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Preservice Teachers' Teaching Efficacy and Motivation in Online Learning (OL)

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Abstract

Preservice teachers' roles in conducting online learning (OL) are getting more attention since OL is increasingly used as instructional methods. Acknowledging the level of efficacy in teaching mathematics through online learning can provide more inputs for developing OL skills. Hence, this study aims to identify the level of efficacy and motivation in teaching mathematics through online learning. A correlational research design was employed to collect quantitative data. A questionnaire was adapted from two instruments, and it was distributed to 126 preservice mathematics teachers. The samples were selected using convenient sampling techniques with consideration of easy access to their agreement to participate in the study. The data was analysed using both descriptive and inferential methods such as Pearson Correlation. The findings demonstrated that the preservice teachers were highly effective and motivated in their instruction of mathematics via online learning. Additionally, a mildly favourable association between preservice teachers' efficacy and motivation in a mathematics class was also found in the data. Although OL is not frequently used by preservice teachers, this study found that preservice teachers demonstrated favourable reactions in terms of motivation and instructional efficacy. However, it is recommended that future studies should investigate the use of qualitative research methodologies to gather insightful data and thereby deliver more comprehensive conclusions.

Keywords: Preservice Teacher, Efficacy, Motivation, Online Learning (OL), Mathematics.

Introduction

Teaching mathematics through online learning (OL) is challenging since a different strategy is required for sustaining student-centered learning and achievement (Abdigapbarova & Zhiyenbayeva, 2022; Japar et al., 2021). Hence, teachers' roles and attention are essential. Studies on motivation reported that teachers' guidance in mathematics class highly influences mathematics achievement. According to Pardimin et al (2018), in the structural performance model, the formation, assessment, and improvement of teaching performance in mathematics play a key role in improving the quality of teaching through mathematical

learning. Hence, preservice teachers also need to adapt to OL. Preservice teachers are the future teachers. Since preservice teachers are going through the process of gaining experience in teaching, they need encouragement to make more decisions in mathematics education. It was observed that preservice teachers' motivation contributes much to their teaching. In a study conducted by Hasan et al (2015), the excitement of preservice teachers for teaching subjects in their domains and their positive teaching experiences are essential sources of motivation and efficacy for the teaching profession. Efficacy in teaching means a teacher's belief in their ability to help students succeed. It includes assisting students in learning, developing effective student programs, and effectively transforming student learning (Gkolia et al., 2014). On the other hand, motivation is an essential element for students to orient their learning in mathematics. They should complete their mathematics education studies in universities and subsequently to serve later after their graduation. They play a vital role as learners in universities and in their future service as teachers in schools. Their self-efficacy and motivation in teaching are getting more attention. Hence, more studies should be conducted to provide significant inputs for the development of mathematics education among teachers and preservice teachers.

Preservice teachers are future teachers who are taking more challenging roles in mathematics education. In addition, teachers must generate new enthusiasm by rejuvenating new teaching ideas and ability to face challenges in teaching (Idris et al., 2007). One challenge faced by them is the use of up-to-date skills and digital means for enhancing teaching. The teaching profession is demanding and sometimes leads to burnout among teachers (Prillel-tensky et al., 2016). Hence, more efforts in conducting training among preservice teachers are coming up among universities. A study by Thorsnes et al (2020) showed that teachers believe that formal university training has been beneficial and with long-term impact. The activities aim to increase pre-service skills in the application of tools in their teaching. According to a study by Panesar (2010), earlier preparatory programs haven't been completed to the required level. In this regard, the belief of self-efficacy contributes to motivation in several ways and makes it possible to perform and manage new teaching and learning situation (Pajares, 1996), such as of the situation of handling OL. This has signified that more investigation into preservice teachers' abilities in mathematics education is required. Little is known about the underlying understanding of how preservice teachers deal with efficacy during their teaching practicum and how they gain or increase the level of efficacy in new teaching situation through OL.

The objectives of this study are to (1) identify preservice teachers' levels of efficacy in teaching mathematics, (2) identify preservice teachers' levels of motivation in teaching mathematics, and (3) investigate the relationship between efficacy and motivation of preservice teachers in the context of OL environment / situation.

The instruction relates to the public university preservice teachers' use of OL to teach mathematics during COVID-19. The findings of this study would benefit preservice teachers, teachers, lecturers, and universities. The results can be used as a reference to improve teachers' teaching efficacy and motivation in OL for mathematics classes. Besides, they can also generate new ideas from the research to improve their practice of OL.

