FEASIBILITY OF STEM-BASED E-MAGAZINE PHYSICS TEACHING MATERIALS ON STRAIGHT MOTION MATERIALS

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ABSTRAK

Bahan ajar memiliki peran yang penting dalam proses pembelajaran, namun seringkali siswa tidak tertarik belajar karena bahan ajar yang menurut siswa membosankan. Oleh sebab itu penelitian ini ditujukan untuk menghasilkan bahan ajar fisika *e-magazine* berbasis STEM yang layak digunakan sebagai pendamping belajar siswa. Penelitian ini menggunakan model *ADDIE*. Teknik analisis data yang digunakan adalah pendekatan kualitatif dan kuantitatif. Hasil penelitian menunjukkan bahwa kelayakan bahan ajar oleh ahli materi memperoleh rerata skor sebesar 3,45 dan ahli media sebesar 2,9.

Kata kunci: bahan ajar fisika, *e-magazine*, STEM

ABSTRACT

Teaching materials have an important role in the learning process, but often students are not interested in learning because the teaching materials according to students are boring. Therefore, this research is aimed at producing STEM-based e-magazine physics teaching materials that are suitable to be used as student learning companions. This study uses the ADDIE model. The data analysis technique used is a qualitative and quantitative approach. The results showed that the feasibility of teaching materials by material experts obtained a mean score of 3.45 and media experts of 2.9.

Keywords: *physics teaching materials, e-magazines, STEM*

INTRODUCTION

Science education is part of education that is useful for preparing students who have the ability to think critically, creatively, logically, and take the initiative in responding to various things in society that are happening in science and technology. Learning physics with the scientific method used can refer to techniques of scientific investigation of phenomena, gaining new knowledge, or correcting and integrating previously acquired knowledge (Mustika, et al., 2016).

Teaching materials have a form that can be used by teachers so that they are facilitated in planning and implementing the learning process (Daryanto and Dwicahyono, 2014). Teaching materials are designed based on the objectives in learning, the characteristics of students and the material being

taught, and the learning strategies used (Suparman, 2012). The validity of a teaching material depends on the considerations of the validator or expert in his field, in this case the validator or expert is asked to give a value to the teaching material and provide suggestions or input for improvement with the aim of the teaching material being assessed for the better (Akbar, 2017).

As time goes on, the teaching materials used are increasingly diverse. Current teaching materials are made more interesting in order to help increase students' enthusiasm for learning. Magazine teaching materials are currently one of the most interesting forms of teaching materials. Magazines in their development use light language when compared to textbooks (Nurjanah, et al., 2014). Magazine in English, magazine can be interpreted as a collection of articles or stories in which various information, opinions, and entertainment are displayed for consumption by the masses along with supporting illustrations (Danesi, 2010). Magazines are published regularly, or publications whose publications are continuous, numbered, or serialized (Sumarsih, 2009). In addition, magazines can also be interpreted as a medium of communication, the information in which is presented in a deep, sharp, and the actual value that is owned is of old value along with the images that are very much displayed (Suryawati, 2011). The benefits of teaching materials in the form of e-magazines based on research by Suprihatin, et al. (2012) found that teaching materials in the form of e-magazines were able to increase students' reading interest in the physics material being taught.

The STEM approach in teaching materials aims so that students are able and understand the four aspects of STEM (Science, Technology, Engineering, and Mathematics) that are interrelated on one subject. The STEM approach in teaching materials is also expected to help students apply everything they learn in their daily life and work environment (Bashooir and Supahar, 2018). Previously, research on the development of STEM-based teaching materials has been carried out by several experts, including by Maulidia (2019) stating that STEM-based teaching materials are feasible to use and can improve critical thinking skills. Furthermore, Adimulia (2019) stated that teaching materials are feasible to use and can improve students' scientific reasoning.

The problems above become a reference for researchers to conduct this research with the aim of producing STEM-based e-magazine physics teaching materials that are feasible to be implemented as companion teaching materials for students. This teaching material is produced with the hope of increasing student interest in learning physics, especially straight motion.

RESEARCH METHODS

The model in the research that the researcher uses is using the ADDIE model. The analysis-design stage produces details of STEM-based physics teaching materials in straight motion materials. At the develop stage, the development of a draft of physics teaching materials was carried out and continued with a validation test by an expert. After the experts (materials and media) state

that the teaching materials are valid to be used, the next stage is carried out.

