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EDUCATOR'S READINESS TOWARDS m-LEARNING IN TEACHING AND LEARNING OF BIOLOGY IN MATRICULATION

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ABSTRACT

In Malaysia, there has been a substantial increase in the adoption of mobile learning (m-Learning) due to advancements in technology and the demand for flexible and inclusive education. The success of implementing m-Learning depends on educators' readiness and positive perceptions towards it. By employing educators who are prepared and proficient in implementing mobile learning, the learning experiences of students can be optimized and have a beneficial effect on attaining educational goals. This study is a quantitative study that seeks to assess the readiness of Biology educators at matriculation colleges, MOE, to utilise m-Learning in the instruction and learning of Biology. The focus of this study involves several variables such as knowledge, skills, and attitudes. This study involves a total of 164 Biology educators from matriculation colleges as respondents. A set of questionnaires has been used as an instrument to carry out this study and is distributed online. The data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. In summary, the findings revealed that educators in the matriculation program, MOE, shown a reasonably high degree of readiness in terms of their knowledge, skills, and attitudes towards the use of m-Learning. Studies of educators' readiness in m-Learning provide valuable insights that can be used to optimize learning experiences through technology and appropriate steps can be taken to support educators in implementing m-Learning successfully.

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INTRODUCTION

In today's ever-changing educational landscape, using technology in teaching and learning methods is crucial for improving outcomes. Mobile learning (m-Learning) is one of the most promising new technologies that is opening up a world of possibilities for both students and teachers. A mobile learning environment (m-Learning) is adaptable, easily available, and tailored to the individual's needs through the use of portable electronic devices. According to (Nikolopoulou, 2021), m-Learning is a method of enhancing student learning through the use of smartphones. The widespread use of smartphones and tablets has led to increased interest from scholars and practitioners worldwide in the potential of m-Learning to revolutionize traditional educational methods (Crompton & Burke, 2018; Kearney et al., 2020)

Science, Technology, Engineering, and Mathematics (STEM) education is one of the disciplines that educational scholars are examining the possible effects of m-Learning. Biology, with its complex concepts and need for hands-on experimentation, stands to benefit significantly from m-Learning strategies. According to (Crompton, 2013; Sung et al., 2016), these strategies not only facilitate ongoing learning outside of the traditional classroom environment by giving students access to information and resources at any time and from any location but also by delivering interactive and engaging content. Teaching with information and communication technology can be facilitated by the use of contemporary technology, such as tablets and mobile phones. Technology is an area that has an impact on education, and this includes curriculum and pedagogy development. Due to Malaysian students' extensive use of smartphones and tablets, there are now more options than ever before to incorporate mobile technologies into teaching methods (Ismail et al., 2016; Mohamad & Yusuf, 2022; Nordin et al., 2017) Therefore, the use of Mobile Learning (m-Learning) as an approach in the teaching and learning of Biology in matriculation is more effective and can further improve educators' skills in the use of information technology.

In the realm of Biology education, m-Learning offers unique opportunity to improve students' knowledge of complex biological concepts through interactive simulations, virtual laboratories, and real-time data collecting (Bano et al., 2018; Zydney & Warner, 2016). The use of mobile devices in science education has showed promise in terms of improving student motivation, engagement, and academic performance (Nikou & Economides, 2018; Sung et al., 2016). Specifically, in the context of Malaysian Biology education, m-Learning has the ability to significantly improve students' understanding of complex biological principles through the use of interactive tools (S. Saidin & Abdul Halim, 2023) Zulkifli & Daud, 2021). This is particularly relevant in Malaysia, where the government has actively promoted the use of technology in education through initiatives such as the Malaysia Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2013) and, more recently, the Malaysia Digital Economy Blueprint (MDEB) 2021-2030 (Economic Planning Unit, 2021).

For these technologies to be effectively implemented as we enter the 21st century, it is essential that educators are prepared to integrate m-Learning into their educational methods (Traxler, 2018). According to Lin et al. (2016), being "ready for mobile learning" is being inclined to embrace or utilise mobile technology for the purpose of providing learning. Educators' openness to and skill with m-Learning technologies will determine the extent to which they can improve student learning in Biology classrooms. The ability of educators to meet the requirements of their pupils, regardless of their background or abilities, is a multi-faceted concept (Ibrahim et al., 2021; Razali et al., 2019; Ridzuan, 2021; Roslin & Salleh, 2021; Talekar, 2017). According to Baran (2014), many teachers who use mobile learning (M-Learning) methodologies have trouble making it work efficiently and incorporating it into their lessons. As a result, many teachers often depend on a strategy of trial and error.

Incorporating m-Learning requires the active participation of educators. So far, studies on m-Learning have mostly ignored teachers' and professors' points of view in favour of those on students (Miglani & Awadhiya, 2017). There is a lack of studies that focus on the viewpoints of educators, especially in the matriculation, even while prior research has mostly examined m-Learning in a broad setting (Cheon et al., 2012; Christensen et al., 2017). Comprehensive knowledge and evaluation of educators' preparation for m-Learning is critically needed, as there is a paucity of dedicated study on the topic. To help fill this void, this study will evaluate teachers' familiarity with m-Learning as well as their attitudes and beliefs about it. The results will hopefully lead to a more modern approach to matriculation-level Biology education. The successful adoption of m-Learning depends on everyone's preparedness, particularly educators. In order to facilitate the teaching and learning

process in an engaging m-Learning environment, readiness are crucial components, making this study vital. Examining the variables that impact Biology educator's readiness to incorporate mobile devices into their pedagogical practices is the primary goal of this paper. With the hope of informing educators, legislators, and stakeholders in educational technology of the benefits and drawbacks of mobile learning (m-Learning) in the field of Biology education.

