

# E-learning with STEM-Based Schoology on Static Fluid Material

*by* Imam Syafe'i Dkk

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## E-learning with STEM-Based Schoology on Static Fluid Material

Imam Syafei<sup>1</sup>, Antomi Saregar<sup>1</sup>, Hairul<sup>1\*</sup>, Andi Thahir<sup>1</sup>, Putri Mardiana Sari<sup>1</sup>,  
Alyt Anugrah<sup>1</sup>

<sup>1</sup> Universitas Islam Negeri Raden Intan Lampung, Indonesia

\*[antomisaregar@radeninan.ac.id](mailto:antomisaregar@radeninan.ac.id)

**Abstract.** The purpose of this research and development is to determine the feasibility and attractiveness of e-learning media with STEM-based Schoology on static fluid material. This study uses the research and development method (Research and Development) proposed by Borg and Gall. The product's feasibility was investigated by 6 validators from three aspects of validation. The attractiveness of the product was tested on teachers and high school students aged 15-16. The results show that the e-learning media with STEM-based Schoology on static fluid material is highly feasible with a percentage of 93% based on the material expert's validation, 86% according to media experts validation, and 83% according to IT experts validation. The results of trials on teachers and students show percentages of 90% and 92.5% which belongs to the very attractive category. It can be concluded that the e-learning media with STEM-based Schoology on static fluid material is highly feasible and appropriate to be used as a learning media.

### 1. Introduction

The world is currently facing the era of the industrial revolution 4.0. Industrial era 4.0 impacts all fields, including education [1, 2]. Many fields of education apply digital technology as a medium in the learning process [3, 4]. Al-Quran Surah Al-Alaq verses 1-5 states that:

" Recite in the name of your Lord who created. Created man from a clinging substance. Recite, and your Lord is the most Generous. Who taught by the pen. Taught man that which he knew not. "(Surah al-'Alaq: 1-5)

The word *iqra'*, according to Quraish Shihab, derived from the Arabic word which means collecting. The word collecting can be elaborated as conveying, studying, exploring, researching, knowing the characteristics of something, and reading both written and spoken. In terms of its object, the command *iqra* includes everything that can be reached by humans [5,6]. On that basis, the technology developed nowadays must be utilized to its full potential, especially in the learning process to improve students' abilities, skills, and motivation to learn [7, 9].

One of technology-based learning is electronic learning or e-learning [10]. E-learning is used to convey learning, training, and education programs using electronic means, for example, the use of computers [11, 12]. Based on the benefits and convenience of e-learning, various models of e-learning appear. Starting from PowerPoint-based to Learning Management System (LMS). There are several types of LMS including Edmodo, Learnboos, Moodle, and Schoology [13].



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Schoology is one of the LMS that provides the facility to interact in the learning environment through online social networks [10] that can be accessed anytime and anywhere globally, as well as more flexible without being bound to space and time [14]. Students can download learning materials, take quizzes, exams, and collect assignments given by teachers [15]. Schoology has several advantages compared to other LMS including 1) Suitability of the theme in the management tools. 2) It provides Google apps. 3) Determine the role, truth, and settings in the management tools [14,15]. Also, Schoology requires students to be more independent in learning, thus, e-learning can increase student activity and creativity [18]. Besides the use of media, the activities and creativity of students can be improved by applying the learning approach to Science, Technology, Engineering and Mathematics (STEM) [15, 16].

STEM learning as an interdisciplinary approach that combines Science, Technology, Engineering, and Mathematics. It focuses on the educational process on problem-solving [21] through a project or product that is integrated with one of the scientific fields in everyday life [22]. The application of the STEM approach indirectly requires teachers to be skilled and creative in developing learning media [23].

