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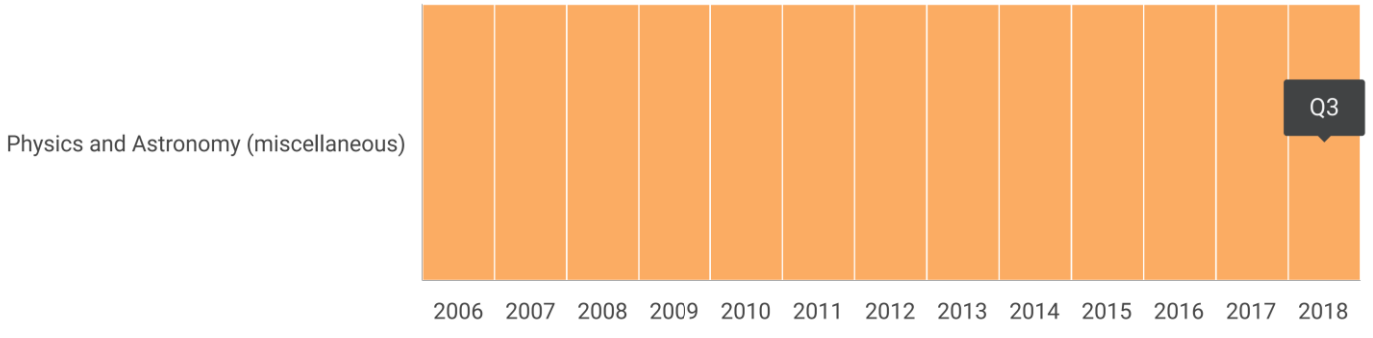

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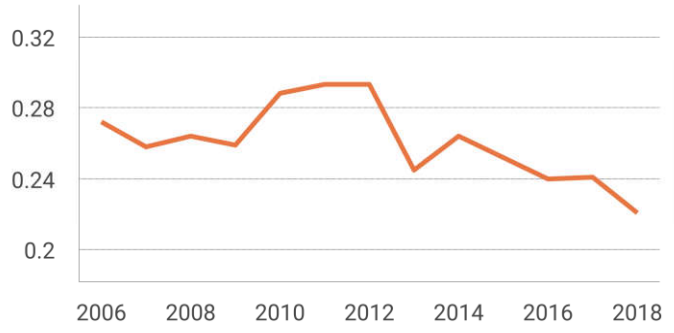

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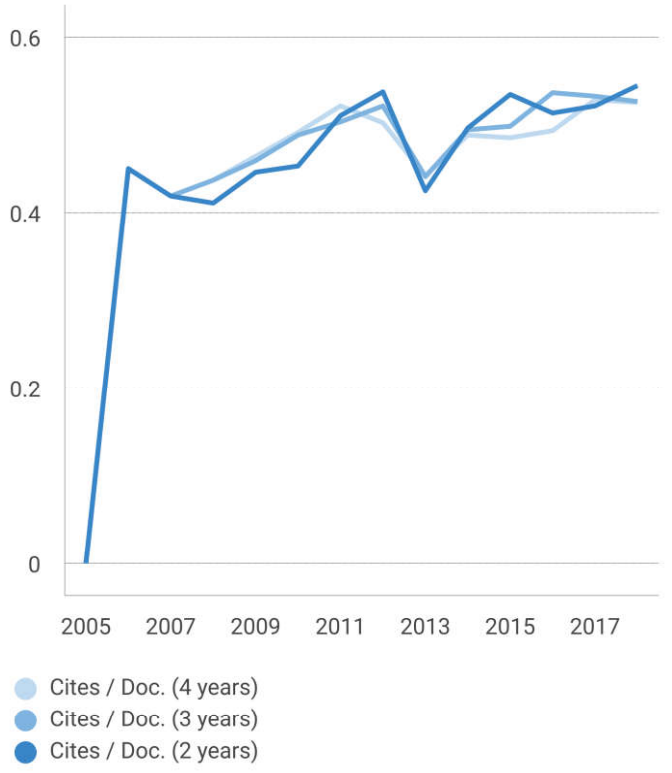