Educators play a pivotal role in m-Learning and student engagement through the use of appropriate pedagogy, and they are also essential to the effective application of technology (Papadakis, 2019; Miglani & Awadhiya, 2017). In order to ensure that students are prepared to use mobile technology in the classroom, teachers should first assess their knowledge and ability levels. Researchers at the North Zone Teacher Education Institution found that instructors' level of readiness significantly affected how often they used mobile learning tools (Shuib et al., 2018). Educators' readiness to use mobile technology to facilitate automobile learning should hence not be undervalued. Therefore, this study aims to examine the extent to which educators are prepared for the use of m-Learning in teaching and learning of Biology in matriculation?

LITERATURE REVIEW

In this technological era, mobile learning (m-Learning) has emerged as a game-changer, providing fresh approaches to improving classroom instruction. There has been encouraging movement towards using technology in the classroom, especially in STEM subjects like Biology. Eltayeb (2015), Ridhuan et al. (2015), Sharples & Malley (2006), and Sophonhiranrak (2021) all agree that mobile learning also called m-Learning involves the use of mobile devices to support educational activities. Using this method, students are no longer constrained by the fixed time and place constraints of traditional classroom education and are free to engage with learning resources, interactive applications, and materials whenever and wherever they like.

In recent years, there has been a lot of interest in incorporating mobile learning (m-Learning) into education. The preparedness of educators for mobile learning and its effects on instruction have been investigated in earlier research. The readiness of educators to integrate mobile learning (m-Learning) in teaching and learning processes is a critical aspect of educational technology adoption. Several researchers have explored this topic, shedding light on different dimensions of readiness and its implications for educational practices. Numerous studies have emphasized how crucial it is for teachers to be prepared to implement mobile learning in the classroom. According to research by (Al-Emran et al., 2016), training and assistance are necessary for educators to improve their proficiency with mobile technologies, underscoring the significance of their readiness for the implementation of m-Learning. This study emphasizes how important it is for educators to adopt new technology to enhance student learning. If educators want to successfully include m-Learning in Biology classrooms, they must comprehend these ideas.

In addition, (Sharples et al., 2017) stressed the importance of tailoring mobile learning activities to the specific pedagogical objectives of Biology courses. Researchers found that students' understanding and retention of biological concepts improved when teachers used mobile learning experiences that were both interesting and relevant to their real-world contexts. In addition, in their review of the research, Kukulska-Hulme and Traxler (2013) looked at the pros and cons of mobile learning in schools. In order to make the most of mobile devices for interactive and interesting learning, teachers will need to adjust their methods. To guarantee the successful adoption of e-learning and m-Learning systems, studies such as (Hidayanto et al., 2020) stress the significance of evaluating the preparedness of both instructors and students. The importance of users' views in determining their preparedness and desire to participate in online learning processes is emphasized by this research.

Almaiah et al. (2022) used the Technology Acceptance Model (TAM) to assess instructors' readiness for m-Learning system use. Their research emphasized the importance of educators' perspectives and attitudes in determining the successful implementation of m-Learning technology. Using Structural Equation Modelling (SEM), this study provided a thorough examination of the factors impacting educators' acceptance and preparation for m-Learning. Assapari and Hidayati (2023) emphasized the need of student preparation in mobile-assisted language learning, as well as the need to assess students' compliance with m-Learning features. Similarly, (Mussa & Sazalli, 2021) evaluated Iraqi EFL instructors' readiness to include mobile learning into their English classroom, providing insight into teachers' opinions and abilities regarding the use of m-Learning.

Furthermore, (Asghar & Mobile, 2021) investigated pre-service teachers' accessibility, acceptability, and readiness for m-Learning technology during the COVID-19 pandemic, revealing the significant impact of personal innovation, service quality, and social influence on m-Learning adoption and readiness. These studies highlight the potential of m-Learning tools to improve education by engaging users effectively and boosting learning results. These studies show the importance of assessing instructors' and students' readiness for mobile learning to properly implement and use technology-enhanced instructional tools.

Pedagogical theories like constructivism and connectivism, which promote active, personalised, and contextual learning experiences made possible by mobile technologies, lend credence to the idea of mobile learning (m-Learning) in the classroom. Aligning with m-Learning's offer of hands-on activities and collaborative learning possibilities, constructivism emphasises learners' active production of knowledge through interactions with the environment. In line with the principles of connectivism, which stress the importance of knowledge being dispersed throughout digital networks, m-Learning makes use of mobile devices to facilitate connections with a variety of information sources and peers. Researchers Sabriet al. (2022) looked at the factors that formal part-time learners consider when deciding whether or not to use mobile learning. They found that factors including social impact, self-directed learning, and effort expectancy were the most important. The significance of technological, individual/user, pedagogical, and social dimensions in the success of mobile learning is highlighted in the research of Naved et al. (2021), which uses a multi-criterion decision-making technique to assess and rank the critical success criteria of mobile learning. Theoretically, this research support m-Learning in education and shows how constructivist and connectivist concepts are crucial for mobile learning to be active, personalised, and contextual.

Educators may encounter various obstacles when introducing m-Learning into the classroom. The successful use of mobile devices in learning environments might be hindered by several factors and obstacles, according to research. According to (Afful & Boateng, 2023), one major obstacle to m-Learning is the level of preparedness among both teachers and students. This preparedness includes things like knowledge of technology, desire to study, and perspective on mobile learning. The accessibility of LMSs and other supporting technologies is also critical for the smooth rollout of m-Learning initiatives. Concerns about the expense of mobile devices are another obstacle that students may face, according to (Ismail et al., 2016), which can limit their use of m-Learning resources. These obstacles show how difficult it is to incorporate m-Learning into classrooms and how important it is to solve problems related to technology, money, and education to increase the uptake and effectiveness of mobile learning programs.

