to investigate the correlation between teachers' confidence and self-efficacy in teaching mathematics. Specifically, the research aims to identify current levels of both confidence and self-efficacy, analyse their correlation, and evaluate the effect of teaching confidence and self-efficacy. This study applies a quantitative approach where data is collected from a target population of 50 trainee teachers. Next, the data is analysed using SPSS where descriptive statistics (mean and standard deviation) and inferential statistics (Pearson's Correlation Coefficient and simple linear regression) are applied. Finally, it is found out that there is a strong positive relationship between the two variables. This means confidence influences the trainee teachers' self-efficacy. The results suggest that teacher education programs should be implemented to ensure the future teachers are ready and have confidence in teaching mathematics effectively.

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Confidence, Correlation Analysis, Mathematics Education, Self-Efficacy, Trainee Teachers

Introduction

According to Bandura's theory, self-efficacy beliefs generally influence classroom behaviour (Bandura, 1986). The self-efficacy beliefs of teachers play a crucial role in their instruction and may influence their selection of activities in the classroom or even their professional work (Martínez-Borreguero et al., 2022). Individual confidence is related to self-efficacy (Jaaffar et al., 2019). The self-efficacy of teachers is essential to the processes of learning and teaching, the curriculum and its content, their classroom roles, and the influence of students on their instructional planning, curriculum execution, classroom management, and assessment (Shahat et al., 2022).

Previous research suggested that the students' self-efficacy, motivation, and achievement in mathematics depend on the teacher's self-efficacy (Marschall, 2021). Therefore, this paper investigates the relationship between mathematics trainee teachers' confidence in teaching mathematics and their self-efficacy.

Previous studies had demonstrated the correlation between teachers' self-efficacy and their teaching behaviour. There were teachers who struggled to adapt their instruction to the unique requirements of their students because they were unconfident in their knowledge and abilities. If the idea of teachers' self-efficacy was used to explain this, teachers with low self-confidence believe they did not have enough time to organise classes or believe that what have been planned will fail (Ramli & Nurahimah, 2020). Self-efficacious mathematics teachers were viewed as being more engaged and dedicated to their careers (Marschall, 2021). Furthermore, teachers who were more proficient in mathematics were more likely to have greater confidence in their capacity to instruct the subject.

A study that was carried out by the Higher Education Leadership Academy (AKEPT, 2011) revealed that only 50% of lessons were taught effectively (AKEPT, 2011). This indicates that the lecturers used a more passive lecture style of information delivery and did not adequately engage the students. It was found that teachers with higher self-efficacy beliefs were more interested, whereas teachers with lower self-efficacy beliefs were more teacher-centred (Peker et al., 2018). This shows that it is important to have quality mathematics teachers and to produce quality mathematics teachers, they must be confident.

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In Malaysia, to promote mathematics trainee teachers' well-being and confidence throughout the teaching practicum, mentor teachers should establish close connections, communicate with them, provide appropriate counselling, and confirm that they are indeed teachers. When working with trainee teachers, mentor teachers must take on interpersonal roles that they are comfortable with, such as being good listeners who encourage their charges. Mentor teachers must have faith in their abilities as educators since doing so will enable and promote trainee teachers' increased confidence in their instruction (Phang et al., 2020).

The relationship between teachers' confidence and self-efficacy in teaching will produce quality teachers. This was proved in the article from Sinar Harian in 2019, a teacher was awarded the Most Exceptional Educator. Kamariah Awang, who is the awarded teacher, said "My confidence is the key to this success" (Zainury, 2019).

Some studies found that the knowledge of certain content does not mean higher self-efficacy of a teacher. Additionally, many trainee teachers still struggle with their confidence in handling a class even though they are strong in mathematical backgrounds. Since teaching requires the trainee teachers to perform in front of class, the low self-efficacy may cause them to have rigid and ineffective teaching style. Therefore, this study examines how confidence and self-efficacy correlate among mathematics trainee teachers.

There are three objectives of this study. The first objective is to identify levels of confidence and self-efficacy of the mathematics trainee teachers. Second objective is to investigate the relationship between the two variables. Third one is to evaluate how far confidence give impacts to self-efficacy of a trainee teachers teaching in a classroom.

