Assessing Validity of Problem-Based Comics for Learning of Social Arithmetic

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Abstract. The use of comics in teaching and learning process is highly important. However, the existing comics do not present problems in students’ daily life. The purpose of this study is to develop valid problem-based comic media on social arithmetic topic. The current research used the development of the Plomp model which consists of preliminary research, prototyping and assessment phase. Nevertheless this paper reports the prototyping and assessment phase only, in which the product was validated by five experts. The instrument utilized in this study was the comic media validation sheet. The results of the validation analysis reached the score of 4.5. This score indicated that the validity of the media was in the highly valid criteria, this the comic media can be tested for small groups of student in a pilot study. Students responded positively to the comic learning media on social arithmetic lesson. With the score of 1333 which is in the ‘strongly agree’ interval.

1. Introduction

Mathematics learning is a learning process that develops the ability to think logically, practically, creatively and dynamically to solve problems related to everyday life [1]. Problems that are usually presented in mathematics learning are not problems that can be solved by one single method, but rather in various ways so that the right solution is obtained. However, some mathematics problems are intricate. Teachers as instructors can assist students to solve such problems, one of the ways, by providing media that help to reduce students’ learning difficulties [2].

The learning media can also create a pleasant learning atmosphere. A joyful and active learning atmosphere can be started with a lot of reading activities; as such, the students’ ability to understand the lesson will get better. One way to foster students’ interest in reading is by presenting interesting textbooks, for example, a book that contains many images like comics. Meanwhile, the problems are that most textbooks currently available are dominated by verbal. There are also some books that combine images and texts, but do not significantly increase students' reading interest; this, students are not encouraged to independently solve problems related to daily-life situations [3,4].

Lack of reading interest results in the decrease of students’ engagements and learning outcomes. The complexity of the teaching materials delivered to students adds to their lack of interest in reading textbooks, specifically math text books. Students tend to be more interested in reading illustrated storybooks (e.g., comics) compared to regular textbooks because comics have a coherent and orderly storyline that makes them easily remember the information provided there [5,6]. This argument is
supported by a study that found that comic media can improve the effectiveness of teaching and learning process, create more interesting learning, sharpen the students’ ways of thinking, establish an active learning and help teachers become more effective and ease them in the learning process[7].

To be easily understand able, comic media definitely need innovations in their development besides to make the learning process pleasant and more meaningful. One of the innovations used in the comic media development is implementing a problem-based learning model. The problem-based learning begins with giving students problems related to everyday life, then the students find alternative solutions to the given problems [8].

Based on the description above, it is necessary to develop the media in order to easily understand the lesson taught that later on will be used to solve problems related to everyday life. The media that the researchers will develop in this study is problem-based comic media on social arithmetic topic. Social arithmetic is one of the topics learned in the 1st grade of junior high school in which this topic is closely related to students’ daily life because they have frequently experienced it. However, several students still have not mastered social arithmetic, especially when it is presented in the form of a story problem, they will find difficulties to solve it. Where as, this topic is highly important since it is a supporting material for algebra. Students will experience difficulties in solving algebraic problems if social arithmetic is still not well-understood [9,10].

The problem-based comic learning media can be used to create an active learning. This is also supported by the results of several studies. According to Buchori and Setyawati [11], character education learning models using comic media can stimulate students’ motivation to learn and improve their character education from an early age to get a successful education in the future. Toh’s study [12] showed that students’ motivation to learn through the use of comics and cartoons in mathematics learning on algebra topic was better and students directly get involved in the learning process. However, the comic media developed has not invited students to independently solve their daily life problems while in the curriculum 2013 students are required to do so. This present study is different from previous research, in which study aims to develop the problem-based comic media that can help students independently solve problems in their daily life.

2. Research Question
Formulation of problems is useful for overcoming confusion in conducting research. Based on the background previously explained, research questions formulated in this study are: 1) Are the problem-based comic media for social arithmetic topic valid? and 2) What is the students’ response to the comic being developed?

3. Method
This research used the Plomp development model which includes preliminary research, prototyping and assessment phase [13]. This paper reports the prototyping and assessment phase, where the development is in accordance with the goal that intends to be achieved in this research. That is to find out the validity and students’ responses to ward the problem-based comic media on social arithmetic.

