An Instructional Media Using Comics on the Systems of Linear Equation

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Abstract. Comic is one of the frequently used media in our daily life. This media has been familiar for the community. Comic is mostly used as entertainment facilities. Along with the current development, comics are not only functioned as a means of entertainment, but also used in the field of education. There were some problems in a classroom which encouraged the researchers to use comics as a solution for those problems. This article aims at discussing on comics as an instructional media which is appropriate for students. This research uses research and development (R and D) method. The results obtained from this study are based on the students' responses of the questionnaires and validation to help them understanding the system of linear equations material. Results show that comics can be used to replace LKS (student worksheet). Feedbacks from students and validators also show that comic is an attractive medium. It is said so since comics link the concrete into abstract things so that it is easily understood by the students.

1. Introduction

There is a reason for using comics as an instructional media. That is the problems occurring in the classroom which have encouraged the researchers to find a way out. Problems came from students who find difficulties in understanding the learning materials. The system of linear equations is one of the most important materials since it is listed as one of the topics being tested in the national examination. Based on the observation, the constraints which are generally experienced by the students came from mathematical modeling. Mathematical modeling is the first stage that must be done in working on the problems related to the system of linear equations in two variables. If the students are not able to follow at the first stage, they would difficult to solve the problems at the current and the later stage. Based on the research conducted by Lee [4], the difficulties that commonly experienced by students in learning algebra are algebra. Students are confused over the uses of letters in algebra and they find algebraic procedures are too abstract.

Packalen and a comic artist, Odoi, [5] in a book entitled "Comics with an attitude" show various comics used as educational campaigns in Africa, and most of the illiterate Africans are greatly helped by the comics. According to the research conducted by Thornrike in Daryanto [3], one of the advantages of comics is, by reading comics intensively, (for example one comic in one month), it is same as reading a textbook in a year. That is the reason why the researchers create a learning material in the form of comic in order to increase students’ interest in learning.

In addition to the previous research in which comics were applied only on economic materials, PKN (civic education), biology, and general knowledge related to everyday life meanwhile in this
study, the researchers try to relate things to daily life and linked them into a mathematical model. Therefore, the researchers want to try whether or not it works on mathematical model as other studies. Comic is selected as a medium to learn the system of linear equations in two variables because of the similar characteristics which could be applied in daily life so that the students could easily transfer the concrete materials into abstract.

2. Experimental Method
This research used a research and development (R and D) method. Sugiyono [6] states that the main activity in this research is to conduct research and literature study to produce certain product design and development activity is to test the effectiveness, validity of the design that has been made, so that it becomes a tested product and can be utilized by the public. Mathematical comic development procedures follow the ADDIE model which includes analysis, design, development, implementation, and evaluation.

The reason for using this model is because this model is one of the most widely used models. It is based on Nada Aldoobie [1] who stated that ADDIE model was one of the most commonly used models to produce an effective product. The subjects of the study were 8-10 students for a limited trial and 30 students for field trials. The trial was performed for several times so that the researchers could find out the weakness of the comic which was being revised later. The researchers also conduct an open interview, observation, and questionnaire of student responses to collect the data related to media used. Experts’ validation results would also be an important factor in this research. The method was conducted to find out the students’ difficulties in relation to the system of linear equations in two variables in the field, how far their understanding on the use of comics, and how their feedbacks and validators in relation to the comics offered by the researchers.

The first step in the development model of ADDIE was by analyzing the difficulties, i.e by visiting the school to conduct interviews with teachers on learning problems faced by the students as well as observing them in the classroom. The process continues on the design, which was designing the learning program so that the learning objectives could be obtained. The next step was development, i.e the researchers began to develop media that would be used in the classroom. This article has not contained a discussion on the implementation and evaluation process since the research was only conducted up to the stage of experts’ validation and the students’ response. The final goal of this article was to create a decent media for dissemination (implemented) within the classroom.

3. Result and Discussion
Based on analysis of the needs, observation, and interview, it could be concluded that students face some difficulties in understanding the concept of linear equations, creating a mathematical model, and solving the equation problems. This could be seen that only few of those who are able to answer the researcher’s questions correctly, the slow response of students when the teacher lured them by giving questions, and many students keep repeating the same questions even though they have been explained. An open interview is also conducted when the researcher introduces mathematical comic to the students. Students may ask questions or give suggestions if any part of the comics is less obvious, both in terms of design and material substance. Thus, it could be a suggestion to the researchers for future improvement.