Literature Review

The theoretical framework of this study has evolved from Bandura's (1997) Social Cognitive Theory, where the theory states that self-efficacy is a primary foundation for motivation and personal achievement. The terminology of self-efficacy has shifted from a general psychological construct to a domain-specific necessity in the school context. This is defined as a teacher's capability to plan and perform what the teachers have planned to fulfil specific teaching assignments (Tschannen-Moran et al., 1998). The evolution pointed out that learning is an ongoing process where internal learning is controlled by selective, cognitive, motivational, and affective processes (Bandura, 1986). Consequently, modern studies focus on the connection of the internal beliefs with external behavioural and environmental factors. Specifically, how a teacher's self-belief directly influences their instructional planning and classroom management (Mansor et al., 2021; Shahat et al., 2022).

Previous experimental studies have demonstrated a significant impact of self-efficacy on instructional quality. Damisch (2021) found a critical inverse relationship where teacher self-efficacy dropped significantly as mathematics anxiety rose. This showed that emotional states influenced the teaching style. However, Maclin (2018) reported that in classroom, teachers with high self-efficacy showed 85% confidence level and 86% in instructional strategies. Furthermore, Alibakhshi, Nikdel, & Labbafi (2020) discovered that when a teacher had high self-efficacy in teaching, it positively impacts the modern and learner-centered strategies. Thus, these findings indicate that self-efficacy can be changed where the teachers can use their own creativity to manage the classroom effectively.

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Besides the positive correlation between teachers' efficacy and performance, the previous studies reveal conflicting viewpoints regarding teaching confidence. Swift (2020) observed a negative relationship between grade-level variety and confidence. The teachers often feel less successful when they need to teach multiple grade or class levels simultaneously. Meanwhile, Pruitt (2022) found that attending workshops in pedagogical increased confidence in teaching specific topics. This was proved by pre-test and post-test confidence assessment conducted by the workshop organiser. This suggests that confidence needs practice to ensure teachers to be more fluent in a classroom rather than having strong knowledge in certain subject (Fackler et al., 2021).

A significant gap in the current literature is that most studies focus on the same countries or cultures. The studies carried out by Damisch (2021), Maclin (2018), and Symes et al. (2023) focused on elementary teachers in the United States, Germany and other Western countries. Therefore, there is insufficient data regarding Southeast Asian populations, specifically in Malaysia. Furthermore, there is less emphasis on pre-service teachers or phase of trainee teachers, who are in the transition from theory to practice period, also known as internship. This gap justifies our current study that focuses on mathematics trainee teachers in a public university in Selangor, Malaysia. This will determine whether Western-centric models of self-efficacy hold true in the Malaysian educational landscape.

Methodology

This study applies a quantitative approach to discover confidence and self-efficacy of mathematics trainee teachers. To start the study, a set of questionnaires was given to two groups of respondents, online or physical. However, there were limited participants in each group as shown in Figure 1.

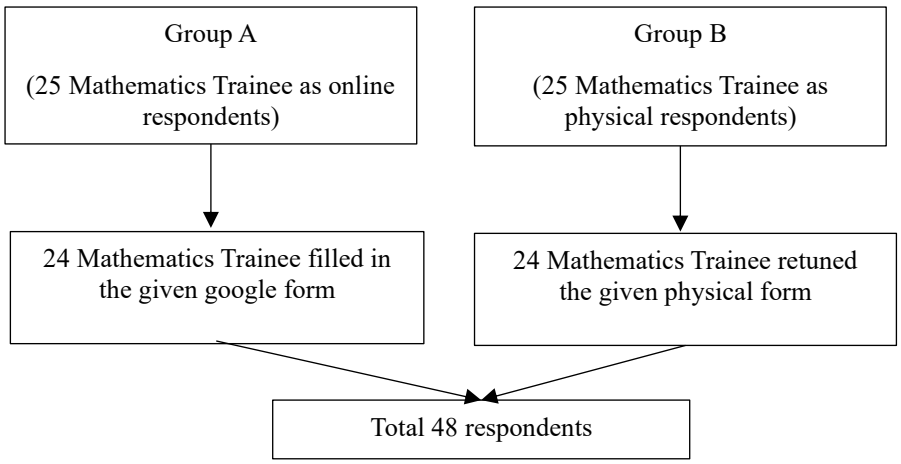

Figure 1: Two Types of Respondents

In this study, the population is 50 mathematics trainee teachers that enrolled at a public university in Selangor, Malaysia, to be specific, the practicum students who were taking Bachelor of Science Education (Hons.) Mathematics Universiti Teknologi MARA (UiTM). Figure 1 shows the sampling process and final response rates of the participants. The initial 50 participants were divided equally into two groups that consisted of 25 participants for different

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survey methods online and physical. Both online and physical methods managed to get 24 respondents respectively. This resulted in a balanced data collection for both methods, producing 48 respondents as a final sample size for the analysis.