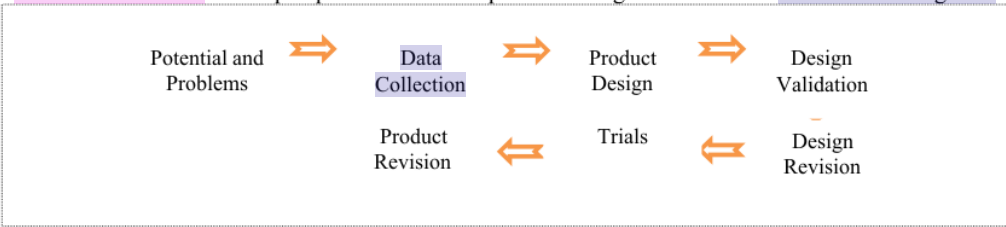
However, the teachers use less varied media in the learning process which causes the students to be less motivated to learn physics. Therefore, students need teaching materials that are interesting, innovative, and easy to use to convey messages properly as an appropriate visualization to provide understanding [24]. Therefore, we need a Schoology-based learning media [25].

Schoology-related research conducted by previous researchers in the development of e-Learning-based Schoology to practice digital literacy [26], development of high school physics learning programs based on e-learning with Schoology [10], and the development of e-learning-based Schoology and Edmodo in terms of motivation and learning outcomes of vocational high school students [17].

Although there are many studies on e-learning-based Schoology, the difference between this research and the previous ones lies in the STEM approach. It is expected to produce decent and interesting media that can support the learning process in the classroom.

**2. Method**

This research uses the research and development method (R & D) proposed by Borg and Gal [27]. The Borg and Gal model were used because this study only wants to know the response of teachers and students' toward the developed product. The 7 steps of the Borg and Gal model can be seen in figure 1.



**Figure 1.** The Borg and Gall Model

The steps of the research & development conducted by the researchers can be seen in table 1.

No	Research and Development (R&D) Method	Description
1	Potential and Problems	At this stage, the researcher conducted preliminary research to determine the potential and problems existed in physics learning
2	Data Collection	After knowing the potential and problems in

No	Research and Development (R&D) Method	Description
		learning physics, then it was necessary to collect data by carrying out an assessment related to media development
3	Product Design	Designing e-learning media with STEM-based Schoology on static fluid material to be used in learning
4	Design Validation	After the initial product had been made, then it was validated by the three experts namely material expert, media expert, and IT expert
5	Design Revision	After completing the validation, the product was then revised according to suggestions and improvements from each of the experts
6	Product Trial	After the product had been declared feasible by the three experts, then the product was tested to know the attractiveness through teachers' and students' responses. The trials were in the form of small-group trial and field trials.
7	Product Revision	After the product had been tested, the product was revised according to the suggested improvement from the trial stage.

The data from this study are in the form of validated data from material experts, media experts, and IT experts as well as teachers and students' responses. Data on the questionnaire assessment was then analyzed using the Likert scale with the rules of scoring 1 to 5, with 1 as the lowest score and 5 as the highest score. The average score of each question can be seen through the following formula [29]:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

Description:

P = Percentage

$\sum x$  = Number of respondents' answers in 1 item

$\sum x_i$  = Number of items' ideal score

The results of the instrument analysis were used to determine the response of the validators in determining the feasibility percentage criteria as can be seen in table 2.

**Table 2.** The scale of Interpretation of Accuracy [30]

No	Interval (%)	Criteria
1	0% ≤ x ≤ 20%	Poor
2	20% < x ≤ 40%	Low
3	40% < x ≤ 60%	Moderate
4	60% < x ≤ 80%	Good
5	80% < x ≤ 100%	Excellent

To interpret the teacher's and students' percentage responses, the assessment criteria presented in table 3 were used.

