

The Role of Malaysian Mathematics Teachers in Promoting 21st Century Learning

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ABSTRACT

Mathematics teaching plays a crucial role in promoting and enhancing the students' achievement. As education leads in the 21st-century learning phase, mathematics teachers pose 21st-century learning skills to promote better learning classrooms for students. This study aimed to validate the instrument and determine the role of the Malaysian Mathematics Teachers (MMT) in promoting 21st-century learning. This research employed a quantitative method with a sample of 256 mathematics teachers in Perak, Malaysia. A set of questionnaires which consisted of 42 items with six dimensions, was distributed to all the participants. The data was analyzed using Partial Least Square (PLS), Structural Equation Modeling (SEM). The exploratory factor analysis (EFA) revealed that the data supports the scale of the study. The results revealed that the instrument is valid and reliable, with a Cronbach alpha value of 0.873. Besides, the results showed that the total variance extracted by the items within the constructs was 82.31%. The level of MMT to promote 21st-century learning is high, with a mean of 3.87. The ministry of education can use this questionnaire by considering the importance of teachers' role and examining the level of mathematics teachers in promoting 21st-century learning.

Keywords: Malaysian Mathematics teachers promoting 21-st Century Learning instrument

1. INTRODUCTION

The government has acknowledged the necessity to reform or reconstruct the educational system to create the comprehension, talents, and requirements that students will need in the twenty-first century. In a word, 21st-century education offers students the required skills to learn and practice to thrive in today's globalized society. It involves the integrity of four

primary skills: creativity, critical thinking, collaboration and communication skills. The twenty-first century is based on the software era, whereby all fields, notably education, should be digitally mastered and technology plays a critical role in education (Henrisken et al., 2016; Sumardi, Risipawati, & Ismail, 2017). Teachers needed for 21st-century learning are competent, qualified, and knowledgeable about classroom instruction

(Huh & Reigeluth, 2017). Therefore, the readiness of mathematics teachers to accept the responsibility of communicating knowledge and then managing the learning and teaching process effectively, as claimed, is desirable in promoting 21st-century learning.

The teacher's role will determine the goal of the 21st-century classroom, which is to prepare students to become productive members of the workplace. This study aims to validate the instrument that is the role of the MMT to promote 21st-century learning and determine the level of roles of the MMT to promote 21st-century learning. This study shows that the teachers have several roles in promoting 21st-century learning and blending the process of learning in their teaching in the 21st-century classroom.

2. LITERATURE REVIEW

2.1. Teaching in an era of change

Parallel with the Industrial Revolution; schools have been formulating pupils with basic industrial skills by providing them with a particular body of information, considered both essential and recognized. According to Kolikant and Rieborn (2020), the expectations are shifting whereby nowadays pupils will work in uncertain environments, handle the exponential growth of information, and become acquainted with new technologies. They might have a new working medium to work, collaborate and communicate.

These changing demands of education trends derived to the 21st-century learning skills which need to be adopted by the teachers to educate and produce according to the trends. At the same time, Bridich (2015) claimed that schools often failed to prepare pupils for the twenty-first-century demands. Thus, the role of teachers is essential to promote 21st-century of learning skills among the pupils especially learning mathematics.

2.2. Twenty-First Century Skills

Now with the transition first from School Integrated Curriculum (SIC) to the School Standard Curriculum (SSC) established in 2014, 21st-century instruction has become a critical component of the

