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Utilizing mobile phones in mathematics class: teachers' and preservice teachers' perceptions

Utilizing mobile phones in mathematics class: teachers' and preservice teachers' perceptions

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Abstract. Mobile phones are one of the technologies that can be used to support mathematics learning, but currently the use of it in the classroom seems to be rarely used by teachers in Indonesia. This study examined a total of 44 mathematics teachers and 62 mathematics preservice teachers' perception in Indonesia for the use of mobile phones in the classroom. Participants were given a questionnaire to determine their support for mobile phones use. The results showed that majority of the participants supported the use of mobile phones for learning. They agreed that mobile phones are useful to provide learning opportunities anywhere and anytime, increase access to technology in the classroom, and provide opportunities for differentiation in instruction. As for barriers, participants worry about students' access application that is not in accordance with the teacher's instructions. They perceived that instructions, control of students and time allocation are the things that teacher need to pay attention before using this media. Although majority teachers reported their support for the use of mobile phone in the classroom, the implementation of this media needs to be improved.

1. Introduction

Currently the use of technology cannot be released in everyday life. One of them is mobile technology in the form of mobile phones. Many studies reported that mobile phones are the most widely used devices for mobile learning (M-Learning) [1,2]. New features on mobile devices increasingly support mobile learning as "one of the key current trends of educational applications for new technologies" [3].

Indonesia as a large-population country was predicted to be the fourth largest smartphone users population in 2018 based on the Emarketer' survey [4]. It indicated that the chances for utilizing mobile phones in learning are considerable. Unfortunately, research related to the use of mobile phones in classroom in Indonesia is still limited especially in mathematics subject. It can be seen from several journal reviews conducted by researchers Liu et al [5], Baran [1], and Chee et al. [2] which did not include Indonesia into countries that contribute to M-Learning research.

Majority of studies on M-Learning show positive results. It most often supports learning in language and art, followed by science [2]. Liu et al [5] reported in their research four primary opportunities for learning, as follows (a) offering students multiple entry points and learning paths and allowing for differentiated learning, (b) enabling multiple modalities via mobile devices by which students have a different learning tool to create their needs, (c) supporting student improvisation in situ - student may improve as needed within the context of learning, and (d) supporting learning to create and facilitate

creating and sharing artifacts. Additional benefits of mobile learning included of increasing motivation, high levels of self-efficacy, and high interest in activities, also increasing interest in collaboration [6]. Mobile phone providing teachers with the ability to personalize instruction [7] and creating student-centered learning opportunities [8].

Regardless of the benefits of using mobile phones in the classroom, the barriers to their use must also be considered. These are included, students distractions, potential for cheating, increasing student disciplinary problems [9], issues with school technology infrastructures [5], and the potential for digital inequity situations to arise [5].

Teacher perceptions regarding the use of mobile phones in learning determine the application of this media in class. The studies about teacher's perception of the use of mobile phones in the classroom revealed varied results, included support [10–13], unsure [14], and did not support [15,16]. According to the importance of the teacher's role in the implementation of mobile learning, and lack of research about mobile learning especially in mathematics, researchers were interested to investigate the perceptions of teachers and preservice teachers in Indonesia about the use of mobile phones in mathematics class.

2. Research methods

This study used a survey research design to investigate perceptions of teachers and preservice teachers regarding the use of mobile phones in mathematics class. The perception included of the useful mobile phone feature for school-related works, benefits and barriers of mobile phone usage, and perceive the use of mobile phone in mathematics classroom. A total of 44 mathematics teachers from some provinces and 62 mathematics graduate students (preservice teachers) from some universities in Indonesia participated in this study. Demographic profiles of all participants were summarized in Table 1. Of those, most of the participants were females (74%), their age between 21-25 years old (53%), graduate students that have never taught at school (28%), and bachelor degree (89%).