This research involved Islamic Junior High School 1 Bireuen (MTsN 1 Bireuen) Based on the observation, the school did not have a problem-based comic learning media yet. For that reason, the school became a subject of this study. To get information from two points of view, two mathematics teachers were selected from the school as validators. The participants in this study involved one class consisting of 30 students.

The instruments used in this study were expert validation sheets adapted from Khabibah, questionnaire sheets adapted from Toh [12] and interview guidelines. Data collected from the expert validation sheets are validity data that include content, format, language and display. While the data obtained from the questionnaire sheets and interview guidelines are students’ responses to problem-based comic learning media. All collected data were then analyzed descriptively and quantitatively. Data about students’ responses were analyzed using a Likert scale and the answers were scored based on the criteria in Table 1.
Table 1. Score for questionnaire responses

| Criteria                  | Value |
|---------------------------|-------|
| Strongly Disagree         | 1     |
| Disagree                  | 2     |
| Doubt                     | 3     |
| Agree                     | 4     |
| Strongly Agree            | 5     |

4. Results and Discussion

4.1. Results

4.1.1. Validity Data. This section will describe, the results of the media development. First, in the preliminary research, we analyzed mathematics curriculum and ensured all objectives and indicators were included in the comic media. Then, we analyzed the characteristics of students in order to adjust the product that would be developed. Afterwards, investigating the situation and conditions of the school was carried out to find out the supports and obstacles faced in the school environment. Finally, in this phase, we an analysis on the users to find out the needs of media on social arithmetic topic. Second, in the prototyping phase, designed plots or dialogs for the comic, sketched the visual images for the plots to produce prototype 1. The prototype 1 was then validated by five experts. The results of the validation analysis are presented Table 2.

Table 2. Results of comic-media validation

| Aspects            | Criteria                                                                 | Validators  | Average of each criteria | Average of each aspect |
|--------------------|---------------------------------------------------------------------------|-------------|--------------------------|------------------------|
| Content            | 1. Accuracy of content                                                   | 4 5 5 5 5  | 4.4                      | 4.5                    |
|                    | 2. Conformity with basic competencies and indicators                      | 5 5 4 5 5  | 4.8                      |                        |
|                    | 3. Grouped into logical parts                                            | 5 5 5 5 5  | 5                        |                        |
|                    | 4. Materials presented were problembased                                 | 4 4 5 5 5  | 4.6                      |                        |
|                    | 5. Suitability of images for material clarity                            | 4 5 4 5 5  | 4.6                      |                        |
|                    | 6. Conformity with time allocation used                                  | 4 4 4 4 4  | 4                        |                        |
|                    | 7. Compatibility as learning media                                       | 4 5 4 5 5  | 4.6                      |                        |
| Format             | 1. Material distribution accuracy                                        | 5 5 4 5 4  | 4.6                      | 4.7                    |
|                    | 2. Clear numbering system                                                | 5 5 5 5 5  | 5                        |                        |
|                    | 3. Positioning setting                                                   | 4 4 4 5 5  | 4.4                      |                        |
|                    | 4. Font size and type                                                    | 5 5 5 5 5  | 5                        |                        |
| Language           | 1. Language accuracy                                                     | 3 3 5 4 5  | 4                        | 4.3                    |
|                    | 2. Simplicity of sentences                                              | 3 4 4 5 5  | 4.2                      |                        |
|                    | 3. Clarity of direction                                                  | 3 4 5 5 5  | 4.4                      |                        |
|                    | 4. Communication level of language used                                  | 4 4 5 5 5  | 4.6                      |                        |
| Display            | 1. Readability (text can be read well)                                   | 4 4 4 5 5  | 4.4                      | 4.5                    |
|                    | 2. Positioning suitability of the pictures and texts                     | 4 4 5 5 5  | 4.6                      |                        |
|                    | 3. Suitability of font type and font size                                | 4 4 5 5 5  | 4.6                      |                        |
| Average of validity |                                                                           |             |                          | 4.5                    |
The results of the comic media validation analysis reached 4.5 in total average which indicated the validity was in the ‘highly valid’ criteria. This comic media fulfilled the content validity as. We referred to the score of four aspects measured namely content, format, language and display. The format aspect met the highest score of 4.7, the content and display aspect reached the medium score of 4.5, while the language aspect obtained the lowest score of 4.3. Referring to the criteria measured, three criteria got the highest score of 5; they are: 1) Grouped into logical parts; 2) clear numbering system; 3) Font size and type. Meanwhile, there two criteria that obtained the lowest score of 4; they are; 1) Conformity with allocation used; and 2) Language accuracy.