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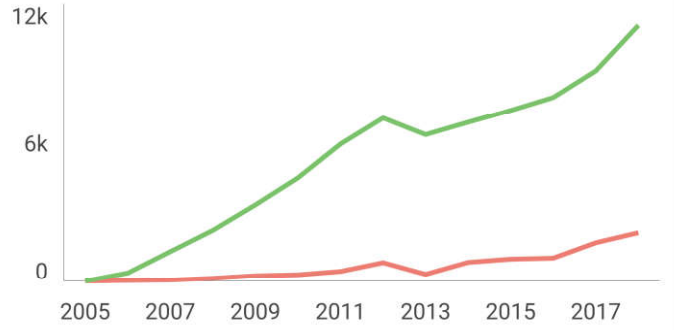

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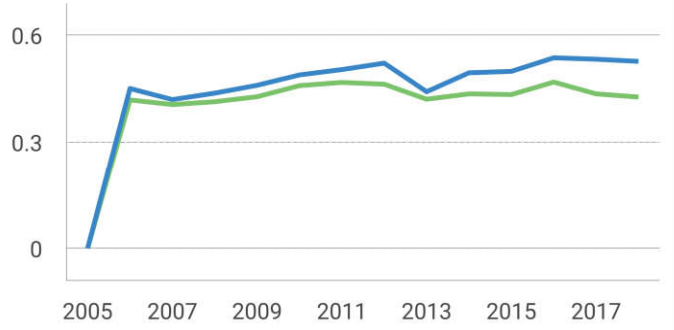

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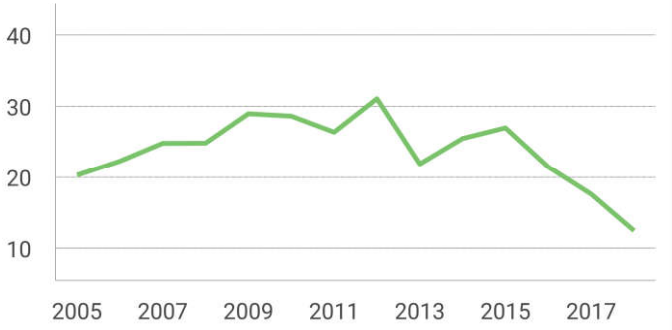

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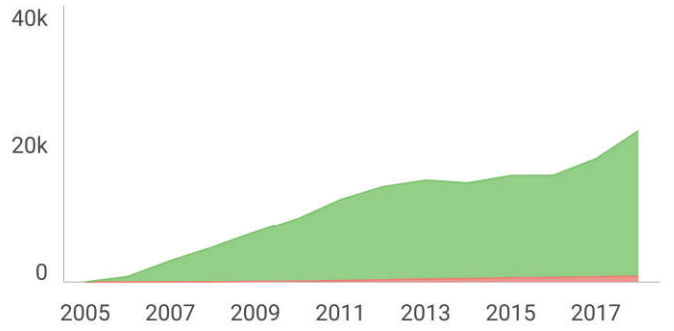

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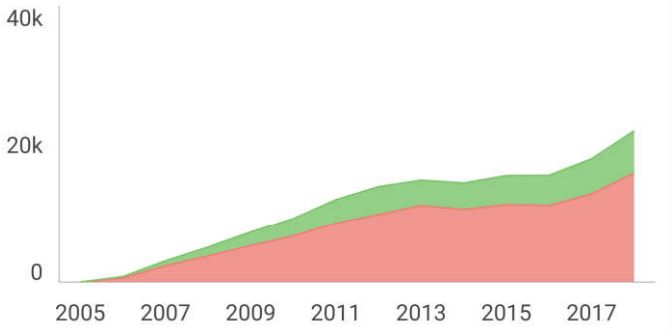