To ensure statistical validity, 50 participants were selected as a sample size using Krejcie and Morgan sampling table (Krejcie & Morgan, 1970). The stratified random sampling was used to ensure proportional representation across different student groups. This also to ensure that the sample was unbiased and provided every trainee an equal opportunity to participate while exceeding the minimum sample size required for correlational research.

The questionnaire was adapted from the Teachers' Sense of Efficacy Scale and the Teacher Confidence Scale by Tschannen-Moran and Woolfolk Hoy (2001). The questionnaire consists of three parts, (i) demographic backgrounds, (ii) 15 items regarding self-efficacy, and (iii) 15 items regarding instructional confidence. To ensure the instrument's reliability is within the local context, a pilot study was conducted with 20 trainees using a bilingual (English and Malay) version of the survey. Then, the questionnaire was sent out in two methods online and physical. The resulting Cronbach Alpha values of the questionnaire exceeded 0.7 ($\alpha > 0.7$). This showed that the participants answered the questions consistently.

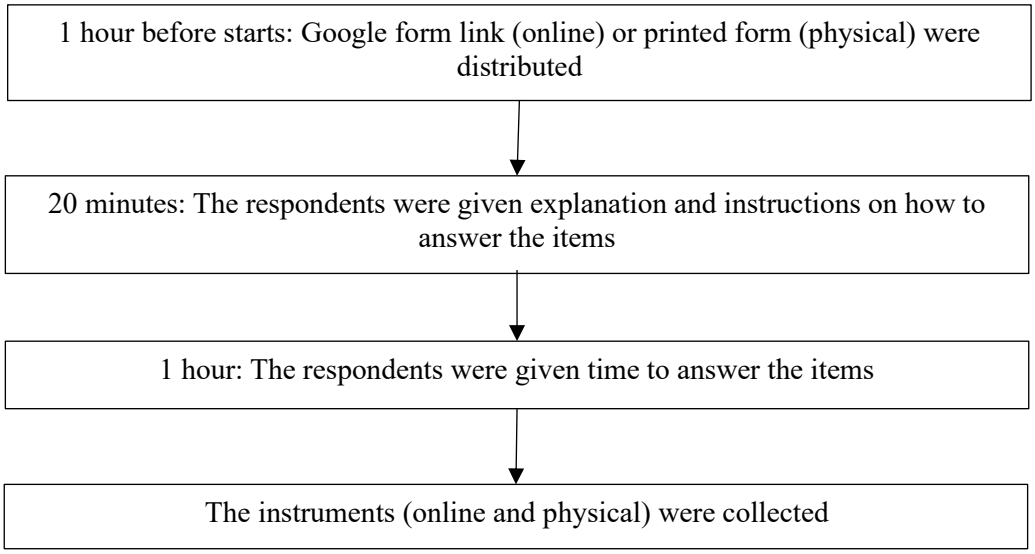

Figure 2: Data Collection Method

Figure 2 shows the flow of how data was collected. Before the participants answering the survey, they were given a briefing that the participation was voluntary. To protect the participant trainees, all data were recorded anonymously and kept strictly confidential. The collection process was done through Google Forms (online) and printed copies (physical). This was done during weekends to accommodate the respondents' practicum schedules. Detailed instructions were provided during a one-hour administration period to ensure that participants understood the items and the results would be accurate.

After collecting data, the data was analysed using both descriptive and inferential statistics. The descriptive analysis focuses on means while standard deviations was used to identify the general levels of confidence and self-efficacy among the trainees. Subsequently, inferential

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statistics such as Pearson's Correlation Coefficient and simple linear regression were applied to test the research hypotheses and determine the strength and significance of the relationship between the two variables. This systematic analysis forms the basis for the findings presented in the report.

Results

Initially, 50 questionnaires were distributed to the respondents, but 48 responses were received, making a response rate of 96%. Data analysis was executed using IBM SPSS Statistics 22.0. Analysis of missing data confirmed 100% data integrity with 0% missing values for both confidence and self-efficacy variables. The normality of the distribution was assessed using the Shapiro-Wilk (SW) test, as shown in Table 1.

Table 1: Tests of Normality (Shapiro-Wilk)

Variable	Statistic	Sig. (*p*)
Confidence Level	.934	.009
Self-efficacy Level	.940	.016

Since the *p*-value is less than 0.05, the data is not normal for both confidence and self-efficacy. However, according to the Central Limit Theorem (CLT) for sample size larger than 30 ($N > 30$), we can use parametric tests like Pearson and regression. Therefore, we can proceed with Pearson correlation and regression analysis since our sample size is 48, more than the threshold value.