Educators are essential in the integration of mobile learning (m-Learning) into educational environments, necessitating a willingness to adopt new pedagogical strategies and support systems. The significance of evaluating the e-readiness of teacher-students is underscored by the research conducted by AltunçekİÇ and Yildirim (2022) to ensure the successful implementation of ODL in professional development. This emphasizes the necessity for educators to comprehend the variables that influence the success of m-Learning, including the implementation of ICT and face-to-face interaction in the classroom. Additionally, (Awadhiya et al., 2014) investigated the utilization of ICT by distance learners in India, emphasizing the necessity of developing ICT-based tutorials and mobile applications to assist learners. This emphasizes the importance of educators providing sufficient technological support and resources to facilitate the successful integration of m-Learning. Furthermore, (Mussa & Sazalli, 2021) conducted a study on the readiness of Iraqi EFL teachers to implement m-Learning. The study underscored the beneficial effects of facilitating conditions, performance expectancy, effort expectancy, and social influence on the readiness of teachers. To facilitate the successful implementation of m-Learning, educators must improve infrastructure and offer training courses to enhance the knowledge of instructors regarding information technology. Additionally, (Stojšić et al., 2019) investigated the readiness of geography teachers to incorporate mobile devices into immersive technologies, underscoring the importance of educators enhancing their digital competencies to ensure the successful integration of immersive technologies into their instruction. In summary, educators must prioritize professional development, support systems, and a readiness to adopt new pedagogical strategies when incorporating m-Learning tools into educational environments.

METHODOLOGY

Research Design and Study Procedure

The design of this study uses a quantitative approach, i.e. a survey in which descriptive data analysis is conducted using a set of questionnaires. The survey method is a data collection system for respondents to analyze and test the relationship between related variables using statistical analysis. Therefore, the choice of a quantitative approach with a survey design is appropriate for the research conducted (Creswell, J.W. and Creswell, 2018). The questionnaire was administered online after permission to conduct the study was obtained from the Education Planning, Research, and Policy Department (EPRD) and the Matriculation Division of the Malaysian Ministry of Education (BMKPM). The link to the questionnaire, along with brief instructions, was sent via WhatsApp to the Heads of Biology departments in 12 colleges under the Ministry of Education Malaysia (MOE) for distribution to all Biology educators in each college. Ethical issues were considered and participation in the survey was voluntary. The researcher also sought permission from the directors of the colleges to participate in this study. The educators were also informed that the questionnaire is anonymous and the data collected will only be used for the study. The data obtained from the questionnaire was then transferred to the Microsoft Excel application before being analyzed using SPSS software version 27.0. The researcher uses descriptive analysis which refers to the analysis of the data obtained from the results of the questionnaire and provides a summary of the data using mean, standard deviation, percentage, and frequency. To interpret the educators' level of knowledge, skills, and attitude toward the use of m-Learning in teaching and learning Biology classes, the mean score obtained was recoded into four levels: low, medium, medium-high, and high (Nunnally & Bernstein, 1994), as shown in Table 1:

Table 1: Interpretation of mean scores

Mean scores	Interpretation
1.00 – 2.00	Low
2.01 – 3.00	Medium
3.01 – 4.00	Medium-high
4.01 – 5.00	High

Source: Nunally and Bernstein (1994)

Populations and sampling

The study's sample consists of 164 Biology educators who teach at the Matriculation colleges. The actual population of the study was 273, but 30 educators were used as the sample for the pilot study. Therefore, the accepted sample size of 164 is sufficient for this study. This is because this sample size is consistent with the sample size determination table of (Krejcie & Morgan, 1970). The demographic attributes of the survey participants, which encompass gender, age, teaching experience, and academic qualifications are shown in Table 2.

Table 2: Percentage Analysis for the Demographic Information of the Respondents

Demographic		Frequency (N)	Percentages (%)
Gender	Male	19	11.6
	Female	145	88.4
Age	21 - 30 years	15	9.1
	31 - 40 years	64	39.0
	41 - 50 years	70	42.7

	51 - 60 years	15	9.1
Teaching experience	0 - 5 years	16	9.8
	6 - 10 years	19	11.6
	11 – 15 years	41	25.0
	16 – 20 years	51	31.1
	21 – 25 years	27	16.5
	26 – 30 years	5	3.0
	30 years above	5	3.0
Academic qualification	Degree	115	70.1
	Master's	41	25.0
	PhD/EdD	8	4.9

Instrument

Research instruments that use questionnaires are suitable for quantitative studies with a survey design because of their versatility, efficiency, and ability to produce generalizable results. To obtain evaluation data for this study, the researcher modified the questionnaire from the survey of (Ridzuan, 2021) Ridzuan investigated *Lecturers' Readiness Level Towards the Use of m-Learning in the Technical and Vocational Education and Training System (TVET)* in his study. The items of the questionnaire were then adapted according to the objectives of this study by using a five-point Likert scale with 20 items.

Validity and reality analysis

This research instrument uses a set of questionnaires that have been refined as a result of a study conducted by Ridzuan (2020). A pilot study was conducted earlier on 30 respondents to determine the reliability of the questionnaire and to ensure there was no difficulty or ambiguity in interpreting each statement/item. The respondents were asked to rate their views on a five-point Likert scale (1=strongly disagree, 2=disagree, 3=moderately agree, 4=agree, 5=strongly agree).). It contains two parts, part A is the profile of the respondents and part B measures the level of readiness of the lecturer. Part B involves 19 statements/items of the m-Learning readiness survey which are used to measure the level of readiness of Biology lecturers towards m-Learning in terms of knowledge, skills, and attitudes.