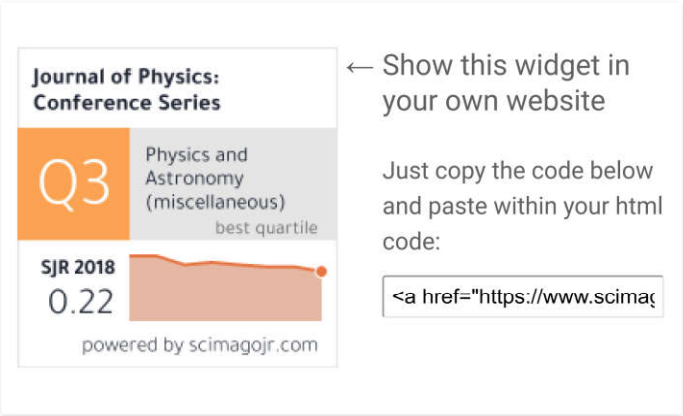

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PREFACE

The fifth International Conference on Research, Implementation, and Education of Mathematics and Science (ICRIEMS) is an annual conference organized by the Faculty of Mathematics and Natural Science, Yogyakarta State University, Yogyakarta, Indonesia and successfully held from 7 to 8 May, 2018. The theme of the 5th ICRIEMS is revitalizing research and education on mathematics and science for innovations and social development. The conference was a forum for researchers, educators, students, policy makers, and practitioners to achieve the innovation and social development through research and education on mathematics and science, as it is accentuated by the theme of this conference. The scope of this conference covers the area of mathematics, chemistry, physics, biology, mathematics education, chemistry education, physics education, and science education. This proceeding contains 157 that have been carefully peer reviewed and selected from 575 papers submitted to the conference.

We would like to express our gratitude to the reviewers of these manuscripts, who provided constructive criticism and stimulated comments and suggestions to the authors. We are extremely grateful as organizers, technical program committee and editors and extend our most sincere thanks to all the participants of the conference for their fruitful work and their excellent contribution to the development of this conference proceedings. Our sincere gratitude also goes to the IOP Publishing editors and managers for their helpful cooperation during the preparation of the proceedings.

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Students' Perceptions of Mathematics Mobile Blended Learning Using Smartphone

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Students' Perceptions of Mathematics Mobile Blended Learning Using Smartphone

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Abstract. This study was aimed to present students' perception of mathematics mobile blended learning using smartphone. A total of 32 junior high school students were involved in the study. The study was a mix method study whereby both quantitative and qualitative research instruments were administered to reveal student perceptions towards their learning experience. The result of this study indicated that the students have positive perspective toward mathematics mobile blended learning using smartphone. Students enjoy learning through the classroom tasks which is performed in the form of teamwork and discussion settings. They also feel challenged to learn independently through online discussions that are facilitated by web aide and smartphones. Students also believe that mobile assessment help them to learn effectively.

1. Introduction

Mathematics has an important role in various fields such as employment, science and technology, medicine, the economy, the environment, development, and in public decision-making [1]. Its important role causes mathematics learning should be able to facilitate students learning relevant mathematical concepts. In this era, teaching and learning process cannot be separated from the existence of technology. This condition requires teachers to improve their technological skills for better mathematics learning [2].

Educational institutions are facing the challenge of providing students with tools for mobile learning [3]. Mobile learning can be an alternative to teach mathematics. According to Tralbesi et.al [4], mobile devices can be used to develop novel educational activities, tools, and learning approaches that attempt to get benefit from the prevalence of mobile devices within the student community. This principle is in accordance with the mathematics learning process that emphasizes an activity to build the concept. The use of mobile learning concepts also can increase students' interest [5].Based on a survey, currently the most widely used website access tool is smartphone (50%) [6]. The existence of smartphone has a potential to stimulate new learning methods [7]. Smartphone has many advantages as well as features that can be utilized for learning mathematics. However, its use needs to be integrated in an instruction learning for the best results.