Table 2: Descriptive Statistics for Confidence and Self-Efficacy (N=48)

Variable	Minimum	Maximum	Mean	Std. Deviation
Confidence Level	3.00	5.00	4.2111	0.45618
Self-efficacy Level	2.53	5.00	4.1472	0.56501

Table 2 presents the descriptive statistics that were evaluated on a 5-point Likert scale for the specified sample size ($N = 48$). The results revealed that the mathematics trainee teachers' confidence level ($M = 4.2111$, $SD = 0.45618$). The minimum value for confidence level is 3.00, showing that no trainee teachers reported low or negative confidence levels. However, the trainees' self-efficacy level is about the same as confidence level ($M = 4.1472$, $SD = 0.56501$). The small standard deviations for both variables (< 0.60) indicate consistent levels among the trainees. This means that they were high confident and had high internal beliefs regarding their capabilities to be the trainee teachers throughout the period of practicum.

Table 3: Correlation Between Confidence and Self-Efficacy

Variable	Minimum	Confidence	Self-efficacy
Confidence	Pearson Correlation	1	.677**
	Sig. (2-tailed)		.000
Self-efficacy	Pearson Correlation	.677**	1
	Sig. (2-tailed)	.000	

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

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Table 3 shows the result of Pearson's Correlation Coefficient (r) that was used to evaluate the relationship between mathematics trainee teachers' level of confidence and their self-efficacy. The results in Table 3 show that there is a strong positive correlation between the two variables, where the value r (46) is 0.677, $p < 0.001$. This finding indicates that the trainee teachers' level of confidence is strongly correlated to higher level of self-efficacy in teaching. Therefore, this proof that the internal cognitive self-beliefs are a foundation for a trainee's professional capacity during the practicum period. This is aligned to Social Cognitive Theory, meaning that the trainees' confidence in teaching affects their internal belief that they can teach effectively.

Table 4: Model Summary of Regression Analysis

Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate
1	.677[a]	.458	.447	.42032

a. Predictors: (Constant), Confidence Level

Table 5: ANOVA for Regression Model

Model	Sum of Squares	*df*	Mean Square	*F*	Sig.(*p*)
Regression	6.877	1	6.877	38.927	.000[b]
Residual	8.127	46	.177		
Total	15.004	47			

a. Dependent Variable: Self-efficacy level
b. Predictors: (Constant), Confidence Level

To evaluate the effect of the independent variable (Confidence) on the dependent variable (Self-efficacy), a simple linear regression, model summary, ANOVA, and Coefficients, were conducted. The model summary and ANOVA results are provided in Tables 4 and 5.

In Table 4, R^2 value shows 0.458, indicating that 45.8% of the trainees believe that their self-efficacy comes from their level of teaching confidence. Furthermore, to test the validity of this prediction, the ANOVA framework was used, and the result is shown in Table 5. The result shows that the overall regression model is highly significant since the value F (1,4) = 38.927, $p < 0.001$. Therefore, the findings show that the trainee teachers' confidence in teaching in front of a classroom creates an internal self-belief while teaching.

Table 6: Coefficients for Regression Model

Model	Unstandardized B	Std. Error	Standardized Beta	*t*	Sig. (*p*)
(Constant)	.616	.569		1.082	.285
Confidence Level	.839	.134	.677	6.239	.000

The coefficients for the regression model in Table 6 show the relationship between the variables. The p-value = 0.000 which is less than 0.05, shows that there is a relationship between mathematics trainee teachers' level of confidence and self-efficacy in teaching mathematics.

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From Table 6, the regression model can be written as the following linear equation:

$$y = 0.616 + 0.839x \quad (1)$$

where,

y = Mathematics trainee teachers' level of self-efficacy
x = Mathematics trainee teachers' level of confidence

Therefore, the regression model is statistically significant, and the coefficient suggests that for every unit increases the trainees' confidence, their level of self-efficacy in teaching increases too. In conclusion, the trainee teachers' confidence plays an important role in building and strengthening a mathematical trainee teacher's self-efficacy in teaching in front of a classroom.

Discussion

This discussion interprets the empirical findings of the study regarding the confidence and self-efficacy of mathematics trainee teachers at UiTM.

Interpretation of Confidence Levels and Self-Efficacy

The descriptive analysis revealed high levels of both instructional confidence (M = 4.2111) and self-efficacy (M = 4.1472) among the trainee teachers. The small standard deviations (0.456 and 0.565 respectively) indicates that the scores of the trainee teachers were close to each other. This means majority of the trainee teachers strongly agreed about their levels of confidence and self-efficacy. The high scores suggest that the trainee teachers are well-prepared for the classroom and yet deliver the teaching in front of the classroom.