Part B contains three constructs. The first construct which contains six items is related to the level of readiness of lecturers towards m-Learning from the aspect of knowledge. The second construct which contains six items is also related to the level of readiness of lecturers towards m-Learning from the aspect of skills. The third construct has seven items that measure the level of readiness of lecturers in terms of attitude. Cronbach's Alpha values for each construct are .950, .964, and .962 respectively. Thus, this instrument is most suitable for this study for two reasons: it explores the readiness of mobile learning as a new aspect of technology integration, and it is considered appropriate in the Malaysian context where m-Learning is still at the exploratory stage and its internal consistency reliability (alpha Cronbach) for the whole item is .979.

Data analysis

The quantitative data that has been collected is analyzed using Statistical Package for the Social Science (SPSS) version 26. The data analysis methods used is descriptive statistics and inferential statistics. Descriptive statistics

used in this study aims to obtain the mean of the three variables. Interpretation of the mean score in this study uses the scale used by Nunnally and Bernstein (1994) as stated in Table 1.

RESEARCH FINDINGS AND DISCUSSIONS

The level of educator's knowledge in m-Learning

Table 3 shows the mean score and level of knowledge of educators about m-Learning. In this section, there are six items created to examine the level of educators' knowledge about m-Learning.

Table 3: Level of Educators' knowledge in m-Learning

No.	Items	SD	D	MA	A	SA	Mean	Standard deviation	Level of knowledge/ Interpretation of mean
1	I know about the definition of m-Learning.	3.0 (5)	10.4 (17)	34.1 (56)	41.5 (68)	11.0 (18)	3.47	0.930	Medium-high
2	I don't have any problems to apply m-Learning in teaching and learning.	0.6 (1)	7.3 (12)	26.8 (44)	51.8 (85)	13.4 (22)	3.70	0.815	Medium-high
3	I know the difference between m-Learning teaching and conventional teaching methods.	1.8 (3)	9.8 (16)	24.4 (40)	49.4 (81)	14.6 (24)	3.65	0.911	Medium-high
4	I learned that m-Learning has many advantages.	1.2 (2)	6.7 (11)	21.3 (35)	51.8 (85)	18.9 (31)	3.80	0.864	Medium-high
5	I learned that m-Learning facilitates the teaching process and learning.	1.2 (2)	6.7 (11)	18.9 (31)	52.4 (86)	20.7 (34)	3.85	0.869	Medium-high
6	I know teaching and learning strategies through m-Learning.	1.8 (3)	7.9 (13)	36.6 (60)	44.5 (73)	9.1 (15)	3.51	0.840	Medium-high
	Overall						3.6583	0.77514	Medium-high

The mean values for the six items are between 3.47 and 3.84. Among the six items, m-Learning facilitates the teaching and learning of Biology (M = 3.84, SD = 0.871) showed the highest mean, followed by m-Learning has many advantages (M=3.80, SD=0.863), educators don't have any problems to apply m-Learning in teaching and learning society in general (M = 3.69, SD = 0.819), educators know the difference between the m-Learning teaching and conventional teaching methods (M = 3.65, SD = 0.915), educators know teaching and learning strategies through m-Learning (M = 3.51, SD = 0.841 and finally educators know the definition of m-Learning (M = 3.47, SD = 0.933) showed the lowest mean. From the table, the educators did not differ much in their level of knowledge in m-Learning. The overall mean value of educators' knowledge in m-Learning is medium-high (M = 3.66, SD = 0.775) which implies that there is a moderate level of knowledge in m-Learning among Biology educators in matriculation.

The level of educator's skills in m-Learning

Table 4 illustrates the mean score and level of lecturers' skills in m-Learning. In this section, there are six items created to examine the level of lecturers' skills about m-Learning.

Table 4: The level of educators' skills in m-Learning

No.	Items	SD	D	MA	A	SA	Mean	Standard deviation	Level of knowledge/ Interpretation of mean
1	I have the skills to implement m-Learning based on diverse student backgrounds.	1.8 (3)	6.7 (11)	50.6 (83)	34.8 (57)	6.1 (10)	3.37	0.776	Medium-high
2	I have the skills to prepare teaching plans and materials through m-Learning.	1.8 (3)	5.5 (9)	31.1 (51)	45.7 (75)	15.9 (26)	3.68	0.870	Medium-high
3	I often use the m-Learning approach in teaching and learning.	1.8 (3)	7.9 (13)	39.6 (65)	39.6 (65)	11.0 (18)	3.50	0.862	Medium-high
4	The m-Learning skills I have can have a positive impact on the teaching and learning process.	1.8 (3)	4.9 (8)	30.5 (50)	47.0 (77)	15.9 (26)	3.70	0.859	Medium-high
5	My m-Learning skills are constantly being improved to ensure a smooth process of teaching and learning.	1.8 (3)	6.7 (11)	29.3 (48)	45.7 (75)	16.5 (27)	3.68	0.891	Medium-high
6	I use m-Learning as much as possible in teaching and learning.	1.8 (3)	11.6 (19)	41.5 (68)	34.8 (57)	10.4 (17)	3.40	0.891	Medium-high
7	I have the skills to prepare Teaching Aids through m-Learning.	1.8 (3)	6.1 (10)	41.5 (68)	39.6 (65)	11.0 (18)	3.52	0.840	Medium-high
	Overall						3.5499	0.77102	Medium-high

Based on the data analysis in Table 4, the first item which is "I have the skills to implement m-Learning based on diverse student backgrounds" is at a moderately high level with a mean score of 3.37 and a standard deviation of 0.776. Next, the second item which is "I have the skills to prepare plans and teaching materials through m-Learning" is also moderately high with a mean score of 3.68 and a standard deviation of 0.870. Likewise, the third item which is "I often use the m-Learning approach in teaching and learning" is at a moderately high level with a mean score of 3.50 and a standard deviation of 0.862. Meanwhile, the fourth item which is "The m-Learning skills that I have can have a positive impact on the teaching and learning process" is at a moderately high level with a mean score of 3.70 and a standard deviation of 0.859. Next, the fifth item which

is "My m-Learning skills are always improved to ensure the smoothness of the teaching and learning process" is also moderately high with a mean score of 3.68 and a standard deviation of 0.891. The sixth item which is "I use m-Learning as much as possible in teaching and learning" is also at a moderately high level with a mean score of 3.40 and a standard deviation of 0.891. The last item "I have the skills to prepare Teaching Aids (BBM) through m-Learning" is also at a moderately high level with a mean score of 3.52 and a standard deviation of 0.840.