The recommended learning model to assist students in learning mathematics by utilizing mobile technology is a blended learning. It consists of an online learning environment as well as face to face learning within the physical classroom [8]. Therefore, blended learning can increase the

effectiveness of a learning activities [9].Although studies about blended learning design have been reported, for example by [8], [10], [11], literature review indicates that very few studies have been carried out on the design of mathematics instruction based on mobile blended learning principle. In addition, what kind of blended learning that can be effective is still unclear [12]. Therefore, we developed a mobile blended learning that conceptualizes a framework for supporting students' mathematics learning outcome.

This development creates challenges for the evaluation of the mobile blended learning quality process. The challenge in testing the quality of learning utilizing information and communication technologies (ICT) is identifying an appropriate way of evaluating the extent of its contribution to students' learning experiences [13]. One way that can be done to know this contribution is by knowing students' perception [14]. In learning environments research, students' perceptions of the learning environment are considered to have a pervasive influence [15]. Students' perception proved able to influence their learning experience and learning outcome [16], so it becomes one of the determinants of the quality of learning [14]. The main purpose of this study is to unravel students' perception of mathematics mobile blended learning using smartphone.

2. Mobile Blended Learning

Blended learning leads teachers to use technology in the learning process. This technology is usually in a form of a website that contains learning materials, live instruction, or learning supplements for students. In blended learning, technology is combined with socialization opportunities and effectiveness of the classroom. In other words, blended learning is a blend of face to face learning in the classroom with online learning [17]. This learning is believed to be appropriate for teaching mathematics. The use of e-learning as an important component in blended learning will help students to understand mathematics. Previous research shows that blended learning can improve students' learning outcome and learning experience [18].

Blended learning that utilizes mobile devices to access the learning website is called as mobile blended learning. This lesson can be applied by adapting to Kashefi, et. al model [10] with some modifications. This modification is done by replacing the computer component to smartphone and replacing the problem solving component to inquiry. Therefore, there are four principles i.e. classroom task, smartphone and web aide, strategies, and mobile assessment. In classroom task principle, mathematical materials are arranged on the website and integrated with students' worksheets so they can learn in the classroom using smartphone. In smartphone and web aide principle, students can access images, animations, discussions forum, materials, assignments, and practice questions through their own smartphones. Principles of strategies are grouped into three components i.e. (1) *Communication*. The communication process used in the learning is done by synchronous communication through chat and asynchronous communication through the discussion board. (2) *Teamwork*. Classroom learning is conditioned in groups of three to four students to help them solve the problems. (3) *Inquiry Method.* Inquiry learning method is used as guidance in preparing the teaching material. In mobile assessmentprinciple, the assessment is done by the principles of formative assessment using online quiz.

3. Student Perceptions of the Learning Environment

Students' perception is an important factor to evaluate the quality of a learning [19]. Consequently, the development of a learning model must consider students' perception. According to Ramsden[14], students' perception can be measured using a Course Experience Questionnaire (CEQ) that focuses on performance indicators such as good teaching, clear goal and standards, appropriate workload, appropriate assessment, and emphasis on independence. In blended learning environment context, Ginns and Ellis [13] measure student perception using questionnaire based on good teaching, good resources, student interaction, and appropriate workload.

In this study students' perception focused on their perception of the main principles of mobile blended learning that is classroom task, smartphone and web aide, strategies, and assessment. Students' perception aspect used is based on the opinions of Ginns and Ellis [13] and Ramsden[14] i.e. good resources, student interaction, clear goal and standards, and appropriate assessment. The four aspects are defined as follows: 1) Good resources refer to the quality of the material that is able to meet the students' learning needs, 2) Student interaction refers to the quality of student communication in face to face learning and online learning, 3) Clear goal and standards refer to a clear idea of where students were going and what's expected of students in this course, 4) Appropriate assessment refers to the test staff here seem more interested in testing what students have understood than what they have memorized.