Furthermore, the high self-efficacy scores imply a low level of mathematics anxiety within this cohort. As Damisch (2021) argued, there is an inverse relationship between anxiety and efficacy. Therefore, the positive results obtained here suggest that the UiTM training program successfully mitigates subject-specific anxiety, allowing trainees to focus on pedagogical execution.

The Correlation Between Teaching Confidence and Self-Efficacy

The goal of the study is to investigate the relationship between mathematics trainee teachers' level of self-efficacy and confidence in teaching mathematics. It is expected that there is relationship between mathematics trainee teachers' level of self-efficacy and confidence in teaching mathematics. Therefore, we used Pearson Correlation to test the relationship between mathematics trainee teachers' level of self-efficacy and confidence in teaching mathematics. Based on Table 4.8, it showed r = 0.677 which indicates positive strong related between mathematics trainee teacher's level of self-efficacy and confidence in teaching mathematics. This shows that mathematics trainee teachers have strong knowledge because mathematics trainee teachers who do not seem to have a good grasp of the topic frequently struggle with confidence (Fackler et al., 2021). Previous research demonstrated that teachers' self-efficacy and confidence contribute to successful social emotional learning applications in the classroom. Based on Kurikulum Standard Sekolah Menengah (KSSM), we can conclude that mathematics trainee teachers can encourage students to understand and regulate their emotions when they confidence in teaching mathematics.

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The primary finding of this research is the statistically significant, strong positive correlation between teaching confidence and self-efficacy ($r = 0.677$, $p < 0.001$). This indicates that as a trainee's belief in their innate ability to succeed (self-efficacy) strengthens, their outward certainty in performing teaching tasks (confidence) increases proportionally.

This result provides empirical support for Bandura's Social Cognitive Theory which suggest that self-efficacy is the foundation of personal achievement. The strong correlation that obtained in this study is consistent with the findings of Fackler et al. (2021), who revealed that a deeper understanding of a certain subject leads to higher confidence of a teacher. In relation to mathematical education, confidence and self-efficacy work close together and they are linked to each other. In simple words, when trainees are competent in mathematical theory, they have higher confidence in their teaching delivery.

Comparison with Previous Research

The result of this study contrast to the results of Evans (2011) where the findings obtained self-efficacy has not been affected by higher knowledge. In this sample of study, the confidence and self-efficacy increased together at the same time. This shows that the program of a Bachelor of Science Education (Hons.) Mathematics at UiTM provides a stable foundation for teaching readiness for its students.

On top of that, the findings support the study done by Morgan (2022) where self-efficacy had correlation to the succesfful implementation of Social Emotional Learning (SEL). By having high confidence, the trainees can help the students to manage their feeling and focus in learning mathematics due to the trainees high in confidence.

Conclusion

This study has achieved the objectives where the trainees' levels of confidence ($M = 4.2111$) and self-efficacy ($M = 4.1472$) are high. The inferential analysis provided strong evidence where $r = 0.677$ and $p < 0.001$. This shows that confidence and self-efficacy have a strong positive correlation. Moreover, the regression analysis showed that nearly half (45.8%) of the trainee teachers have self-efficacy due to having confidence in teaching confidence. The results proved that the trainees' internal belief are correlated to teaching style in a classroom.

The findings align to the Bandura's Social Cognitive Theory where self-efficacy is the foundation for teaching pedagogy in Malaysia. Therefore, instilling self-efficacy is important for educators to deliver the knowledge to the students effectively. In a nutshell, the educators must have both confidence and high self-efficacy to ensure that the the knowledge can be transferred effectively without interuption.

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Ethics Statement: This study was conducted in accordance with ethical research standards. All procedures involving human participants were reviewed and approved by the Universiti Teknologi MARA, approval number ED/REC/F/11104. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic purposes.

Author Contribution Statement: All authors contributed significantly to the development of this manuscript. Faris Marzuqi Amran was responsible for the study as a whole including data collection, analysis, and result interpretation. Zaid Mujaiyid Putra Ahmad Baidowi was responsible for supervising, drafting, rephrasing and restructuring the final manuscript. Norzaidah Md Noh contributed to refining the literature review, drafting, and formatting the manuscript. Mohamad Norzamani Sahroni contributed to final analysis, interpreting and reviewing the results. All authors read and approved the final version of the manuscript prior to submission.

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