Overall, the average mean score for the items that measure lecturers' skills in m-Learning is 3.5499, indicating a moderately high skill level. The findings of the study show that the highest mean score was obtained on items related to m-Learning skills possessed by lecturers capable of having a positive impact on the teaching and learning process where the highest mean score was 3.70. The item with the lowest mean score is the lecturer's skill in implementing m-Learning based on diverse student backgrounds where the mean score is only 3.37.

The level of educator's attitudes in m-Learning

Table 5 illustrates the mean score and level of lecturers' skills in m-Learning. In this section, there are six items created to examine the level of lecturers' skills about m-Learning.

Table 5: The level of educators' attitudes in m-Learning

No.	Items	SD	D	MA	A	SA	Mean	Standard deviation	Level of knowledge/ Interpretation of mean
1	I like to use m-Learning in teaching and learning.	1.8 (3)	4.3 (7)	32.9 (54)	42.1 (69)	18.9 (31)	3.72	0.883	Medium-high
2	I have more fun teaching through m-Learning approach.	1.8 (3)	6.7 (11)	30.5 (50)	42.7 (70)	18.3 (30)	3.69	0.911	Medium-high
3	I am constantly learning how to use m-Learning regularly.	1.8 (3)	6.7 (11)	36.0 (59)	37.2 (61)	18.3 (30)	3.63	0.920	Medium-high
4	I always share about strategy teaching and learning through m-Learning with colleagues.	1.8 (3)	11.0 (18)	40.2 (66)	37.2 (61)	9.8 (16)	3.42	0.879	Medium-high
5	I am always ready to face challenges in the use of m-Learning.	1.8 (3)	5.5 (9)	29.9 (49)	47.6 (78)	15.2 (25)	3.69	0.862	Medium-high
6	The m-Learning approach in teaching and learning is easier than the conventional approach.	1.8 (3)	6.7 (11)	32.9 (54)	38.4 (63)	20.1 (33)	3.68	0.932	Medium-high
7	I always encourage my colleagues to use m-Learning in their	2.4 (4)	9.8 (16)	35.4 (58)	41.5 (68)	11.0 (18)	3.49	0.903	Medium-high

teaching and learning.				
Overall	3.6176	0.81043	Medium-high	

Table 5 shows the analysis of the questionnaire on the level of educators' attitudes toward the use of m-Learning in the teaching and learning of Biology. Based on the data analysis, the first item which is "I like using m-Learning in teaching and learning" is at a moderately high level with a mean score of 3.72 and a standard deviation of 0.883. Similarly, the second item which is "I enjoy teaching through m-Learning approach" is at a moderately high level with a mean score of 3.69 and a standard deviation of 0.911. Meanwhile, the third item which is "I always learn how to use m-Learning regularly" has a mean score of 3.63 and a standard deviation of 0.920 which is also at a moderately high level. Next, the fourth item which is "I always share about strategy teaching and learning through m-Learning with colleagues" is at a moderately high level with a mean score of 3.40 and a standard deviation of 0.879. Meanwhile, the fifth item which is "I am always ready to face challenges in the use of m-Learning" has a mean score of 3.69 and a standard deviation of 0.862 which is also at a moderately high level. The sixth item which is "The m-Learning approach in teaching and learning is easier compared to the conventional approach" is also at a moderately high level with a mean score of 3.68 and a standard deviation of 0.932. The last item which is "I always encourage my colleagues to use m-Learning in their teaching and learning" is also at a moderate level with a mean score of 3.49 and a standard deviation of 0.903.

Overall, the average mean score for the items that measure the lecturer's attitude towards m-Learning is 3.6155 showing a moderately high level of attitude. The results of this research show that the highest minimum score is obtained on items related to lecturers' willingness to use m-Learning in teaching and learning where the mean score is 3.71. Meanwhile, the item that recorded the lowest mean score was the lecturer's willingness to share teaching and learning strategies through m-Learning with colleagues approach with a mean score of 3.43.

DISCUSSION

Readiness of m-Learning from the aspect of knowledge

The moderately high level of knowledge about m-Learning among Biology educators with an average mean score of 3.6646 and a standard deviation of 0.77230 reflects a growing trend in educators' awareness of mobile technologies. The results of this descriptive analysis indirectly show that Biology educators in matriculation colleges, MOE have moderately high knowledge about m-Learning and understand the difference between the application of m-Learning in teaching and learning of Biology and conventional teaching and learning methods in matriculation programs, MOE. It also describes the Biology educators in the matriculation college, MOE have moderately sufficient knowledge and moderately high efficiency to implement m-Learning in the teaching and learning of Biology. The findings of this study are in line with the findings of a previous study conducted by Ridzuan A.A., (2020) which found that educators have moderately high knowledge of m-Learning in the TVET system. The results of the study show the same pattern because the population and study sample are almost the same because they involve educators at the higher education level.