Aspects of good resources will reveal students' perceptions of the smartphone and web aide principle. Aspects of student interaction are expected to reveal students' perceptions about communication and teamwork components on strategies principle. Clear goal and standards will reveal students' perceptions of clarity of classroom tasks, inquiry learning, and online learning. Appropriate assessment is expected to reveal the mobile assessment principle that has been developed in mobile blended learning. As the result, these four aspects will reveal students' perceptions about the mobile blended learning principles.

4. Method

This study was driven by a mixed method approach whereby both quantitative and qualitative research instruments were administered to measure student perceptions towards their learning experience in the mobile blended learning environment. Subjects comprised of 32 seventh graders junior high school (12-14 years old) using credit semesters.

Prior to the implementation teachers were also invited to discuss the learning through Focus Group Discussion (FGD) to ensure learning goes as expected. The face to face learning takes 4x80 minutes and online learning is further divided into 4x40 minutes of self-learning and structured tasks for 4x40 minutes. Classroom learning is done by face-to-face through classroom tasks, inquiry learning, and group activities using smartphone. Self-learning is done online by utilizing communication facilities on mobile Moodle discussion forums between students and students, and between teachers and students. Then, the online structured task is done by providing interactive quiz (mobile assessment) through e-learning Moodle mobile using smartphone.

Data were collected using 5-point Likert scale with 14 surveys items and semi-structured interview. Interviews were conducted for 16 randomly assigned students. The results were triangulated to get an in-depth insight into the students' perceptions of the mobile blended learning. The survey items were statistically analyzed and the results are presented in Table 1. A reliability analysis was done and the survey yielded a Cronbach Alpha of .782 which could be considered reliable according to Lim et.al. [20] as the value is above 0.6. For interview data analysis, Miles and Huberman [21] qualitative analysis method was adopted as the main framework. Three stages of this method that were used to analyze the responses were data reduction, data display, and conclusion drawing.

5. Result and Discussion

Before the design of mathematics instruction through mobile blended learning was applied, we discussed it with teachers through a Focus Group Discussion (FGD). In general, teachers agree on the learning process that will be done. The suggestion given by the teacher is to conduct an assessment on each students' worksheet as one form of student control in the classroom. This step is done so that the students focus more on learning using smartphones. In addition, this process is also done as evidence to provide information to teachers and students about the learning process [22]

After the learning is completed, students are given a questionnaire to determine their perception of mobile blended learning. The results of the survey are presented in Table 1. These data are presented in the mean and standard deviation. As seen in Table 1, according to Widoyoko[23] the survey yielded positive responses from the students with all the survey items having means above 3.4.

Table 1. Students' perceptions of mobile blended learning.

		Survey items	(M)	(SD)
1	Good resources	The teaching materials in this unit of study are good at explaining things (based on inquiry method).	4.03	.695
2		The online mobile tasks are designed to get the best out of students.	4.18	.693
3		Lesson material can be accessed using a smartphone so it is easy to learn from various places.	4.31	.535
4		Learning that begins with contextual problems helps me learn to solve non-routine problems.	4.13	.554
5		The materials (animations, pictures, questions) helped me to learn during the face-to-face session.	4.13	.554
6	Student interaction	Online discussion helped me understand the material more deeply.	4.16	.723
7		I interacted with other students using chat room/discussion board even if they weren't assessed.	4.28	.634
8		Classroom discussion help me understand the material.	4.25	.622
9		Teamwork setting in face to face learning help me learn more deeply.	4.03	.822
10	Clear goal and standards	The guidelines for using Moodle mobile were clear to me.	4.00	.762
11		Information needed for assignments was integrated into Moodle mobile.	4.25	.440
12		Information needed to understand the purpose and contents of the unit was clear.	4.53	.567
13	appropriate assessment	Online quizzes helped me to learn effectively.	4.13	.707
14		To do well in the online quizzes and written assessment all you need is a good understanding.	4.56	.564

The results of surveys and interviews on students' perceptions of mobile blended learning are described as follows.