Table 1. Demographic profiles of participants

	Categories	Participant	Percentage
Gender	Male	28	26%
	Female	78	74%
Age	21 - 25 years old	56	53%
	26 - 30 years old	25	24%
	31 - 35 years old	5	5%
	36 - 40 years old	2	2%
	more than 40 years old	18	17%
Profession	Teacher:	44	42%
	teaching in primary school	3	3%
	teaching in junior high school	17	16%
	teaching in senior high school	24	23%
	Graduate student (preservice teacher):	62	58%
	have never taught at school	30	28%
	had taught in primary school	4	4%
	had taught in junior high school	10	9%
	had taught in senior high school	18	17%
Highest degree	Bachelor	94	89%
	Master	12	11%

Data for this study was collected by questionnaire adopted with modification from Thomas et al [15]. The questionnaire was translated into Indonesian, then modified by adding and eliminating some open-ended questions that were adjusted to the needs of this study. The modified questionnaire has been distributed to 25 graduate students of mathematics education to check for understanding, validity

($r > 0.34$), and reliability ($\alpha > 0.85$). The questionnaire consisted of 55 items contained a mix of question types including close questions, checklist, Likert scaled using 5-point scales (1 = Strongly Disagree: 5 = Strongly Agree), and open-ended. Six items used to gather the teachers' and preservice teachers demographic data as well as the type of mobile phone their owned and current mobile phone policy in their school district, 4 items used to gather their support for the use of mobile phones in the classroom, 21 items used to gather their perceptions regarding useful mobile phones features, 12 items used to gather their perception of the benefits to using mobile phone in the classroom, 7 items used to gather barriers to using mobile phone in the classroom, 5 items used to gather their expertise with technology (1 = novice: 5 = expert), their experiences using mobile phone for mathematics learning, and their perception about the use of mobile phone in mathematics class.

Data collection procedures were carried out by distributing paper-based and online questionnaire to mathematics education graduate students (preservice teachers) and mathematics teachers in some universities and school in Indonesia. The method for choosing the participants were voluntary and random sampling. Since the main purpose of the research was to study the perception of the use of mobile phone in mathematics class, descriptive statistics such as frequency, percentage, mean and standard deviation were calculated to summarize the data.

3. Results and discussion

The participants reported that all of them owned smartphone with data plan. They also reported the expertise of technology which most of them were experienced users of technology (M = 3.42, SD = 0.799). Further review revealed that 7% reported that they were experts, 40% reported their proficiency at level 4, 44% reported their proficiency at level 3, 8% reported their proficiency at level 2, and 2% reported to be a novice user of technology.

Teachers and preservice teachers that have ever taught at school (n = 76) were asked about the mobile phone policy that most closely aligns with their school policy. Most of them (43%) reported that students are not allowed to have mobile phones on school grounds, meanwhile others reported that students are allowed to use mobile phones throughout the school day under this condition: for instructional purposes (34%), use them outside of class hours (17%), must be in the off mode (3%), and must be entrust to school until the end of the lesson (3%). This finding would be one of the main barriers for implementing mobile learning in classroom, based on the project tomorrow report, the ban on the use of mobile device is one of the main obstacles using technology at school [17].

3.1. Support for the use of mobile phones in the classroom

The questionnaire asked the teachers and preservice teachers about their support for the use of mobile phones in the classroom. The results revealed that the majority of the participants would/do use a mobile phone for school-related work (M = 4.11, SD = 0.718), they would/do allow their students to use mobile phones for school-related work (M = 4.02, SD = 0.901), they perceive that mobile phones could/do support student learning (M = 3.76, SD = 0.937), and they support the use of mobile phones in the classroom (M = 3.36, SD = 1.092). Furthermore, the teachers reported more support for mobile phone use (M = 3.48, SD =1.158) than preservice teachers (M = 3.27, SD =1.034), but they were less support about the use of mobile phone for school-related work than preservice teachers (see Table 2). Over all the participants supported the use of mobile phones in the classroom. This finding is similar to the results of other studies [10,12,13].

Table 2. Teachers and preservice teachers support for the use of mobile phones in the classroom

Support	Total (n = 106)		Teachers (n = 44)		Preservice teachers (n = 62)	
	M	SD	M	SD	M	SD
I support the use of mobile phones in the classroom.	3.36	1.092	3.48	1.158	3.27	1.034

I would/do use a mobile phone for school-related work.	4.11	0.718	4.18	0.716	4.06	0.716
I would/do allow my students to use mobile phones for school-related work.	4.02	0.901	3.89	1.049	4.11	0.764
I think that mobile phones could/ do support student learning.	3.76	0.937	3.84	0.903	3.71	0.957

3.2. Mobile phones features for school-related work

The participants were asked to identify the features/functions of mobile phones that they believed could be useful for school-related work. They reported how strongly they agreed or disagreed that 21 mobile phone features/functions could be useful for school-related work (see Table 3). The teachers and preservice teachers identified access the internet as the most useful feature, while play a game as the least useful feature. This finding was similar with Thomas and O'Bannon's survey study report that they investigated the perception of 1121 teachers in Kentucky and Tennessee [15]. Furthermore, send/receive email, use educational app, take a picture and post a picture online were also identified as useful features for school related-work, meanwhile play a podcast and play music as least useful in this study.