The findings of this study are also in line with the study (Jalan & Ahmad, 2022) in the History subject of rural primary schools on the use of m-Learning which is also at a moderate level. Although the population and subjects studied are different, i.e. educators at the higher education level and primary school educators, the results of the study have shown almost the same pattern. Next, a study conducted by (Miasan & Tengku Kasim, 2018) found out the level of practice of m-Learning by Novice Teachers of Islamic Education serving in Sabah. This study uses a qualitative approach. A total of 4 informants were interviewed, representing 4 areas in Sabah. The findings of the study recorded that they have basic preparation in terms of owning m-Learning tools and basic device-handling skills for learning and facilitation purposes. This study is also on the same track. Although the research methods used to conduct the study are different, the findings of the study confirm that all informants have basic knowledge to operate mobile devices in the classroom.

Meanwhile (Samad et al., 2019) study of the acceptance and readiness to use m-Learning among primary school Science educators found that the level of readiness of educators from the aspect of knowledge is high. Although some educators do not apply M-Learning in their learning and facilitating, they acknowledge the usefulness of mobile technology to help in learning and facilitating sessions. It follows that science educators need to be prepared to increase their level of knowledge regarding the use of mobile technology. This is considering that technology evolves and changes at a fast pace and educators who are not willing to keep up with the latest developments in technology will be left behind. This should not happen because educators are the frontrunners who carry the task of conveying information to students through learning and facilitating in school. Therefore, educators should take the initiative to learn and explore mobile technology. Educators' attitudes must also be positive and mobile technology must be accepted as an essential factor to help the learning and facilitating process as well as to improve student excellence. Implementing M-Learning requires a high level of commitment from both educators and students; otherwise, it would neither be feasible nor effective. According to (Mahat et al., 2012), before educators can apply mobile technology in the classroom, they should take steps to improve their existing skills and knowledge so that the teaching and learning process can run smoothly.

However, the findings of this study are contrary to the findings of a quantitative study conducted by (Karmila et al., 2015). The results of the study show, that teachers in Indonesia have a good perception towards mobile learning. Their knowledge of mobile learning was average but they had a willingness to learn more about mobile learning. Financial and device issues were not obstacles for the teachers to participate in a mobile learning environment. Interestingly, the knowledge and readiness of teachers, who taught ICT subjects, of mobile learning were lower than teachers with mathematics, science, and other subjects. The majority of teachers who are the sample of the study have chosen the item either disagree or strongly disagree that they know about mobile learning. The findings represent a percentage of 55.5%, indicating that teachers do not have sufficient knowledge about M-Learning.

Similarly, the results of the latest study conducted by (N. D. Saidin & Husnin, 2021) are also slightly contrary to the findings of this study. The purpose of the study is to examine the level of knowledge and the level of readiness of secondary school teachers in rural areas and to find out the difference in the level of knowledge and the difference in the level of readiness of teachers in rural secondary schools based on gender towards the Google Classroom platform in the Teaching and Facilitation (PdPc) process. The quantitative study involved 262 secondary school teachers in Kudat district. The results of this study found that the level of knowledge of rural secondary school teachers towards the M-Learning platform Google Classroom is at a low level and the readiness of rural secondary school teachers towards the M-Learning platform i.e. Google Classroom in the teaching and learning process is at a high level. The results of this study also found that there is a difference between the level of knowledge and the level of readiness of male and female teachers towards the m-Learning platform which is *Google Classroom*.

The difference in the findings of this latest study is likely to be caused by changes in the country's education system in the era of the Covid-19 pandemic which demands non-face-to-face and mobile learning. In the pandemic era, the use of m-Learning in education has given freedom to teachers and students to choose an effective and appropriate learning medium according to their situation (Tengku Kasim & Miasan, 2021). This is also stated by (Matzavela & Alepis, 2021), that interest in m-Learning has increased worldwide by academic disciplines and subsequently in the age of COVID-19, the need to enrich m-Learning methods has emerged. m-Learning becomes a promising tool to be a global leader in the education field (Miglani & Awadhiya, 2017), especially during the COVID-19 pandemic.

Chiu and Churchill (2021) stress that a thorough understanding of learning object design that makes use of multimedia learning principles is necessary for efficient m-Learning in science topics like Biology, rather than merely a cursory knowledge of mobile technology. Although educators may possess practical knowledge, it is possible that they do not possess a thorough theoretical understanding, as indicated by the lower mean score (3.47) for knowing the definition of m-Learning. The findings of Kaliisa et al. (2019), who observed notable differences in m-Learning expertise between educators in developed and developing nations, are consistent with

this knowledge gap between theory and practice. They contend that variations in the availability of professional development opportunities and technology infrastructure are frequently the cause of these discrepancies.

It's interesting to note that the meta-analysis by Sung et al. (2022) shows that better learning outcomes are not guaranteed by the simple inclusion of mobile devices. They emphasize how crucial instructors' pedagogical expertise is to making the most out of these resources. This begs the question of whether the knowledge assessed in this study is adequate for using m-Learning in Biology teaching in a way that will have a significant impact. Furthermore, the intricacy of the knowledge needed is highlighted by Bano et al.'s (2018) systematic review of m-Learning in scientific and maths education. They contend that for m-Learning to be effective in various domains, one must possess both a thorough understanding of subject-specific educational methodologies and technological know-how. The current study's metrics might not fully capture this complex knowledge demand.

Readiness of m-Learning from the aspect of skills

Data analysis of the educator's skill level regarding the use of m-Learning in teaching and learning Biology in matriculation shows that it is at a moderate level with an average mean score of 3.5499 and a standard deviation of 0.7702. The findings of this study are in line with (Jalan & Ahmad, 2022) study which identified the level of readiness of rural elementary school History teachers towards the use of m-Learning in History subjects from the aspects of knowledge, skills, and attitudes of teachers where the level of teacher skills towards the use of m-Learning in teaching and learning of History is also at a moderate level.