Malaysian curricular transformation (Bakar & Ismail, 2020). The implementation of 21st-century education was accepted and profitable throughout this period. Teachers' responsibility to prepare the pupils for the 21st century was increased as the teachers need to navigate the pupils accordingly to the necessity of 21st-century skills (Yunos, 2015). This builds a necessity for teachers to train pupils with a holistic education that accentuates life skills like communication, cross-cultural collaboration, and critical thinking (Teo, 2019). At the same time, Nir, Ben-David, Bogler, Inbar, and Zohar (2016) categorised 21st-century skills into four main disciplines: meta-cognitive, interpersonal, intrapersonal, and technological. The scholars added that cognitive skills were the pupil's ability to construct meaningful and comprehensive knowledge and implement it creatively in new environments and situations. Metacognitive awareness and self-directed learning were the notable attributes of cognitive skills (Kolikant & Rieborn, 2020). Interpersonal skills are defined as one's ability to be involved with others through teamwork, leadership, and cooperation. Meanwhile, intrapersonal skills concern one's response to challenges and difficulties, namely intellectual openness, self-regulation, and managing emotions. The last discipline is about technological skills related to one being literate concerning information and communication technologies (ICTs). The element of particular importance has given to the careers that formerly had slight, or nothing to do with ICT is currently under pressure to incorporate technology into their regular activities (Martinovic & Freiman, 2016). In Malaysia, researchers such as Vinathan (2016), Tamuri and Hussin (2017), Arbua et al. (2017), Salehudin et al. (2015), Jamil et al. (2017), Ibharim et al. (2015) and Zain et al. (2015), have conducted studies on the needs, challenges and 21st-century skills as a compound in implementing 21st-century learning. On the other hand, some scholars have asserted that communication, collaborative, critical and creative thinking skills are important to teaching and learning (Salehudin et al., 2015; Yunus, 2015; Johnson & Hoyte, 2015) and

were perceived to generate competitive pupils through 21st-century learning (Ismail, 2018; Arbua et al., 2017; Zain et al., 2015). Therefore this study has insisted on scrutinising the role of teachers, especially MMT, in promoting 21st-century learning.

The role of teachers in school is to have a deep understanding of the subject matter, technical exploration of teaching techniques, communication, creativity, technological-based teaching and evaluation (Arumugham, 2019). Similar to Wijaya (2020), Arumugham (2019) also agreed that the crucial role of the teachers is essential to enhance 21st-century learning. The researcher has reported that the teacher's willingness and ability have established pupils' interest in fun learning. Therefore the present study is necessary to examine the paradigm of teachers role, especially the teacher's knowledge and the classroom behaviours. Thus, the present study aims to validate the instrument to cultivate the role of MMT in promoting 21st-century learning.

3. METHODOLOGY

This research employed a quantitative method. A total of 256 mathematics teachers in Perak, Malaysia were sampled. A set of questionnaires which consisted of 42 items with six dimensions, was distributed to all the respondents. The data was analyzed using SMART PLS-SEM.

3.1. Development of Instrument

Instrument development can initiate in many ways. One of the ways to develop an instrument is from the literature review. In this study, literature in mathematics education was reviewed to develop one set of the instrument. Forty-two items were developed and categorized into six dimensions: Master the subject (curriculum content), Skilled in pedagogy (teaching & learning), Understand students' development and love them, Understand the Learning Psychology, Have counseling skills and Use the latest technology. All of the items were designed to evaluate MMT's attributes in order to enhance 21st-century learning. Teachers were required to determine how much they agreed to the statement on a five-point Likert scale. The options are 1 (strongly disagree) to 5 (strongly agree) (Radhakrishna, 2007). These items provide input about the level of MMT to promote 21st-century learning. In this study, five Likert scales were used to measure Malaysian mathematics teachers' role in promoting 21st-century learning.

3.2. Data collection instrument

The MMT to promote 21st-century learning questionnaire was validated by four experts in mathematics education. Experts accepted all the items. The items were revised according to the experts' advice and comments. The developed items were tabulated in table 1.

Table 1. Developed items according to the dimensions

No	Items
Master the subject (curriculum content)	
1	I master content knowledge in mathematics.
2	I prepare my lesson well before the lesson starts.
3	I refer to my colleagues to better understand the concepts in mathematics.
4	I attend courses related to mathematics.
5	My content knowledge is good.
6	I can solve all the problems related to content in mathematics.
7	I have problem-solving skills in mathematics.
Skilled in pedagogy (teaching & learning)	
1	I teach mathematics using a different approach according to my student's abilities.
2	My teaching method is always different.
3	My students scored well because of my techniques of teaching.
4	Cooperative learning in mathematics help students to understand a better concept in mathematics.
5	I assign a group task for my students to solve problems.

