Learning work and energy through Aminuddin and Aminullah Comic

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Abstract. The interesting learning media will help students to understand physics. Comic is one of the alternative learning media that can be used in the learning process. The using of comic has been used widely in the field of education. This research aimed to develop a work and energy comic based on Jambi folklore, Aminuddin and Aminullah, for senior high school students. The scenes of comic will be connected to the concepts of physics especially on the work and energy concepts. This study used research and development method referring to the ADDIE model which consisted 5 stages: Analyze, Design, Development, Implementation and Evaluate. The results of the students response and expert validation of comic showed that the comic is feasible to use in learning.

1. Introduction
Physics is a branch of science that studies objects in nature, natural phenomena, as well as the interactions of objects in nature. Work and energy is one of the topics studied in physics. The previous study showed that students were able to solve the problem mathematically but they have difficulty in understanding the concept [1]. Based on initial observations in SMA Negeri 8 Kota Jambi, it was found that students had difficulty in understanding the concepts of work and energy. There are many factors that cause this problem. One of them is learning media. Their learning media are mostly in the form of textbooks, and students are less interested in reading them. To understand the concepts of work and energy, appropriate and attractive media are needed. The use of attractive learning media can increase student imagination [2].

Comic is a combination of learning models and innovative learning media in the learning process [3]. Comic is a unique medium compared to other readings because they are presented in the form of images [4]. Learning using comic can make students think more critically [5]. The use of comic as learning media has a positive and significant effect on student learning outcomes and understanding [6]. The advantages of learning media in the form of comics can increase motivation, understanding, learning outcomes, and student interest in learning [7,8].

The developed comic differs from other comics because we use Jambi folklore, Aminuddin and Aminullah, as the basic storyline of the comic. Several scenes in the Aminuddin and Aminullah folklore will be related to the concept of work and energy. Our reason uses the Aminuddin and Aminullah folklore as the basis of the story in the comics is because this folklore is the local wisdom of the Jambi. Work and energy comic based on Aminuddin and Aminullah folklore can be used as supporting media in learning media of physics.
2. Methods
The method used in this research is Research and Development (R&D). Research and Development defined as a systematic method that aims to improve, develop, produce, and to test the effectiveness of certain products, models, methods, procedures to be better, more effective and efficient [9]. The procedure of developing comic of work and energy follows the ADDIE model which includes analysis, design, development, implementation, and evaluation [10]. However, this research was only carried out until the development stage.

In Analysis stage of ADDIE model, researcher conducts a needs analysis by visiting the school and then distributing questionnaires to the needs of students to find out the problem. The next stage is design, researcher design products ranging from sketching to digitization. The last is development, researcher developed the comic based on the design and conducted a feasibility test in the form of material and media validity tests.

3. Results and discussion
Based on the results of initial observations through distribution of needs questionnaires, it can be concluded that students have difficulty in understand the concepts of work and energy. Many factors cause this problem. One of them is the learning media. From the results of the analysis of needs questionnaire, students tend to be interested in learning media that displays images compared to full text learning media. Comic is a medium that presents images and can be used as an alternative learning media. Analysis of the questionnaire needs also shows students' interest in reading media in the form of comics. Work and energy comics can be made as supporting media and independent learning media for students. The use of comics in learning have positive impact for students’ attitudes in reading interest and can be used as alternative books in learning. Comics also can be used as learning media both inside and outside the classroom, and comics can prevent student boredom [11].

The results of the validation by material and media experts show that comics are feasible to use as supporting media in learning work and energy concept. There are some suggestions and comments on comics such as the placement of conversation balloons, improvements in writing, and improvements on the comic's cover. Here, we will show the snapshot of developed comics.

![Figure 1. Front cover of comic.](image)
Figure 1 shows the front cover of work and energy comics. The cover displays the characters in the comics namely, Aminudin origins as a tiger and Aminullah as a cow.

Figure 2. Content of comic.

Figure 2 shows one of the scenes in the comic. The scene shows a cow working in a rice field. The activity will be connected to the concept of work and energy.

Figure 3. Display of examples in comic.
The developed comic is also equipped with problems as shown in Figure 3 and it is validated to determine their eligibility.

**Table 1. Eligibility.**

| Score interval          | Categories     |
|-------------------------|----------------|
| \( X > 4,2 \)           | Very good      |
| \( 3,4 < X \leq 4,2 \)  | Good           |
| \( 2,6 < X \leq 3,4 \)  | Fair           |
| \( 1,8 < X \leq 2,6 \)  | Low            |
| \( X \leq 1,8 \)        | Very low       |

Eligibility is based on Table 1 conversion of actual scores into qualitative categories. Validation of comics is done by material and media experts. The result of validation of material and media as shown in table 2 and 3.

**Table 2. Validation of material expert.**

| Aspect                                                      | Mean | Information |
|-------------------------------------------------------------|------|-------------|
|                                                             | Expert 1 | Expert 2 |     |
| Clarity of learning material                                | 4     | 3,7       | 3,85|
| Suitability of comics with the learning objectives          | 4     | 4         | 4   |
| Suitability of comics with learning material                | 4     | 4         | 4   |
| Accuracy in using symbols / symbols of Physics              | 4     | 4         | 4   |
| The attractiveness of comic as a learning medium            | 5     | 4         | 4,5 |
|                                                             | **Total Mean** | 4,07 (Good) |     |

Table 2 shows the results of the validation of material experts. The validation of material expert consists of several aspects that will be assessed by the validator. Assessments are conducted several times including revisions in case of clarity, suitability, symbol, and attractiveness of comic. The result shows the total mean rating of 4,07 in good categories.

**Table 3. Validation of media expert.**

| Aspect                                                      | Mean | Information |
|-------------------------------------------------------------|------|-------------|
|                                                             | Expert 1 | Expert 2 |     |
| The accuracy of size                                        | 4     | 4         | 4   |
| The accuracy of arrangement of pictures                     | 4     | 3         | 3,5 |
| Interesting pictures                                       | 4     | 3,7       | 3,85|
| The simplicity of learning media                            | 4     | 3,75      | 3,9 |
| Integration of visual aspect                                | 5     | 4         | 4,5 |
| Clarity flow                                                | 5     | 5         | 5   |
|                                                             | **Total Mean** | 4,12 (Good) |     |

Table 3 shows the results of media validation. The validation of media expert also consists of several aspects that will be assessed by the validator. Assessments are conducted several times including revisions in case of accuracy of size and arrangement of pictures, interesting pictures, simplicity, integration and clarity flow of comic. The result shows the total mean rating of 4,12 in good categories.

**4. Conclusion**

The process of developing comic consist of analysis, design, and development stage. Based on the results of material and media validation, it can be concluded that Aminudin and Aminullah comic is
feasible to use as learning media for students to study work and energy concept and the development of comics can be proceed to the next stage of development.

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