Table 3. Teachers and preservice teachers perceived useful mobile phone features for school-related work

Features	Total (n = 106)		Teachers (*n* = 44)		Preservice teachers (*n* = 62)	
	M	SD	M	SD	M	SD
Send/receive text message	3.94	0.960	3.98	0.941	3.92	0.972
Send/receive email	4.32	0.721	4.20	0.756	4.40	0.683
Access the Internet	4.43	0.630	4.50	0.622	4.39	0.631
Take a picture	4.12	0.876	4.16	0.851	4.10	0.893
Post a picture online	4.06	0.899	4.00	0.905	4.10	0.893
Record a video	3.97	0.946	3.98	0.965	3.97	0.933
Watch a video	3.84	1.056	3.91	1.083	3.79	1.034
Post a video online	3.81	1.083	3.82	1.134	3.81	1.045
Record audio	3.95	0.955	3.82	1.072	4.05	0.851
Post audio online	3.79	0.988	3.68	1.144	3.87	0.852
Play music	3.04	1.345	3.07	1.304	3.02	1.374
Play a podcast	2.99	1.128	2.91	1.041	3.05	1.184
Play a game	2.22	1.174	2.34	1.224	2.13	1.129
Use clock/alarm/timer	3.64	1.159	3.64	1.208	3.65	1.123
Use calendar	3.92	0.826	3.98	0.839	3.87	0.813
Use calculator	3.69	0.965	3.80	0.967	3.61	0.956
Use a social networking site	3.08	1.289	3.30	1.358	2.94	1.216
Download an app	3.81	1.047	4.05	1.086	3.65	0.985
Use educational apps	4.33	0.786	4.18	0.960	4.44	0.612
Scan QR codes	3.39	0.947	3.32	1.124	3.44	0.796
Create QR codes	3.15	0.877	3.09	1.041	3.19	0.737

3.3. Perceived benefits of mobile phones usage in the classroom

The participants were asked how strongly they agreed or disagreed about the benefits to using mobile phones in the classroom (see Table 4). Teachers agreed that all were benefits but viewed some as more beneficial than others. They indicated that providing anywhere/anytime learning opportunities, increasing access to technology in the classroom, providing opportunities for differentiation in

instruction were the most beneficial reasons to use mobile phones in the classroom. The preservice teachers perceived all of the above to be benefits; however, they also viewed some as more valuable than others. They indicated that mobile phones were most beneficial in providing anywhere/anytime learning opportunities. This finding similar with Thomas and O'Bannon's study report, though the participants were unsure about allowing mobile phones in the classroom [14]. Furthermore, increasing access to technology in the classroom, and increasing digital fluency were other benefits of mobile phones usage in this study.

Table 4. Teachers and preservice teachers perceived benefits of mobile phones usage in the classroom

Benefits	Total (n = 106)		Teachers (n = 44)		Preservice teachers (n = 62)	
	M	SD	M	SD	M	SD
Increase access to technology in the classroom	4.06	0.888	4.02	1.011	4.08	0.789
Increase student engagement	3.62	1.077	3.75	1.189	3.53	0.979
Increase student motivation	3.65	1.116	3.68	1.239	3.63	1.020
Facilitate student creativity	3.76	0.977	3.80	1.099	3.74	0.879
Increase student/teacher productivity	3.82	0.888	3.89	0.982	3.77	0.812
Decrease digital divide for students with no computer at home	3.58	1.106	3.68	1.183	3.52	1.043
Increase collaboration	3.41	1.044	3.59	1.094	3.27	0.987
Increase communication	3.60	1.016	3.82	0.983	3.45	1.011
Increase digital fluency	3.98	0.869	3.86	1.036	4.06	0.716
Provide anywhere/anytime learning opportunities	4.19	0.790	4.18	0.911	4.19	0.692
Provide opportunities for differentiation in instruction	3.96	0.739	4.02	0.812	3.92	0.679
Provide opportunities to improve students self-regulated learning	3.84	0.982	3.86	1.057	3.82	0.925

3.4. Perceived barriers to mobile phones usage in the classroom

Participants were asked how strongly they agreed or disagreed about the barriers to using mobile phones in the classroom. The teachers and preservice teachers identified students' access the phone / application that is not in accordance with the teacher's instructions as the primary barrier. The teachers least concerned about students cyberbullying and students send pictures, videos, links or sexual texts, meanwhile preservice teachers more concerned about it (see Table 5).