4.1.2. Student Responses. The questionnaires contains statements to find out students’ responses after the implementation of social arithmetic lesson using problem-based comic media. Based on the analysis results, students’ responses were described in Table 3:

| Statement Number | Scoring Scale |
|------------------|---------------|
|                  | SA A D DA SD  |
| 1                | 115 16 3 2 1  |
| 2                | 120 16 3 2 0  |
| 3                | 110 12 6 4 1  |
| 4                | 70 56 3 2 0   |
| 5                | 115 8 6 4 1   |
| 6                | 80 40 9 2 0   |
| 7                | 90 36 6 2 0   |
| 8                | 120 8 3 0 1   |
| 9                | 90 24 15 0 1  |
| 10               | 80 40 6 4 0   |
| Total Score      | 990 256 60 22 5 |

If each statement gets the highest score of 5, the sum of total score of all scoring scales has a maximum score of 1500, derived from 5 x 10 x 30, where the highest score in each statement is 5, the total number of statements is 10, and the total number of respondents is 30. Based on Table 3, the sum of total score of each scoring scale is 1333. It can be described as follows.

![Figure 1. Students’ responses to the comic media](image)

The questionnaire of students’ responses showed that implementing the learning by using the problem-based comic media gave a positive impact on the learning with the score of 1338, which is considered within the interval for strongly agree scale. The learning media of problem-based comic
allowed students to equitably experience the events happening in their surroundings. The students were able to discuss the problems given by the teachers using and reflecting upon knowledge and skills that they already had. This statement was also supported by the results of the interview carried out with students. The vignette is presented as follows:

M : What do you think about the comic?  
S : It’s fun, because there are a lot of figures 
M : Do you understand the problem given in the comic?  
S : Not at all, Miss.  
M : Which part do you not understand?  
S : The problem in the worksheet Miss. I take a long time to understand the problem 
M : Were all of the problems answered?  
S : Yes, Miss, but some answers were wrong. When the other groups presented their work some of my answers were different from their.  
M : But, is it fun to learn the comic?  
S : Yes’ miss. I am excited.  
M : What if we make the other topics in the form of comics?  
S : Would that be fun and we won’t get bored, miss

4.2. Discussion
The development of the problem-based comic media was conducted using the Plomp development model which consists of preliminary research, prototyping and assessment phase. To get a valid product, as stated by Sugiyono [14], the product should be assessed by experienced experts as validators. In this development, the validators were a mathematics education lecturer and mathematics teachers. The results of the validation process revealed that the product enveloped in this study was in the valid category.

Based on the analysis, the validation score reached 4.5 that means the validity of the product was in the highly valid criteria. The comic learning media contain problems, problem solving strategies, student worksheets for each meeting and questions based on each basic competence, the validators suggested that the assessment rubric include the detailed score for each step of the problem solving. The five validators argued that the media could be used with a minor revision. In terms of language, content and display. Regarding the language aspect, some words were not properly used, such as the use of words in the beginning of the sentence and others. Meanwhile, in the content aspect, the problem presented did not meet the criteria used for the comic media that would be developed. Thus is, the problem should be an open-ended problem the solution can be carried out in more than one way of solving. In the display aspect, there were several images that did not align with the content or texts we intended to convey.

The next step was to revise the product that had been validated. Revisions were made to the parts considered not to meet the feasibility of the problem-based comic media in accordance with the experts’ suggestions. After revision, the media were ready to be tested in small groups of students in a pilot study. The revised product will become the comic media used for social arithmetic topic.

After conducting a pilot test, the results of students’ responses concluded that students preferred learning by using the social arithmetic comic media, because the delivery with the comic media was easy to understand. This finding was in line with the previous study that stated that a fun learning could have a positive impact on students’ hence it would affect students’ interest and their learning outcomes [15].

The final objective of this study was to assess the validity of the comic-based media on social arithmetic topic and to create a more effective products before conducting a pilot study, as suggested by Sugiyono [14] that product designs that are rationally valid will be more effective.
5. Conclusion
In conclusion the development of the comic media on social arithmetic topic was considered valid. This statement was based on the validation analysis results that reached score of 4.5, which means that the validity was in the ‘highly valid’ criteria. Therefore, the problem-based comic media met the content validity. In the next stage, the problem-based comics media on social arithmetic topic can be tested in small groups of students in pilot study.

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