Development of blended learning media using the mentimeter application to improve mathematics creative thinking skills

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Abstract. In general, this study aims to improve the learning quality in the mathematics education department of State University of Medan to welcoming the industrial revolution 4.0. Specifically, the aim is to develop blended learning media using the Mentimeter application to improve students' creative thinking skills. This type of research is research and development. This development research refers to the Thiagarajan theory which consists of four stages: define, design, develop and disseminate. The instrument of this research is the learning media validation sheet, student response questionnaire, practicality questionnaire and the test of mathematical creative thinking skills. Blended learning media by using this Mentimeter application was declared valid by six experts, is a practical media, getting a positive response from students, but not capable of improving student mathematics creative thinking skill on mathematics department.

1. Introduction
The application of the IQF curriculum (Indonesian National Qualifications Framework) motivates lecturers to innovate both in learning models and learning media. This innovation aims to realize the outcome learning of students according to IQF curriculum. Competencies that must be possessed by a scholar in the IQF curriculum, Described at level 6, that is: 1) able to apply the skills and utilize knowledge and technology in solving problems, 2) Mastering the theoretical concepts of an understanding in general and specifically, 3) Able to analyze data and information wisely so as to make the right decisions and be able to take alternative solutions individually or in groups, 4) responsible for yourself and others.

Similarly at the State University of Medan, in particular, the mathematics education study program has implemented the IQF curriculum since the 2016/2017 school year. So that from its year, there have been a lot of changes, such as a review of the achievements of graduates to learning outcomes. The learning model was changed to a six task-based learning model, commonly referred to as the term IQF tasks, Critical book report, Critical review journal, idea engineering, mine research, and a final project. Indirectly The task given is a step to familiarize students to read, utilize technology, think creatively and be able to solve problems. The implementation of this model is expected to be able to produce competent graduates according to their qualifications.

One of the competencies that must be had by the undergraduate student can forgive technology in solving problems. Technology is all the tools that can help humans in solving problems including in education; technology can be used to affect the learning process. To realize this competency, must be some efforts must be done in the learning process. One of them is to get used to using technology as a learning medium. This habit begins by the lecturer as a facilitator of the learning process.

But the reality in the field, researchers found that there are still few lecturers who are accustomed to learning to use technology, as shown in Table 1, is an interview with students, 85% of students, state
that campus facilities are adequate for learning using technology media, but only 34% of lecturers use media technology-based learning.

| NO | Indicator                                      | Percentage | Criteria       |
|----|-----------------------------------------------|------------|----------------|
| 1  | Availability of facilities for learning media based on technology | 85 %       | Adequate       |
| 2  | Learning media based on technology             | 34 %       | Inadequate     |

Media word comes from the Latin language "medium" means an introduction or intermediary. While according to KBBI the media interpreted as intermediaries, liaison, communication tools such as newspapers, magazines, radio, television, films, posters and banners located between 2 parties. Learning Media is a technology that can deliver messages related to learning [1], also a physical means to deliver learning content/materials such as books, films, videos, slides and so on [1]. The function of this learning media can streamline the learning process so that the expected learning objectives are achieved optimally [2][3]. Learning media is not only limited to use in the classroom, the media as a tool in the learning process both inside and outside the classroom, so it can be said that learning media is a component of learning resources or physical means that contains instructional material that can stimulate students to study [4]. Learning media in this study are technologies that are utilized to deliver lecture material, to produce a conducive, efficient and effective learning environment.

Learning process should be carried out anywhere, though between lecturers and students not at one time or in one room. Namely blended learning, learning that combines learning in the classroom with learning outside the classroom online by utilizing various communication technologies. Blended learning consists of two words, blended (combination/mix) and learning. Another term that has the same meaning is the hybrid course, which consists of two words, hybrid means that the mixture or combination and course means courses. Blended learning is a learning process that combines or mixes face-to-face learning with computer-based learning [5]. Computer-‘based learning means that learning is online or e-learning [6]. Then that mixed learning has two main elements, first is learning in class and second is online learning. In the online learning use the internet network which there is web-based learning. Blended Learning is a combination of multimedia technology, CD-ROM, video streaming, virtual classes, e-mail, voicemail, and others with traditional classroom learning. Its cold is merging or mixing two learning approaches that are used so that learning is created and will not cause students bored [7]. On learning in higher education, blended learning usually consists of class meetings face to face once per week, with students use online learning to complete group projects and class assignments others [8]. Theoretically and some research results illustrate that blended learning can improve students’ academic abilities compared to learning that only uses conventional (face-to-face) classes. [9].