Literature Review

Online Teaching

Online teaching is the practice of imparting knowledge to others through virtual platforms. This instructional method uses live classrooms, video conferencing, webinars, and other online resources. Online apps have been created and are intended to aid in the process of learning and comprehension. With technological advancements, the quality of distance education has improved, as has the popularity of e-learning due to the trend toward online learning (OL). Both online teachers and students are getting more familiar with computers and the internet as time passes. It is assisting them in the creation of a more effective virtual educational environment. Distance learning is a technique of studying that broadcasts lessons via correspondence without requiring students to attend on-site classes. According to Simonson et al (2016), distance learning, alternatively referred to as distance education, e-learning, or online learning, is a type of education characterised by the physical separation of teachers and students during instructions and various technologies to facilitate communication between students and teachers.

On the other hand, distance learning is becoming an established part of education, with tendencies to continue expanding in the future of education. Because of the pandemic, which later on classified as an endemic, online learning OL has become a better alternative for education delivery in order to keep people from infected with COVID-19. Online learning provides advantages for everyone exploring technology for flexible education. Each learner has a distinct path and a different style of learning for meeting the needs of different learning groups such as visual learners or auditory learners and other type of learners. Teachers may customise the online learning system in many ways with its variety of choices and resources. It is the best method for teachers to create an ideal environment for learning that meets the needs of students with different styles of learning.

There are many tools available on the internet to help teachers in conducting their OL classes. In a study by Nicole et al (2019), it is essential (or common??) to understand that online teaching demand some technical challenges, and yet there are many tools available to assist teachers to become more effective in imparting their teaching and helping students to achieve success.

According to Allam et al (2020), OL is a new norm that should not obstruct interactive learning for the best academic results and should instead encourage exceptional success in a variety of subjects and disciplines. Online instruction is a student-cantered method that keeps a human touch while increasing student interest and engagement levels in virtual classrooms.

Teaching skills are crucial when it comes to developing strong relationships with students. Many people have access to the digital tools that online teachers utilise to share with their students. According to Cialon et al (2014), teachers should also make use of technology to help students access, create, and manage their learning in a variety of contexts. In terms of education, instruction, and skill development, teachers will have a lot of autonomy. This method of education encourages students to engage with one another with their peers. It helps them feel more at ease of online discussions while dealing with complex topics. To teach online, reliable network connections and computer device systems are a must. More mobile apps are being created nowadays because they are convenient and easily accessed by public.

The mobile versions of the live teaching application have assisted in boosting the number of students who attend and register for classes.

Level of Efficacy amongst Preservice Teachers in Teaching Mathematics

Preservice teacher education is the term given to the education and preparation offered to student teachers before they begin their teaching career. In contrast, chances for learning about giving instruction / teaching are provided to these future teachers.

A person's self-efficacy is defined as their confidence in performing at a level that has an impact on their lives (Bandura, 1994). Self-efficacy influences how people feel, think, and behave. Such beliefs produce varied consequences via four main mechanisms which are cognition process, motivating, affectionate, and selecting processes.

Learning outcomes serve as the cornerstone for teachers to plan for their course design and evaluation, guiding students' attention to matters of consequence. The teacher may also consider learning outcomes as an inclusive teaching technique since outcome-based education assist students to understand what is expected.

According to the research findings by Giles et al (2016), teachers' efficacy is associated with a range of desired student outcomes, making their effectiveness an essential component in providing high-quality mathematics education to students. There is no evidence to support that preservice teachers' self-efficacy increase when they teach online. However, research by Peebles et al (2014) reported that during the field experience, preservice teachers' self-efficacy was more likely to improve when they spent more time with direct, individual teaching to students with exceptional needs and less time with observation and whole-class instruction.

The self-efficacy should be introduced through preservice teacher education programmes. Understanding and encouraging self-efficacy beliefs amongst teachers may be crucial in lowering the present attrition rate in education (Pendergast et al., 2011). There is a high demand on teacher preparation programmes, to produce highly competent teachers. Mastery experiences, vicarious experiences, verbal persuasion from teacher educators, and verbal persuasion from cooperating teachers all play a role in influencing instructors' ideas about their own abilities as teachers during teacher education programmes (Clark & Newberry, 2018). The induction year and mastery experiences during student teaching have the two biggest effects on a teacher's ability to be effective. Prior studies have demonstrated that while some effectiveness indicators rise during student teaching, others may fall (Hoy & Woolfolk, 1990). Therefore, additional research is needed to support the current status.