**Table 3.** The scale of Interpretation Accuracy [30]

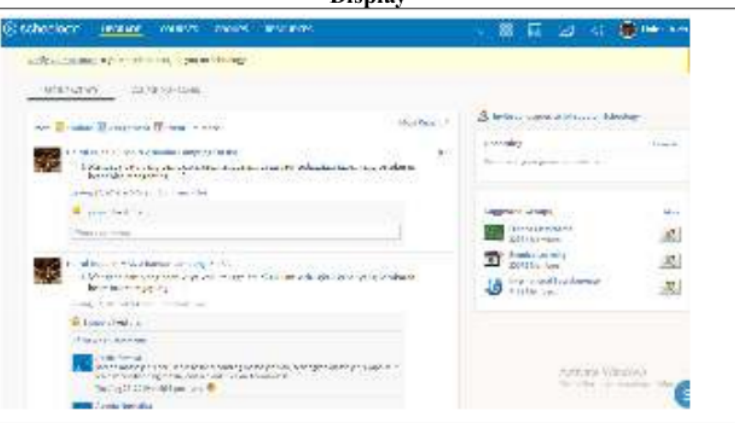

No	Interval (%)	Criteria
1	$0\% \leq x \leq 20\%$	Unattractive
2	$20\% < x \leq 40\%$	Less Attractive
3	$40\% < x \leq 60\%$	Moderately Attractive
4	$60\% < x \leq 80\%$	Attractive
5	$80\% < x \leq 100\%$	Highly Attractive

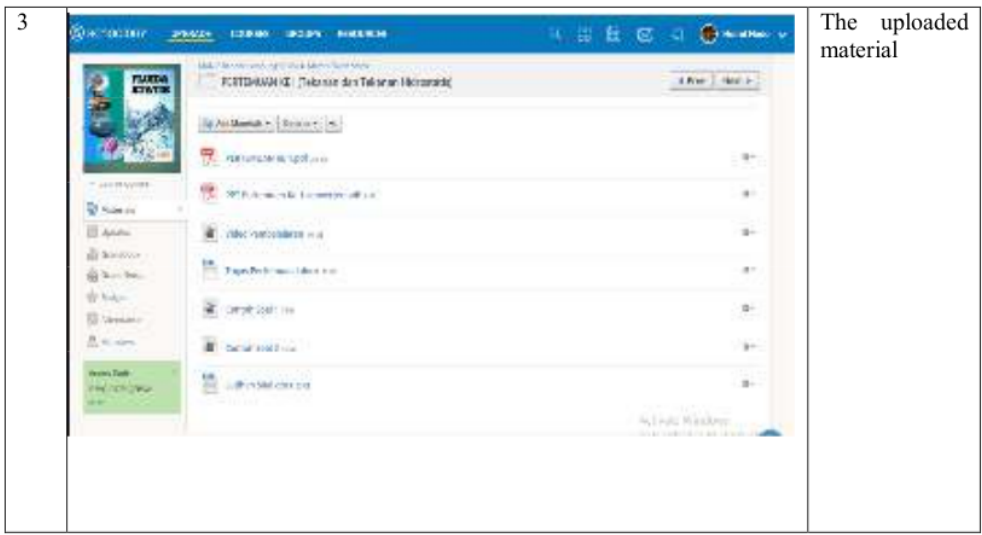
**3. Results and Discussion**

The final product of this research is E-learning media with STEM-based Schoology on static fluid material. The problems found in the field were many students have never given varied and practical learning media. The presence of images, symbols, and videos on learning media will make it easier for students to understand the material presented by teachers. Teachers still use printed media in teaching the learning material, especially in physics. Thus, the researchers developed the E-learning media with STEM-based Schoology.