The results of the analysis of 25 previous studies selected in a systematic literature review by (Thian & Mohd Matore, 2020) have shown that the majority of teachers have mobile technology and have the skills to apply mobile technology to implement m-Learning in the teaching and learning process. This systematic literature highlight was made to study the readiness of teachers and students towards the use of mobile learning from the aspects of basic readiness, skill readiness, psychological readiness, and expenditure readiness. The findings of the study show that the majority of teachers and students have mobile technology and are ready to carry out mobile learning. They also have the skills to apply mobile technology to do learning activities.

Rosiva et al., (2022) uses an exploratory research design to determine the readiness of teachers and junior high school students in Secondary High Schools in Indonesia to use their mobile phones as a learning tool that can be implemented during a pandemic. According to this study, the readiness in m-Learning is grouped into two; (a) Tool Readiness and (b) Skills Readiness. The results show that all teachers (100%) and students (99%) are ready to own a mobile device and most teachers (89%) and students (85%) have acquired the basic skill requirements for m-Learning. The readiness of the device is surveyed given the accessibility of mobile phones with satisfactory internet capabilities. The outcome showed all respondents had a mobile phone and internet capability (100%). It can be decided that most of educators had device readiness to use in the teaching-learning process via their mobile phones.

Similarly, a study conducted (Baharun et al., 2017) involving 42 pre-service program lecturers at five campuses of the Malaysian Teacher Education Institute (IPGM) in the central zone also found that lecturers have at least one mobile device technology with the devices they have at least the required minimum capacity to implement m-Learning. This revealed that the lecturers have access to the technology needed for the incorporation of m-Learning in their formal teaching process. They also showed a high level of acceptance and intend to use m-Learning in their formal course

The findings of this study also strengthen the findings of a study conducted by (Miglani & Awadhiya, 2017) on the level of readiness and perception of 120 teachers of eighteen Open Universities spread across five Commonwealth Asian countries (Bangladesh, India, Malaysia, Pakistan, and Sri Lanka) towards m-Learning. The analysis of responses obtained from 102 teachers indicates that they have the device and skill readiness to impart m-Learning. The study also revealed the presence of positive perceptions for m-learning among them. They affirmed that m-Learning has the potential to engage the learner to a greater extent. The average percentage of respondents with basic and advanced skills for m-Learning was found to be 59% and 21.5% respectively. This analysis shows that respondents have the basic skills to adapt m-Learning and engage in it. However,

respondents are less proficient in higher skills in using m-Learning to optimize its use in formal teaching and learning processes.

However, the findings of this study are contrary to the findings of a quantitative study conducted by (N. D. Saidin & Husnin, 2021) on 262 teachers from a population of 644 secondary school teachers in Kudat district. The results of the study have shown that a total of 117 teachers with a percentage (44.7%) have the skills to use hardware and technology applications in education at a good level. This finding is contrary to the results of this study which found that the level of teachers' skills in using m-Learning in Biology is at a moderate level.

In addition, the findings of a quantitative study conducted by (Roslin & Salleh, 2021) are also slightly contrary to the findings of this study. The study was conducted on 88 Special Education teachers in a district in the state of Johor. The findings of the study show that the use, skills, and attitudes of Special Education teachers toward the use of m-Learning as a teaching and learning aid are at a high level. The implications of this study show that almost all Special Education teachers involved in this study use m-Learning as an aid in teaching preparation and during teaching.

The difference in the findings of this study may be influenced by some issues such as there are schools in rural areas that find it difficult to use m-Learning platforms such as *Google Classroom, Telegram, and WhatsApp* limited in schools, student economic factors, as well as the level of knowledge and teachers' willingness to learn new skills (N. D. Saidin & Husnin, 2021) (Rerah & Mohamed, 2021). In addition, some teachers are less skilled in the use of ICT which results in them not being able to use m-Learning applications effectively (Baharun et al., 2017)

The total mean score of 3.55 for Biology instructors indicates a medium-high level of m-Learning proficiency, which calls for critical examination. The creation of an instructional design approach for mobile blended learning by Suartama et al. (2019) highlights the advanced abilities teachers require. These encompass not just functional abilities but also the capacity to create educational programs that skillfully combine mobile and conventional methods. The results of this study might not adequately convey this intricacy. The capacity to create and execute bite-sized learning modules and tests that are appropriate for mobile platforms is another essential skill set, as highlighted by Nikou and Economides' (2018) work on mobile-based micro-learning and assessment. This begs the question of whether the competencies assessed in this study accurately capture the unique demands of m-Learning in Biology instruction.

According to Crompton et al.'s (2017) systematic study, there are considerable differences in the skills needed for successful m-Learning between different educational levels and topic areas. This implies that the particular skills required for Biology instruction at the matriculation level may not be well reflected by a general measure of m-Learning skills. Furthermore, the study conducted by Ifinedo et al. (2020) on teacher educators in Nigeria highlights the interaction between skills and other elements such as institutional support and beliefs. They contend that abilities must be analyzed in the larger framework of an educator's work environment rather than being seen in a vacuum. This viewpoint casts doubt on the current study's emphasis on skills as a stand-alone component. The study of Stevenson et al. (2019) on the use of apps as cognitive stepping-stones adds another dimension to skills: the capacity to choose and use applications that are in line with certain biological learning objectives. Broad assessments of m-Learning skills may fall short of capturing this particular combination of talents.