Level of Motivation amongst Preservice Teachers in Learning Mathematics

The two primary elements of teacher motivation are the desire to educate students and a caring attitude toward students when carrying out their teaching obligations (Kyriacou et al., 1999). Teachers' motivation, which is shown, among other things, by their passion and sense of fulfilment at work, depends on how many psychological demands that they can satisfy while teaching.

The foundation of a teacher's motivational approach with their students is what they say and do in lessons to encourage students to participate in learning activities.

By juxtaposing the two approaches to teaching—controlling and autonomy-supportive—it achieves this. The importance of teacher motivation is clear given that it is a crucial factor intricately linked to many aspects of education, such as students' motivation, educational reform, instructional strategies, and instructors' psychological performance and well-being.

According to Jesus and Lens (2005), the importance of in-service teacher motivation studies was to increase students' motivation, promote educational reform, and achieve instructors. Years of teacher motivation study have a strong tradition in the following five research fields: influence factors; motivation and teacher effectiveness; the relationship between motivation of teachers and motivation of students; teacher motivation study in various disciplines; and tools to evaluate motivation for teachers. Several studies have shown that teachers' motivation may be increased by their choice of teaching materials, programmes and teaching techniques, as well as the structure and discipline of the classroom (Kaiser, 1981). Praver and Oga-Baldwin (2008) presented the list of variables that directly motivate (intrinsic motivation) and those that motivate indirectly (autonomy, working relationships, self-realization, and institutional support). They felt that these variables had a significant impact on teacher motivation throughout their careers. Because intrinsic motivation is an essential element for pre-service teachers to choose a profession, extrinsic effects are often noted, particularly financial advantages such as pay, pensions, insurance, and others.

Demotivation might occur occasionally for a variety of reasons. Negative factors that undermine the existing motivation are involved in demotivation (Dornyei & Ushioda, 2011). Five reasons for demotivation are put forth, including stress, teacher autonomy restriction, self-efficacy inefficiency, inappropriate career structures, repeated content, and constrained intellectual growth potential.

Methods

The study involved an initial sample of 126 public university preservice teachers. Questionnaires with 10 Likert scales ('1' for the most disagreeable to '10' for the most agreeable) were used to collect data. A questionnaire is one of the most important tools in social science research to gain data, information, and insight into the behaviour, characteristics, and factors of the participant regarding the investigated topic (Bulmer, 2004). Specifically, questionnaires were practically used to gather information from a large audience in a short time. In this study, a questionnaire was carefully designed in relation to the objectives of the study. The questionnaire was adapted from Tschannen-Moran and Hoy (2001) for the factor of efficacy and Sahat et al (2018); Abos et al (2018) for the factor of motivation. This study utilised convenient sampling by asking for agreement from the preservice teachers who were involved in teaching practicum in various schools for a period of 14 weeks. These samples are from a public university in Malaysia.

The exclusion criteria were preservice teachers who were not teaching mathematics. A final total of 126 preservice teachers participated in this study. This research used Inferential Statistics namely the Pearson Correlation to examine the relationship between preservice teachers' levels of efficacy in teaching mathematics and the level of motivation

among the preservice teachers who were teaching via OL during pandemic period of COVID-19.

Findings

The descriptive analysis was used to identify preservice teachers’ level of efficacy and motivation in teaching mathematics through OL.

Research Question One

What are the preservice teachers’ levels of teaching efficacy?

Three efficacy factors—cognitive, behavioural, and affective—as well as the overall efficacy were presented using mean and standard deviation to gauge the level of preservice teachers in teaching mathematics through OL. Table 1 shows the mean overall efficacy was 9.60 (SD=0.27) out of a maximum achievable score of 10.00. In terms of efficacy, the affective factor had a higher mean of 9.61 (SD=.35). The findings indicated that preservice teachers were enthusiastic about using OL to teach mathematics. Cognitive aspect had the lowest mean, 9.58 (SD=0.29). According to the findings, affective efficacy was regarded by preservice teachers as being the greatest, followed by behavioural and cognitive efficacy.

Table 1
Three factors of preservice teachers’ level of efficacy.

Efficacy Factor	Min	Max	Mean (M)	Standard deviation (SD)
Cognitive	8.44	10.00	9.58	0.29
Behavioral	8.00	10.00	9.60	0.33
Affective	8.50	10.00	9.61	0.35
<i>Total Efficacy</i>	8.40	10.00	9.60	0.27

*Note: M=mean, SD=standard deviation, N=126

Research Question Two

What are the preservice teachers’ levels of motivation?