5.1 Students' Perception of Classroom task

The survey results show that students feel the information needed to understand the purpose and contents of the unit was clear (item 12, M=4.53, SD= .567). It means they know the goal of learning well so the learning becomes more meaningful. These results are supported by the response obtained from the interviews are as follows.

"The instructions in the students' worksheet are complete so we know what to do without waiting for instructions from the teacher."; "I know the purpose of my learning, so I learn more seriously."

The next result shows that the teaching materials which is arranged based on the step of inquiry learning in this unit of study are good at explaining things (item 1, M=4.03, SD= .695). Inquiry learning facilitates students to practice solving contextual problems through more formal steps. The use of smartphone to access the material on mobile Moodle helps students to learn the quadrilateral concept in more depth. Most students stated that at first, they felt uncomfortable with mobile-based inquiry learning. However, in subsequent learning, they stated that inquiry learning is appropriate to help them solving non-routine problems. This conclusion can be seen in the feedback from the students obtained through the interview process.

"Learning with the inquiry steps is troublesome at first because I am not familiar whit that, but over time I feel this learning is more appropriate to learn solving problems that are rarely encountered."

In addition, according to students, learning that begins with contextual problems helps them to learn to solve non-routine problems (item 4, M=4.13, SD= .554). Students reveal that learning with contextual problems makes them more confident in solving other real problems.

"The contextual issues given at the beginning of the lesson made me feel able to solve other real problems I encountered."

This result is in line with the study by Lin and Li [24] on the use of contextual problems as part of good mathematics instruction.

Students also feel that classroom discussion help them understand the material (item 8, M=4.25, SD=.622). Through discussions, students have the opportunity to discuss the findings obtained through observations on animation. They enjoy learning mathematics in the teamwork setting. They think that teamwork setting in face to face learning help them learn more deeply (item 9, M=4.03, SD= .822). These results are supported by the response obtained from the interviews are as follows.

"I prefer to study in groups and discussions because I can exchange ideas on solving problems."

"Teamwork learning helps me learn faster. I can ask my friends directly about my problems."

This result is in accordance with the study by Koichu et.al [25] which suggests that discussions can help students better understand mathematical material.

5.2 Students' Perception of Online Learning

Students think that the online mobile tasks are designed to get the best out of students (item 2, M=4.18, SD=.693). Students believe that they are given the opportunity to show their abilities through assigned tasks. Students state that online learning has many benefits because they are not limited by time and place. This result can be seen in the expression of students through the interview as follows.

"Online learning helps me learn more than I used to learn in the classroom because I can study anywhere"; "The tasks given in online learning are quite a lot but also stimulate me to learn more."

Students utilize online discussion facilities to ask for material or questions they have not understood.

According to them, online discussion helped them understand the material more deeply (item 6,

M=4.16, SD=.723). Online discussions are guided by the teacher, so students can learn without

waiting for the classroom learning. They interact with other students using chat room/discussion board

even if they weren't assessed (item 7, M=4.28, SD=.634). It means that students like the learning

through online discussions. This result is also seen from the interviews.

"I love to do online discussions because I can ask questions about materials that I have not understood directly without having to wait for mathematics learning in the class"

Students who feel embarrassed to ask on a discussion board can directly ask the teacher or other friends through the chat session. According to some students, chat session can stimulate them to ask more deeply. The results can be seen from the interview.

"I prefer to ask through the chat facility because sometimes I am embarrassed to directly ask on the discussion board that can be read by other friends.";

"Chat sessions are helpful because they stimulate me to ask questions."

Providing opportunities for direct discussions between students and teachers or students with students synchronically through chat and online discussion of asynchronous facilities through discussion boards is proved to make students feel more comfortable learning online. This result is in line with previous research on online learning which shows that students not only want to learn in asynchronous environment but also in synchronous environment [16].