The use of technology as a learning medium aims to make learning effectively, one of the indicators of learning effectiveness is the increase in students’ thinking abilities, the expected ability is higher order thinking skills such as mathematics creative thinking skills. Mathematical creative thinking ability is one of the higher-order thinking skills that must be developed to students [10]. The Mathematical creative thinking ability can be seen from the following 4 aspects: (a) fluency of thinking, if they can provide more than one relevant idea and the solution is correct and clear, (b) Students are able to think flexibly if, they can provide answers in more than one way (variety), the process of calculation and results are correct, (c) Students have the ability to think original (Originality) If they can provide answers in their way, the calculation process and results are correct, and (d) Students have the ability to think in detail (Elaboration) If they can provide correct and detailed answers [11]. Based on that aspect of mathematical creative thinking ability, the level of mathematical creative thinking ability is divided into four level, is very creative, creative, quite creative and not creative [12]. Indicators of creative mathematical thinking in this study are fluency, flexibility, and novelty.
However, from early research data, the result creative thinking ability tests of twenty students at 3rd semester obtained that only two students entered the very creative thinking category, three creative students, the rest entered the non-creative category.

| No | Creative level     | Number | Percentage |
|----|--------------------|--------|------------|
| 1  | Very Creative      | 2      | 9 %        |
| 2  | Creative           | 3      | 13 %       |
| 3  | quite Creative     | 5      | 22 %       |
| 4  | Not Creative       | 13     | 56 %       |

The Mentimeter one of learning medium with a web-based application that can be downloaded easily, on mobile phones and laptops. The Mentimeter application can be used as a learning media because it is a percentage application that is interactive, students can immediately respond to the material from the lecturer by sending the response from their mobile phones that have been installed by the Mentimeter application. As a presenter to explain the learning material, its Mentimeter is different from the Mentimeter to give a response or feedback. As an Audience, the Mentimeter application can download in the Play store. If the audience wants connecting with the presenter, the audience must enter the presenter Mentimeter code available at the top of the presenter slide. Learning with this application can be done through student and lecturer, not in one classroom.

Based on the explanation above, it can be concluded that it needs an effort to produce students according to their qualifications, one of which familiarizes them using technology to support their ability improvement. For this reason, researchers want to develop blended learning media by using Mentimeter applications to improve students' creative thinking in mathematics.

2. Methodology
This research was development research which was a type of research to develop a new product or to perfected existed products [13]. This development research was Four-D Model, proposed by Thiagarajan. The research was conducted at the Department of mathematics, State University of Medan. The instruments of this research were the learning media validation sheet, student response questionnaire, practicality questionnaire and the test of mathematical creative thinking skills. To got the average value of the expert validator used the formula:

\[
\text{Average} = \frac{\text{Total Score}}{\text{Number of Aspects}}
\]

The formula to see the readability, student response and practicality of the product as follows:

\[
\text{Percentage} = \frac{A}{B} \times 100\% 
\]

A: The proportion of students who choose
B: Number of students (respondents)

Data analysis to know how an increase in students' mathematical creative thinking can be obtained from the normalized gain index data as follows:

\[
\text{Index Gain} = \frac{\text{Postes} - \text{Pretes}}{\text{Ideal Score} - \text{Pretes}}
\]

3. Results and Discussion
3.1 Define Stage
The definition stage begins with curriculum analysis, first semester students, the 2018/2019 school year at the State University of Medan, Faculty of mathematics and natural science use IQF curriculum. One of the competencies that must be realized in the IQF curriculum is students can utilize technology to solve problems. The learning model used based on 6 IQF tasks is a Critical book report, Critical review journal, idea engineering, small research, and project. The learning implementation plan turns into a semester learning plan, so learning activities have been arranged for one semester based on this 6 task.

Then, analyze the characteristics of students, students who are the object of this study are first semester students who take the set and logic material. Cognitively, the age of students at the formal operational level, it means that they can think abstractly [14], so that students are ready with abstract material of lectures such set or logic, besides the age of students is included in the millennial generation, the generation that was born when technology was so sophisticated, so that this generation was considered as literate technology generation [15-16]. Next, the researcher identifies material about the set and logic, collects and selects relevant material and composes systematically. The results of the syllabus analysis and material analysis, then formulated outcome learning and learning indicators by the competency standards of set and logic courses. From curriculum analysis and characteristic analysis of students, researchers chose the product that was developed is a blended learning media using Mentimeter application.