Three motivational elements (effort, emotional support, and confidence) as well as overall motivation were measured using mean and standard deviation to determine the levels of motivation among preservice teachers for teaching mathematics with OL. The mean for overall motivation, as shown in Table 2, was 8.72 (SD=0.31), out of a possible value of 10.00. The highest mean, 9.65 (SD=0.30), was obtained for the element of confidence. It showed that they were at ease instructing math using OL. An effort was made with the lowest mean of 9.36 (SD=0.60). This refers to the attempts made by preservice teachers to teach mathematics using OL. According to the findings, preservice teachers' motivation to teach mathematics with OL was scored best in confidence, then effort, and finally emotional support.

Table 2

Three factors of preservice teachers' level of motivation.

Motivation Factor	Min	Max	Mean (M)	Standard deviation (SD)
Effort	7.50	10.00	9.35	0.60
Emotional Support	8.42	10.00	9.64	0.30
Confidence	8.40	10.00	9.65	0.30
Total Motivation	8.72	10.00	9.54	0.31

*Note: M=mean, SD=standard deviation, N=126

Research Question Three

Is there any significant relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL?

The following inferential analysis provides an answer to Research Question 3: Is there any significant relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL? The hypotheses are as below:

Ho: There is no significant relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL.

Ha: There is a significant relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL.

Table 3 shows that there is a significant relationship between the two variables since the p-value is 0.000, which is less than $\alpha = 0.05$. It can be determined that there is a significant relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL. Based on the Pearson correlation value ($r=0.656$), there is a moderately strong relationship between preservice teachers' level of efficacy and motivation in teaching mathematics through OL, meaning that both variables tend to increase together / positively correlated.

Table 3

Result of Pearson Correlation Analysis

		Efficacy
Motivation	Pearson Correlation	0.656**
	Sig. (2-tailed)	0.000

Discussion and Conclusion

With a mean of $M = 9.60$, the findings showed that preservice teachers had a high level of effectiveness in teaching mathematics. Additionally, the preservice teacher reported higher mean scores across all efficacy domains (cognitive, behavioural, and affective). Affective, which referred to preservice teachers engaged in teaching mathematics through online learning, had the greatest mean of 9.61 ($SD=.35$) in terms of efficacy. Cognitive had the lowest mean, 9.58 ($SD=.29$). Despite the fact that their cognitive scores were marginally lower than their affective scores, the preservice teachers had sufficient mathematics knowledge to carry

out their teaching assignments. They can maintain their affective components while persevering in any math-related activity, as has been clearly established.

Mathematics-related activities have been shown to have a close link between the affective and cognitive domains (Grigg et al., 2018). Teachers are expected to go above and beyond the call of duty in this description, which calls on them to make a concerted effort to include cognitive components to impart critical STEM knowledge to students and coach them in mathematics tasks (Li & Schoenfeld, 2019). Similar to how students design important roles to play in putting forth consistent, successful efforts to promote the adoption of STEM features in mathematical exercises or challenging situations, teachers (and presumably preservice teachers) do the same (Jeong et al., 2022).

In the study, the outcomes also showed that preservice teachers, with a mean of $M = 9.54$, had a high degree of motivation in teaching mathematics. Confidence, emotional support, and effort are the three motivating factors. Confidence, which refers to preservice teachers' confidence in conducting OL, was the element of motivation with the highest mean of 9.65 ($SD = .30$). The preservice teachers showed high emotional support and effort in OL, even though their effort was less than their confidence.

It is crucial for teachers to exhibit confidence in their ability to teach mathematics because this empowers them to use their knowledge in new ways, which advances knowledge and promotes constructivism in mathematics education (Umugiraneza et al., 2016). Since ensuring preservice teachers' competency and strong confidence may improve their responsibility to carry out OL efficiently, their participation may be in line with the current implementation of OL (Tiba & Condy, 2021). The association between preservice teachers' motivation and efficacy in teaching mathematics via OL, however, is only somewhat substantial. The relationship can be explained further in terms of the pedagogical and subject competence of prospective teachers (Lachner et al., 2021). They invest more effort into training and promoting their teaching confidence from the beginning of their knowledge growth journey. In order to have a positive attitude toward any form of online teaching and learning, preservice teachers must collaborate in order to accept any changes.

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