The data that has been obtained is then analyzed. Data analysis techniques to obtain research results using qualitative and quantitative approaches. Qualitative data can be in the form of criticisms and suggestions put forward by experts and then collected in order to make improvements to this STEM-based e-magazine teaching material product. Quantitative data acquisition is converted to qualitative data with a scale of 4 (Likert scale) as the stages of obtaining product quality made with the following description:

Table 1. Rating score category

Category	Score
Not good	1
Not good	2
Good	3
Very good	4

a. Determine the average score of each aspect that is assessed using the equation (Siregar, 2017):

$$\bar{x} = \frac{\sum x}{N}$$

Information:
$\bar{x}$ = Average score calculated by experts
$\sum x$ = Total score by expert
N = Quantityall scores

b. Converts scores to a 4 scale

The reference for changing the score to a scale of 4 is to calculate the ideal average (Mi) which can be found using the equation:

$$Mi = \frac{1}{2}(ideal\ maximum\ score + ideal\ minimum\ score)$$

After getting the value *Mi*, then find the ideal bauku deviation (*SBi*) with the equation

$$SBi = \frac{1}{6}(ideal\ maximum\ score - ideal\ minimum\ score)$$

c. Determine the assessment criteria

The assessment criteria based on the standard deviation that has been calculated using the above formula can be seen in the following table

Table 2. Product feasibility interpretation criteria (modification)

Quantitative Score Range	Category

$X \geq Mi + 1,5SBi$	Very good
$Mi + 4\ 1,5SBi \geq X \geq Mi$	Good
$X > M \geq Mi - 1,5SBi$	Not good
$Mi - 1,5SBi > X$	Not good

Adaptation: Mardapi, 2012

The equation of the assessment criteria is then changed in a scale range of 1-4.

$$Mi\ (mean\ ideal) = \frac{1}{2}(4\ +\ 1) = 2,5$$

$$SBi\ (simpangan\ baku\ ideal) = \frac{1}{6}(1\ -\ 4) = 0,5$$

Based on the assessment criteria for a value scale of 4, the assessment criteria for research are obtained, namely in Table 3 below.

Table 3. Product Feasibility Interpretation Criteria (Modification)

Quantitative Score Range	Category	Eligibility Criteria
$X \geq 3,25$	Very good	Very worth it
$3,25 \geq X \geq 2,5$	Good	Worthy
$2,5 > X \geq 1,75$	Not good	Not feasible
$1,75 > X$	Not good	Very unworthy

Adaptation: Mardapi, 2012

DISCUSSION

This research was conducted in an effort to produce physics teaching materials in electronic form in a format according to magazines and contain the four STEM (science, technology, engineering and mathematics) sciences that are suitable to be used as a support for learning physics. The feasibility of the teaching materials used is based on the validation of material experts and media experts. The results of the study are described as follows.

1. Feasibility of teaching materials by experts

a. Material expert

Consisting of two physicists, the average value was taken to validate the material in this teaching material. The aspects assessed consist of content feasibility, presentation feasibility, linguistic feasibility, and STEM assessment. The results of the validation of teaching materials by material experts are in the following table.

Table 4. Assessment based on material expert validation

Aspect	Average score	Category	Eligibility Criteria
Content eligibility	2.8	Good	Worthy
Serving eligibility	2.8	Good	Worthy
Language eligibility	2.8	Good	Worthy
STEM Assessment	2.6	Good	Worthy
Average score	3.45	Very good	Very Worthy

Based on the table, it is found that all aspects are in the good and decent category. So the material expert stated that the STEM-based e-magazine physics teaching material was feasible to use with an average score of 3.45.

b. Media expert

The validator in this study consisted of two media experts who were experts in the media field. The results of the validation by the two media experts were taken the average which was then analyzed to determine the suitability of a teaching material. The aspect assessed by media experts is the graphic aspect. The following are the results of the validation obtained by each media expert.

Table 5. Assessment based on media expert validation

Aspect	Rating Item (N)	Validators (n = 2)		Total score for each item	Average score
		1	2		
Graphics	Compliance with ISO standards	3	3	6	3
	Size suitability with the contents of the e-magazine content	3	3	6	3
	The colors of the layout elements are harmonious and clarify the function	3	3	6	3
	The letters used are precise and easy to read	3	3	6	3

Don't use too many letter combinations	3	3	6	3
Consistency of the layout created	3	2	5	2.5
Content illustrations can clarify and facilitate understanding	3	3	6	3
Placement of titles, subtitles, illustrations, and image captions does not interfere with the page	3	2	5	2.5
Total aspect score ($\sum X$)				20.5
Average score ($\bar{x}$)				2.9
Category				Good
Criteria				Worthy

Based on the assessment of media experts, it was found that the teaching materials obtained an average score of 2.9 with appropriate criteria.

CONCLUSION

Research by experts has produced STEM-based e-magazine teaching materials that are good and feasible to use. Eligibility is obtained through validation carried out by experts consisting of media experts and material experts. Eligibility by media experts and material experts obtained eligibility of 2.9 and 3.45.

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