Table 5. Teachers and preservice teachers perceived barriers to mobile phones usage in the classroom

Barriers	Total (n = 106)		Teachers (n = 44)		Preservice teachers (n = 62)	
	M	SD	M	SD	M	SD
Students access the phone / application that is not in accordance with the teacher's instructions	3.75	1.316	3.61	1.318	3.85	1.306
Students cheat	3.48	1.436	3.23	1.396	3.66	1.436
Students cyberbullying	3.17	1.463	2.80	1.358	3.44	1.477
Students send pictures, videos, links or sexual texts	3.18	1.459	2.75	1.432	3.48	1.400

Students access inappropriate content on the internet	3.28	1.478	2.89	1.434	3.56	1.444
Students do not have access to Wi-Fi connectivity	3.26	1.176	3.05	1.147	3.42	1.172
Students need to be given special directions so that it takes longer time	3.41	1.164	3.25	1.227	3.52	1.103

3.5. Perceive for the use of mobile phones in mathematics class

The participants were asked about their perception of utilizing mobile phone in mathematics class using open-ended questions. The answers of the participants were coded and categorized to summarize the data, as follows:

Question 1: Have you ever used mobile phone as a learning media in class? If ever, please provide an overview of how you apply the learning?

This question was given for teachers and preservice teachers that have ever taught at school (n = 76). The results revealed that 59% of them have never used mobile phone as a learning media in class, meanwhile 40% of them have ever used it, while remaining (1%) did not give answer. Teachers who have ever used mobile phone as learning tool reported that they use mobile phone in mathematics class for searching material, references, questions on the website, using learning application (Geogebra, Grapher free, MalMath), sending online teaching materials or assignments, and giving students online test or quiz.

Question 2: What do you think about the use of mobile phone as a media for learning mathematics in class?

This question was given for all participants (n = 106). The results revealed that 74% of participants agreed for the use of mobile phone as a media for learning mathematics in class. Typical answers included:

"I agree, mobile phone as a supporter of the learning process"
"If the teacher can make students focus on the instructions, learning to use a smartphone is very useful. Students can be invited to explore their knowledge. In addition, teachers are more efficient in giving assignments"
"very helpful if it is used according to portion and purpose"

Furthermore, there were 20% of participants disagree for the use of mobile phone as a media for learning mathematics in class, some of them prefer to use computer/laptop than mobile phone. Typical answers included:

"For now, I don't agree, because not all students have a mobile phone. On the other hand, students are easier to off task / not concentrate on learning than using school computers"
"It does not help much for math subjects"
"Not too essential in the process of learning mathematics in class"

Meanwhile 4 % of participants neutral about this, they state that using mobile phone in class could give positive and negative impact. Then, the remaining participants (2%) did not give the answer.

Question 3: If you support mobile phone use in learning mathematics, what things should the teacher pay attention to design the learning?

This question was given for all participants (n = 106). They reported that clear instruction, control of students, time allocation, student characteristics, internet availability, ease of using the application, student' collaboration, provide clear evaluation were the most things should the teacher pay attention to design mathematics learning that use mobile phone as media.

Question 4: In your opinion, what mathematical material makes it possible to apply by utilizing mobile phone as learning media?

Majority of the participants reported that geometry was the most possible material to apply by utilizing mobile phone as learning media because geometry requires visual appearances. Furthermore, they also state that all material was possible to apply as long as teacher could design it.

4. Conclusion

Majority of mathematics teachers and preservice teachers in this study almost had the same perception about mobile phones use in the classroom. They agreed that mobile phones can support mathematics learning. Although more participants supported the use of mobile phones in mathematics class, the implementation of this media was still very limited. The study reported that majority of schools do not allow students to take their mobile phones to school, perhaps the schools worried about student disruption or other factors. Meanwhile the implementation of technology is strongly influenced by school policy, this study can be used by stakeholders to develop of future school policies related to the use of mobile phones in the classroom.

The population of this study involved teachers and preservice teachers from only some universities and provinces in Indonesia which limits the generalizability of the study. Studies related to larger samples are recommended for future research.

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