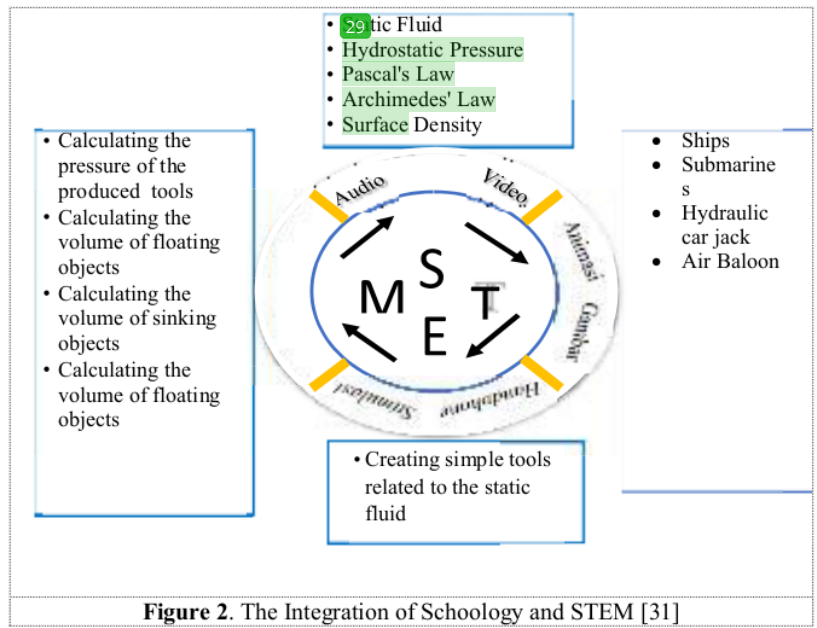
The next stage was gathering information as a solution. The information collected was used as a reference in predicting students' needs for the learning media to be developed. The developed E-learning media with STEM-based Schoology is presented in table 4.

**Table 4.** E-learning Media with STEM-based Schoology

No	Display	Information
1		Home display
2		Class pages



The STEM learning approach is presented in the Schoology. The parts of STEM in Schoology can be seen in Figure 2.



The feasibility of the prod<sup>19</sup> was obtained from the assessment of material experts, media experts, and IT experts. The details of the results of the material experts' validation can be seen in table 5.

**Table 5.** The Results of Material Expert Validation

No	Evaluation Aspects	Average Score	Percentage	Criteria
1	Content Quality	4.6	93%	Excellent
2	Language	4.5	90%	Excellent
3	Implementation	4.9	97%	Excellent
4	Visual display	4.5	90%	Excellent
5	Ease of Use	5.0	100%	Excellent
6	STEM learning approach	4.5	90%	Excellent
<b>Average</b>		<b>4.7</b>	<b>93,33%</b>	<b>Excellent</b>

Table 5 shows the results of the percentage of each aspect obtained from the two material experts validation with 93% for the content aspect, 90% for language, 97% for implementation, 90% for visual display, 100% for ease of use, and 90% for the STEM learning approach. Thus, the average score of all aspects is 93%. This shows that the developed media is feasible to be used and belongs to the excellent category. The following are the results of the media expert validation.

**Table 6.** Media Expert Validation Results

No	Evaluation Aspects	Average Score	Percentage	Criteria
1	Content quality	4.5	90%	Excellent
2	Language	4.5	90%	Excellent
3	Workability	4.3	87%	Excellent
4	Visual display	4.2	83%	Excellent
5	Audio Aspect	4, 3	84%	Excellent
6	Ease of Use	4.0	80%	Excellent
<b>Average</b>		<b>4.3</b>	<b>86%</b>	<b>Excellent</b>

Table 6 shows the results of the percentage of each aspect obtained from the two media experts validation with 90% for the content quality, 90% for language, 87% for aspects of implementation, 83% for visual display, 87% for audio aspects, and 80% for ease of use. Thus, the average score of all aspects is 86%. This shows that the developed media is feasible to be used and belongs to the excellent category. The following are the results of IT experts' validation that can be seen in table 7.