5.3 Students' Perception of Smartphone and web aide

According to students, the guidelines for using Moodle mobile were clear (item 10, M=4.00, SD= .762). As a result, students understand what to do on self-directed online learning. They claim that the clarity of guidance for online learning allows them to learn instantly without any confusion.

"The directions on Moodle mobile are pretty clear so I know what I need to do on online learning."

Students state that the subject matter can be accessed using a smartphone so it is practical to learn from various places (item 3, M=4.31, SD= .535). The simplicity of accessing material through smartphones enables students to learn without being constrained by time and space. They also do not have to bother bringing books everywhere to study mathematics. These results are seen in the student answers as follow.

"I carry my smartphone everywhere so I can learn mathematics from various places."

"Because the math material can be accessed through my smartphone so I can learn without having to open the book."

This result is in accordance with the study by Rius et.al. [3] that the advantage of learning to use mobile devices such as smartphones is because students can learn anywhere and anytime.

According to the students, the materials in Moodle mobile helped them to learn during the face-to-face session (item 5, M=4.13, SD=.554). Many students believed that using interactive animation,

picture, and diagram can make it easier to understand the properties of the quadrilateral. They get a chance to directly view the responsive picture and play the animation to understand the quadrilateral properties. The activities make the students get more experience in learning. These results are can be seen in the student answers as follow.

"the existing quadrilateral animation, diagrams, and pictures helped me to identify in more detail the properties of quadrilateral"

This conclusion is in line with the previous study which shows that blended learning can improve the learning experience and learning outcome students [18].

The learning of mobile blended learning has made students more enthusiastic to learn the quadrilateral material. Students become more active in learning and do not just depend on the teacher. Students feel happy with the design of learning using smartphone. They think that learning is done as well as playing. This statement can be seen in the following result.

"I am excited to learn using smartphone because it feels like playing while learning"

This result is in accordance with a previous study by Andreicheva and Latypov[5] that the use of the concept of mobile in learning process can increase students' interest to the learning.

5.4 Students' Perception of Mobile Assessment

At the beginning of the assessment, there are instructions to help students complete the quiz. According to students, the information needed for assignments was well integrated into Moodle mobile (item 11, M=4.25, SD= .440). They know what to do to complete the task. Most of them stated that the mobile assessment feature is practical because they can try to solving problems anytime and anywhere. This result is supported by the students' answer in the interview as follows.

"I think the guidance of the assessment work is clear enough so I am not confused to get it done."

"Something that I think is practical is that I can test my mathematics skills through assessment on my smartphone whenever I want."

According to students, to do well on the online quizzes all they need is a good understanding (item 14, M=4.56, SD= .564). As a result, to be able to complete the quiz well, they must learn in more depth. They feel that this technique improves their mathematics skills. Students also state that online quizzes helped them to learn effectively (item 13, M=4.13, SD= .707).

"I need to learn more in order to finish the quiz well and I think it is effective to me"
"many questions are testing mathematics concepts so I need to learn more to get the best results."

The existence of a review at each end of the work helps students to know which material has not been mastered yet. This conclusion is indicated by the result of student interview as follows.

"the review on my result (structured task) help me to learn more deeply about the material."

These results are in accordance with the principles conveyed by Simuth and Schuller [26] that teachers need more emphasis on feedback.

6. Conclusion

Students enjoy the classroom task that begins with contextual problems and is done through classroom discussion in teamwork settings. In online learning, students feel challenged to complete the assigned task and do online synchronous and asynchronous communication to learn mathematics.

Students are helped by the material in the form of explanations, animations, pictures, and diagrams presented in the web aide and can be accessed from anywhere and anytime via smartphone. According to students, the mobile assessment feature is effective to help them learn mathematics. In general, students have positive perspective toward mobile blended learning so it can be said that mobile blended learning is quite qualified. Unfortunately, this study is only to evaluate the mobile blended learning quality process from students' perspective. In the next study, it is expected that the evaluation process is focused on other aspects that determine the quality of mobile blended learning.

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