No	Items
6	I assign the task which students explore beyond the mathematics classroom.
7	My students do a presentation after solving a given problem in groups
	Understand students' development
1	I monitor students' improvement from time to time.
2	I discuss with parents about students' problems.
3	I care about my students' needs during my lesson.
4	I entertain my students whenever they need my help.
5	My students admire my teaching style.
6	I provide a calculator for those students who could not afford to buy.
7	I do personal coaching after school hours for students who are weak in mathematics.
	Understand the Learning Psychology
1	I reward my students upon completion of their mathematics homework.
2	I appreciate my students who help their friends to solve mathematical problems.
3	I encourage my students to solve a problem based on their experience.
4	Reinforcement tasks in mathematics help my students have a better understanding of the lesson learned.
5	I promote students' learning from examples during mathematics lessons.
6	I promote my students learning through experiments in my mathematics lessons.
7	I post a problem for my students to solve during mathematics lessons.
	Have counselling skills
1	I help my students to do reflective on their problems.
2	I listen to my students' mathematical problems during the mathematics lessons.
3	I let my students summarise mathematics lessons at the end of the lessons.
4	My students interpret the problem given to them.
5	My students listen to my advice.
6	I discuss with my students who have a problem.
7	I encourage my students to complete mathematics homework.
	Use the latest technology
1	I am using the smartboard in my mathematics lessons.
2	Mobile application helps me to guide my students easily.
3	I am using YouTube in my mathematics lessons.
4	Mathematics software like Geogebra helps me to teach mathematics easier.
5	Using animation in my lesson improves students' understanding of the topic.
6	Using technology in my mathematics lessons improve students' engagement in the lessons.
7	Technology in mathematics lessons improves students' achievement.

4. FINDINGS

4.1. Educators' Profile

The data was collected from mathematics teachers from Perak state, Malaysia. A total of 256 survey questionnaires and all the participants

responded to the survey. The demographic information of the participants is presented in Table 2. Based on gender, 46% of respondents were males, while 54% were females.

Table 2. Demographic of the participants

Gender	Male	Female
Number of Participants	118	138
Percentage (%)	46	54

4.2. Reliability and Validity Assessment Using Exploratory Factor Analysis

The Cronbach's alpha coefficient method was selected to estimate the amount

of measurement error in the test in the current study. In general, the lower acceptable limit of Cronbach's α coefficient is at 0.70 (Sekaran, 2003). The following table

indicates that all constructs of this research are reliable (more than 0.70). The individual construct reliability ranges from 0.821 to

0.938 (Table 3). Table 3 shows the reliability of MMT to promote 21st-century learning constructs in the test.

Table 3. Reliability of MMT constructs

	Number of items	Cronbach's α coefficient
Master the subject	7	0.938
Skilled in pedagogy	7	0.925
Understand students' development	7	0.911
Understand the Learning Psychology	7	0.854
Have counselling skills	7	0.843
Use the latest technology	7	0.821

In addition, exploratory factor analysis (EFA) was run to confirm that the data support the selected scale for the present study. The overall reliability of the instrument within

piloting was $\alpha = 0.873$ or 87.3%, which is above the recommended threshold of 0.7 (Nunnally, 1978).

Table 4. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.842
Bartlett's Test of Approx. Chi-Square	1802.316
Sphericity Sig.	0.000

Table 4 indicates that EFA results revealed the Kaiser-Mayer-Olkin (KMO) statistic. For all of the constructs, the sample reliability was more than the minimum suggested value of 0.60 (Kaiser & Rice, 1974). Furthermore, the significance of Bartlett's test of sphericity reveals that the correlation between the measurement items was greater than 0.3, indicating that EFA was valid (Hair, 2009).

Table 5 indicates the rotated component matrix, and total variance explained. The findings show that there are all factors and Every loading factor exceeds 0.5. As an outcome, the convergent validity of the pilot test' constructs is proven. In addition, the total variance extracted by the questions within the constructs was 82.31%. As a result, there is no issue with construct validity.