Readiness of m-Learning from the aspect of attitudes

Overall, the level of educators' attitude towards the use of m-Learning in teaching and learning Biology in matriculation is at a moderate level with an average mean score of 3.6176 and a standard deviation of 0.81043. The findings of this study are also similar to the findings of a study conducted by (Rerah & Mohamed, 2021) who found that the level of teacher attitude is at a moderate level for conducting teaching and learning online mode. In the context of online teaching and learning, it is classified into two parts namely; synchronic and asynchronous methods. The results of this study also found that there is a significant linear influence of teacher knowledge, skills, and attitudes on teacher readiness. This shows that the difference in teachers' attitudes towards the use of m-Learning may be influenced by the level of knowledge and skills of the teacher in the use

of m-Learning. There is a need for teachers to increase their knowledge of current digital application hardware to keep pace with the development of modern education today. The findings of this study are also in line with the study conducted by (Jalan & Ahmad, 2022) who found that the level of teachers' attitude towards the use of m-Learning in teaching and learning of History is also at a moderate level.

However, the findings of this study are a little contrary to the study conducted by (Ridzuan, 2021) who found that the level of attitude of Lahad Datu Community College lecturers about m-Learning is at a moderately low level. This is due to their positive attitude or perception towards m-Learning still exists. The openness of educators in sharing and accepting views related to the use of m-Learning among colleagues can help teachers further improve their knowledge and skills about m-Learning.

Salleh & Siraj, (2016) investigate History teachers' view towards the need to develop m-Learning teaching model based on the inquiry method for the secondary school History subject. UTAUT theory was used as a basic model for the study. The overall findings show that teachers have at least one mobile technology device (100%, n=120) mainly (74.2%, n = 89) with devices at least at level 2 (voice call capability, SMS, video call, email, Internet surfing, image and video recording and software to download). The finding of this study reveals that History teachers have access to the necessary technology for m-Learning. This shows a positive level of acceptance and intention in using mobile devices as well as a high desire to use mobile devices in teaching planning to use m-Learning in the teaching of secondary-level history subjects.

Likewise, the study conducted by (Roslin & Salleh, 2021) Special Education class teachers also contradict the findings of this study. The study shows that the use, skills, and attitudes of Special Education teachers towards the use of m-Learning as a teaching and learning aid are at a high level. The sample of this study is different, that is among Biology educators in matriculation and the findings of the study found that the level of educators' attitude towards the use of m-Learning is at a moderate level and not at a high level as in the study.

The total mean score of 3.62 indicates that Biology educators have a medium-high level of positive attitudes toward m-Learning, which is encouraging but has to be critically examined. Researchers Cheng et al. (2019) found that when teachers see m-Learning as a tool for active, experiential learning, their attitudes toward technology tend to be more positive. This trend is especially true in the field of environmental science education. On the other hand, they do point out that worries about implementation issues can moderate these attitudes. The complex attitude interaction may be under-measured in the present research.

Educators' perspectives on the function of mobile devices in evaluation are another facet of attitudes brought to light by Dalby and Swan's (2019) research on the use of digital tools for formative evaluation in maths classes. Their research shows that many teachers see mobile tech's formative assessment possibilities, but that worries about access and equality dampen these enthusiasms. While similar worries might exist among Biology teachers, they might not have been adequately measured in this study. In their analysis of the obstacles to m-Learning implementation in secondary schools, Kearney et al. (2020) offer a critical viewpoint on the mindset of teachers. They state that there is a complicated terrain of attitudes that may not be entirely reflected by simple metrics since favourable attitudes can exist with substantial concerns about actual execution.

Although not specifically addressing m-Learning, the review of artificial intelligence in mathematics education by Lai and Hwang (2021) provides insightful information on how teachers feel about cutting-edge tools. They point out that teachers' views on how these technologies complement or compete with more conventional methods of instruction greatly influence their attitudes toward them. Educators' perceptions of m-Learning's compatibility with traditional Biology pedagogy may shape their perspectives on its use in the classroom. Researchers Zhai et al. (2018) found that high school physics teachers' opinions towards m-Learning were complex, including mixed feelings about the technology's potential and worries about disruptions to student focus in the classroom. Although the present study may not have captured all instances of this tension, it may be present among Biology educators.

CONCLUSION AND RECOMMENDATION

According to the results of this study, educators' readiness to teach and studying Biology in matriculation is at a modest level. The readiness of educators includes their level of knowledge, skills, and attitude toward the utilization of M-learning in the teaching and learning of Biology. While the findings of this study hold significance, they provide a rather oversimplified depiction of educators' readiness for M-learning in the field of Biology education. The additional research highlights the intricate interplay between knowledge, skills, and attitudes, suggesting that preparation is a complex notion that may not be fully captured by individual assessments. Moreover, the focus of the research on general m-learning preparation may overlook the specific requirements of Biology education. For Biology education to be successful in mobile learning (m-Learning), it requires specialized knowledge and abilities that may not be evident in general assessments of m-Learning readiness. The levels of readiness in all three dimensions; knowledge, skills, and attitudes ranging from moderate to high, should be observed. Optimistic mindsets and seeming readiness may not inevitably translate into effective implementation. The transformation of preparedness into actuality can be significantly impacted by institutional constraints, technical assistance, and educational challenges. Future research should consider developing more intricate, discipline-specific evaluations of m-learning readiness for Biology education and examining the extent to which actual m-Learning implementation aligns with perceived readiness in Biology courses. Examining the impact of contextual factors, such as institutional support and technical infrastructure, on educators' ability to effectively use m-Learning. Essentially, while the current study provides valuable analysis of instructors' readiness for m-Learning in Biology teaching, it also highlights the need for more comprehensive, intricate, and contextually sensitive approaches to understand and promote this preparedness. We need to update our understanding of educator preparation to keep up with the advancements in m-Learning. This means acknowledging and adapting to the intricate and ever-changing nature of this rapidly evolving educational landscape. Ultimately, the present study offers useful insights into the preparedness of educators for mobile learning in Biology education. However, it also emphasizes the necessity for more thorough, nuanced, and contextually aware ways to comprehend and promote this preparedness. As the field of m-Learning progresses, educators must adapt their notion of preparedness to match the intricate and dynamic nature of the fast-evolving educational environment.

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