3.2 Design Stage
At this stage, researchers create a Mentimeter account to sign in to the Mentimeter application. Then design lecture contracts, learning materials, and assignments in the Mentimeter application which will be seen by students. Then the researcher also installed to handphone the Mentimeter application using the play store, to see if the Mentimeter on the laptop was connected to the cell phone by entering the Mentimeter code at the laptop. Material designed in the form of percentage slides and pictures. At this stage too, make tests, observation sheets, and questionnaires. Mathematical creative thinking skills test consists of 6 items, which will be tested before and after learning. In addition to the test, a questionnaire was also used to measure the criteria of media practicality and student response. Then made the first draft that is validated by an expert.

After designing instructional materials on the Mentimeter application media (draft 1), then this media is given to six validators, consists of two people from development experts, two people from material experts and the rest, are media experts. According to Table 3 the average value given by six validators is 4.57 with valid criteria. Some of the suggestions given by the validator, such the lack of color variations on the slide in the Mentimeter and the layout of the material on the slide. Furthermore, fix it according to suggestions and criticisms from the validator. This valid and revised learning media is the second draft (draft II) that will be tested on a small group.

| Validator      | Value | Criteria |
|----------------|-------|----------|
| Validator I    | 4.76  | Valid    |
| Validator II   | 4.90  | Valid    |
| Validator III  | 4.85  | Valid    |
| Validator IV   | 4.09  | Valid    |
| Validator V    | 4.4   | Valid    |
| Validator VI   | 4.33  | Valid    |
| Average        | 4.57  | Valid    |

3.3 Development
Small group analysis was conducted to see the readability of the media; this test gives ten students. According to Table 4 below, it shows that media readability is good which readability value is 80.6. The
readability of a media is important because it affects the mastery of the material to be delivered. Good mastery of the material by students who use learning media is due to media that is easily understood by students so that messages or information carried by the media can be easily accepted by students [17]. The results of this readability revision are draft III which will be tested on a large scale.

| Table 4. Media Readability |
|---------------------------|
| Score | Percentage | Criteria |
|平均 | 40.3 | 80.6 | Good |

The large-scale test is carried out for first semester students who take set and logic courses. Based on Table 5, learning media using the Mentimeter application is a practical medium with an average value of practicality of students and lecturers is 83.5%.

| Table 5. Practicality of Media |
|-------------------------------|
| Subjek | Percentage | Criteria |
|Lecturers | 84 % | Practical |
|Students | 83 % | Practical |
|Average | 83,5% | Practical |

Then, to see the effectiveness of this learning media with the value of the increase in students' creative thinking abilities and student responses. According to Table 7, the average student pretest score is 50.65 while the average posttest score is 61.2. The value of the increase in students 'creative thinking ability is 0.2 with a low category, or it can be said that an insignificant increase. There is not an increase in students' mathematical creative thinking ability. Both pretest and posttest, the value of creative thinking skills of students is still in the low category or not creative. However, when viewed from the response of students about learning media using the Mentimeter application, based on Table 6, students gave a positive response to 83.9, it is very inversely proportional to the value of increasing of students' low mathematical creative thinking skills. To analyze this, researchers conducted interviews with students, when learning outside the class, most of the students find it difficult to understand the material of learning, it should be when at in the classroom, the question about the material it, but they do no to ask questions, finally allowing themselves to be no understanding.

| Table 6. Student Response |
|---------------------------|
| Average | Positive | Percentage | Negative | Percentage |
| | 19.3 | 83.91 | 3.7 | 16.1 |

| Table 7. Improvement Of Math Creative Skills |
|---------------------------------------------|
| Average | Pre-test | Post-test | Gain |
| | 50.65 | 61.2 | 0.20 |

4. Conclusion
The product of this development research is a blended learning media, learning media using a Mentimeter application. In the design stage produced draft one which was declared valid by the expert,
then revised according to the expert produced draft 2, draft two was tested to produce a good value of bias, then revised to produce draft 3. Then the media tested by large groups produced good practicality and positive response from students, but this media is not effective to improve the ability of creative mathematical thinking.

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