The students’ feedbacks related to mathematical comic are that comic is an interesting image and storyline, understandable media, and a media that could make them easily to understand the difficult materials. Besides, they suggest that the comic should be copied. The validation result related to the mathematical comic showed that the comic was interesting to use both inside and outside the class. Nevertheless, there are some suggestions and improvements as follows; the proportion between image and writing should be balanced, improvement in terms of the staining, and the context adjustment of mathematical comic. Figure 1 shows the front cover of mathematical comic. The cover displays six Junior High School students who are the characters in the comic. The existence of the characters aims to revive the atmosphere like comics in general. The comic characters will also deliver the teaching material to the students, namely the system of linear equations.
Figure 3.1. Front Cover of Mathematical comic

Figure 3.2 shows the daily activity of the characters in the comic described as typical Junior High School students. The characters consist not only of the smarts but also the slackers, the forgetfuls, etc. It aims to avoid monotonous comic storyline. The characters’ expressions are not designed as flat and serious characters. Sometimes the characters express their confusions when studying, gives panic expression when they do not accomplish the assignments, and happiness expression when they are able to answer the teacher’s questions. The contents contain not only material, but also the casual conversations among characters in order to avoid the students’ boredom towards the contents of the comic. The results of this study found a link in Chyntia Bolton’s research [2] which states that comic can create a more relaxed classroom atmosphere. Humor and visual presented in comic can also help the learners to understand the abstract content.
Figure 3.2. Content of the comic
Figure 3.2 shows the mathematical modeling, i.e. the change from the concrete into an abstract form. The material introduction is started by taking a sample from the surrounding environment in order to make the students easier to continue the next step.

![Material delivery of the comic](image)

**Figure 3.3.** Material delivery of the comic

The comic has been appropriate with the indicator of content feasibility. Table 1 shows the validation done by the material experts. The validation consists of several aspects that will be assessed by the validator. Assessments are conducted several times including revisions in case there are less obvious contents, such as improper concept, errors on writing the symbol, improper use of diction, etc.

| Rated Aspects                              | Average | Information |
|--------------------------------------------|---------|-------------|
|                                            | Expert 1 | Expert 2    |            |
| Presentation Techniques                    | 4        | 3.6         | 3.8        |
| Learning Presentation                      | 4        | 3.75        | 3.88       |
| Supporting The Presentation                | 4        | 3.5         | 3.75       |
| Material Coverage                          | 4        | 4           | 4          |
| Conformity of the Item with the Material   | 4        | 4           | 4          |
| Contextuality                              | 4        | 3.8         | 3.9        |
| Conformity with student development        | 4        | 4           | 4          |
| Communicative                              | 4        | 4           | 4          |
| Interactive Dialog                         | 4        | 4           | 4          |
| Straightforward                             | 4        | 3           | 3.5        |
| Conformity of language rules               | 4        | 3.67        | 3.83       |
| **Total Average**                          | **3.88** |             | (very valid)** |
Table 2 shows the validation by the media experts. Similar with material validation, media validation also consists of several aspects that will be assessed by the validator. Assessments are conducted several times including revisions related to the problems of the contents, such as unrelated image and sentence, unclear comic strip, and poor coloring, etc.

| Rated Aspects                  | Average | Information |
|-------------------------------|---------|-------------|
| Expert 1 | Expert 2 |            |
| Learning Design | 4 | 3.83 | 3.9 |
| Visual Quality | 4 | 3.6 | 3.8 |
| The usefulness of mathematical comics | 3.7 | 3.7 | 3.7 |
| **Total Average** | **3.8 (very valid)** |             |

4. Conclusion
Based on the results obtained, it can be concluded that comic can be used as an alternative to replace LKS (Student Worksheet). It means that the contents are similar to LKS (Student Worksheet) which contains materials, questions and discussions, and exercises. The differences are that comic is packed in a more interesting form by the existence of image as a mean of delivering the material. Comic is proper to use for the students, especially on the system of linear equations material in two variables. It is considered as the very well media used both inside and outside the class. The storyline of comic is more interesting rather than LKS (Student Worksheets), so that it can be effective to prevent the students’ boredom.

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