**Table 7.** Results of IT Experts Validation

No	Evaluation Aspects	Average Score	Percentage	Criteria
1	Content Quality	5.0	100%	Excellent
2	Coloring	3.7	73%	Good
3	Letter (Font)	4.0	80%	Good
4	Pictures and Video	4.0	80%	Good
5	Audio	4.0	80%	Good
<b>Average</b>		<b>4.1</b>	<b>83%</b>	<b>Excellent</b>

Table 7 shows the results of the percentage of each aspect obtained from the two IT experts validation with 100% for the content quality aspect, 73% for coloring, 80% for letters, 80% for images and videos, and 80% for audion. Thus, the average score of all aspects is 83%. This shows that the developed media is feasible to be used and belongs to the excellent category. The data of the trials and two physics teachers' responses conducted in two schools is presented in table 8.



**Table 8.** The Teachers' Responses

No	Aspects	Percentage (%)	Category
1	Content quality	93%	Highly attractive
2	Media quality	94%	Highly attractive
3	Technical quality	93%	Highly attractive
<b>Total</b>		<b>93%</b>	<b>Highly attractive</b>

Table 8 shows the results percentage obtained for each aspect based on the responses of the two physics teachers with 93% for the content quality aspects, 94% for the media quality aspect, and 93% for the technical quality aspect. Thus, the average score of all aspects is 93%. This shows that the developed media is feasible to be used and belongs to the highly attractive category. The small-group trial was conducted to 30 eleventh-grade students of two senior high schools in Bandar Lampung. The percentage can be seen in table 9.

**Table 9.** The Results of Small-Group Trial

No	Aspect	Percentage (%)	Category
1	Content quality	93%	Highly attractive
2	Media quality	94%	Highly attractive
3	Technical quality	93%	Highly attractive
<b>Total Aspects</b>		<b>93%</b>	<b>Highly attractive</b>

Table 9 shows the results percentage obtained for each aspect based on the small-group trial with 93% for the content quality aspects, 94% for the media quality aspect, and 93% for the technical quality aspect. Thus, the average score of all aspects is 93%. This shows that the developed media is feasible to be used and belongs to the highly attractive category. Field trial was conducted to 88 eleventh-grade students of two senior high schools. The percentage can be seen in table 10.

**Table 10.** The Results of Field Trial

No	Aspects	Percentage (%)	Category
1	Content Quality	93%	Highly attractive
2	Media quality	92%	Highly attractive
3	Technical quality	92%	Highly attractive
<b>Total Aspects</b>		<b>92%</b>	<b>Highly attractive</b>

Table 10 shows the results percentage obtained for each aspect based on the field trial with 93% for the content quality aspects, 92% for the media quality aspect, and 92% for the technical quality aspect. Thus, the average score of all aspects is 92%. This shows that the developed media is feasible to be used and belongs to the highly attractive category.

The advantages of the E-learning media with STEM-based Schoology on static fluid material include 1) the E-learning media with STEM-based Schoology on static fluid material is composed of videos and information that are packaged so that the students can understand the material, 2) the E-learning media with STEM-based Schoology on static fluid material is equipped with videos, simulations, and pictures that support static fluid material and activities that can be carried out by students, and 3) the display of the E-learning media with STEM-based Schoology on static fluid material has been developed using interesting blend of colors.

#### 4. Conclusions and Suggestions

The E-learning media with STEM-based Schoology on static fluid material is highly feasible with a percentage of 93% based on the material experts' validation, 86% according to media experts

validation, and 83% according to IT experts validation. The teachers and students state that the E-learning media with STEM-based Schoology on static fluid material is highly attractive. The teacher's responses obtained a percentage of 90% while the small-group trial and field trial obtained percentages of 93% and 92%. This shows that the E-learning media with STEM-based Schoology on static fluid material is very attractive and can be used as one of the supporting media in learning physics.

Based on the research findings, the researchers provide a suggestion for improvement in the future. For further researchers, since this research ends at the seventh stage, it is better to proceed to the ninth stage to measure the effectiveness of the media on learning outcomes or at the tenth stage or dissemination. The school teachers, especially senior high school or Islamic high school, are expected to be able to use innovative and practical learning media to support learning that is tailored to the character of students' needs.

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