Table 5. Rotated Component Matrix

Items	Master the subject (Sc)	Skilled in pedagogy (Pd)	Understand students' development (Us)	Understand the Learning Psychology (Ps)	Have counselling skills (Cs)	Use the latest technology (Lt)	Variance Explained
Sc1	0.91						15.62
Sc2	0.87						
Sc3	0.86						
Sc4	0.84						
Sc5	0.77						
Sc6	0.73						
Sc7	0.68						
Pd1		0.88					14.72
Pd2		0.85					
Pd3		0.82					

Items	Master the subject (Sc)	Skilled in pedagogy (Pd)	Understand students' development (Us)	Understand the Learning Psychology (Ps)	Have counselling skills (Cs)	Use the latest technology (Lt)	Variance Explained
Pd4		0.79					
Pd5		0.74					
Pd6		0.70					
Pd7		0.69					
Us1			0.92				
Us2			0.89				
Us3			0.81				
Us4			0.75				15.82
Us5			0.72				
Us6			0.69				
Us7			0.66				
Ps1				0.93			
Ps2				0.89			
Ps3				0.80			
Ps4				0.76			13.21
Ps5				0.71			
Ps6				0.70			
Ps7				0.67			
Cs1					0.91		
Cs2					0.88		
Cs3					0.85		
Cs4					0.83		12.92
Cs5					0.79		
Cs6					0.73		
Cs7					0.68		
Lt1						0.94	
Lt2						0.92	10.02
Lt3						0.89	
Lt4						0.85	
Lt5						0.82	
Lt6						0.75	
Lt7						0.71	
Total							Variance Explained
82.31							

Overall, the alpha reliability coefficients for all of the items were found to be satisfactory. As a result, all of these items were maintained. As a result, the questionnaire would be practiced to research on related to 21st-century learning.

4.3. MMT level in promoting 21st-century learning

The table revealed that the MMT level to promote 21st-century learning is high, with a mean of 3.87. Mathematics teachers

possessed the highest mean of 4.39 in master the subject and the lowest mean of 3.21 in using the latest technology. This illustrated that many MMT has mastered the subject well and preferred to teach with the minimum usage of technology (3.21). Most of the teachers in this study should be provided with a user-friendly technological platform to integrate into the mathematics lessons.

5. DISCUSSIONS

Mathematics teachers were playing a crucial role in promoting 21st-century learning in the mathematics classroom. As part of 21st-century learning, 'digital literacy has been upraised to highlight a set of essential competencies to cope with the demands of the future era (Wijaya, 2020). The high level of use of technology among MMT promotes 21st-century learning in their respective classrooms. Furthermore, this study also aligned with Arumugham (2019), who agreed that the crucial role of the teachers is essential to enhance 21st-century learning. In addition, Taufik and Maat (2017) supported the finding of this study whereby teaching approaches play a vital role in attracting and fostering pupils understanding and interest in learning Mathematics. Besides, understand the students' development also help the mathematics teachers to promote 21st-century learning in the mathematics classroom. As a mathematics teacher posing counseling skills is vital to monitor and advise students in the mathematics classroom.

6. SUGGESTIONS

Even though the scale was established utilizing meticulous development and validation processes, the study was found to be without limitations. This study has certain limitations in that it explains 82.31 per cent of the variation. One potential problem is the lack of measurement theory to describe the link between the MMT scale and its underlying dimensions to enhance 21st-century learning. Furthermore, only secondary school educators are permitted to utilize freshly created surveys. Even though the factor structure stability was validated, it is strongly recommended that further research be done on other samples to guarantee generalizability. This idea is similar to (MacKenzie, Podsakoff, & Podsakoff, 2011) who stress the necessity of verifying the psychometric properties of a questionnaire with a new set of samples. Furthermore, the study should be performed using Confirmatory Factor Analysis in the future (CFA).

7. CONCLUSION

Overall, the instrument on the role of the MMT to promote 21st-century learning is valid and reliable. The level of the role of MMT to enable 21st-century learning is high. It explains that the MMT from Perak state successfully practiced 21st-century learning in their respective mathematics classrooms. This study can extend to other states in Malaysia and different levels of mathematics teachers. Besides that, this study can also be extended across other countries to find the mathematics teachers' role in promoting 21st-century learning in mathematics classrooms.

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