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# Development of learning videos for natural science subjects in junior high schools

**Partono Siswosuharjo[1], Al-Bahra[2], Po Abas Sunaarya[3]**
[1]Information Systems Study Program, Faculty of Engineering, Muhammadiyah University of Banten, Banten, Indonesia
[2]Information Technology Education Study Program, Faculty of Science and Technology, University of Raharja, Tangerang, Indonesia
[3]Retail Management Study Program, Faculty of Economics and Business, University of Raharja, Tangerang, Indonesia

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**ABSTRACT**

The purpose of this study was to determine the development procedure and the feasibility of learning media for whiteboard animation in Natural Sciences subjects at SMP Padindi, Tangerang Regency. This study uses a research and development (R&D) approach. The development model in this study is the analysis design development implementation evaluation (ADDIE) model. The feasibility test is carried out by means of individual testing (one to one) on 3 experts, namely material experts, learning experts, and media experts, as well as 3 students. In addition, a small group test was also carried out on 9 students. The results showed that: i) the material expert test was 87.5%, the learning expert was 85%, the media expert was 84.44%, 3 students were 88.84%, and the small group was 90%; and ii) this whiteboard animation learning media is suitable for use based on the results of media trials by experts and students.



***Corresponding Author:***

Partono Siswosuharjo
Information Systems Study Program, Faculty of Engineering, Muhammadiyah University of Banten
Banten, Indonesia
Email: partonosiswosuharjo@stmikmbanten.ac.id

## 1. INTRODUCTION

Globally, most science curricula aim for students to develop conceptual, procedural, and epistemological understandings. A recent focus of school science education curricula has been to develop scientifically literate citizens able to make informed decisions about the socio-scientific issues that arise in their everyday lives [1]. Provision of basic information is not sufficient for expressive cognition and learning in teaching natural sciences (NS) concepts. There is some old methodology of scientific ways of educating learners about scientific conceptions in which deficits occur in the teaching process [2]. Provision of students with meaningful additional elected experiences developed in a way that allows them to continue working on their ideas in a way that is more scientific and accurate is encouraged. Apart from language, students' sociocultural background also affects their understanding of science concepts [3]. The science teacher should, therefore, understand issues of language and students' background in the effective teaching of science concepts. To ensure that there is effective learning and teaching of science, it is the teacher's role to find ways to address language problems that may hinder students' conceptualisation science concepts. Teaching NS concepts to students that are not familiar with foreign language is a challenge because of the students' environment. The language of instruction exerts significant challenges and demands extraordinary experience from students involved in learning science concepts [4].

Media is an essential part of the learning process to help the teacher transfer and explain the lesson, which can be observed from audiovisual tools to stimulate the students during the lesson [5]. Media can be

encountered in every form of assisting learning tools, which can be used as a bridge to transfer the lesson in order to achieve the learning objective [6]. Learning media is a tool to clarify some information given and improve the students' learning motivation. Using learning media can replace one of the teachers' roles in the lesson as a presenter because learning media has some unique potential to help the students in the learning process [7].

Constructivist learning can be experience in virtual media [8]. The virtual media bring the real-world phenomena to the multimedia, make the essential process of particular phenomena show in multi-dimensional media. One of the common multimedia in daily life is video. Video is categorized as an effective learning medium to help the students to comprehend the learning material because it provides the students withmoving pictures and voice whic is interesting for the students [9]. The ability of video to visualize the lesson really effectively helps the students to understand the dynamic material.

Further, through video there is potential for developing an epistemological understanding of the concept of evidence in science, and the opportunity for small group discussion [10]. This is also supported by research results which state that video is a good learning medium that helps students absorb material because it provides audio-visual, image, and sound in one unit at the same time [11]. To support learning with video, you should be intentional about your design in order to reduce extraneous processing and to manage the essential processing of the material [12]. Learning is better when content is presented in learner-paced segments. Create multiple, short, single-concept videos of 6 minutes or less rather than one long one [13]. The purpose of this study was to determine the development procedures and feasibility of blackboard animation learning media in science subjects at Padindi Middle School, Tangerang Regency.

## 2. METHOD

This study uses a research and development (R&D) approach. The field of instructional design offers one model, analyze, design, develop, implement and evaluate (ADDIE) [14] that takes into account learning theory, the learner's needs and environment, and approaches to training practitioners in evidence-based practices. It provides a systematic approach to the analysis of learning needs, the design and development of a curriculum, and the implementation and initial evaluation of a training program [15], [16]. The steps for this model development are carried out with the preliminary research stage, namely making direct observations on the implementation of learning regarding the learning process, supporting and inhibiting factors of learning, learning needs and expectations of the media to be developed. Furthermore, planning media development by focusing on the development of learning media in the form of whiteboard animation media. The data collection technique is done by observing, distributing questionnaires and conducting interviews. The data collection instrument used was in the form of a questionnaire which was carried out by giving a set of written statements or questions to the respondent to be answered. The questionnaire used in this study was distributed to media experts, material experts, learning experts, teachers and students as respondents. The questionnaire was given using the individual data collection method (one to one) consisting of material experts or teaching, learning and media teachers, as well as 3 students, and a small group of small groups (small group) to be conducted on 9 students randomly selected.

## 3. RESULT

### 3.1. Model development results

#### 3.1.1. Needs analysis

**A. Analysis of student characteristics**

Result show on the Table 1 is interest of class VII students of SMP Padindi obtained from the results of distributing questionnaires, it was stated that 72% of students were interested in natural science subjects, while 28% of students were not very interested in natural science subjects. Table 2 is the motivation of students in class VII SMP Padindi Junior High School obtained from the results of distributing questionnaires, it is stated that 76% of students have high motivation in natural science subjects, while 24% of students are not very motivated in natural science subjects. Meanwhile, the results of the analysis of the learning styles of the seventh-grade students of SMP Padindi showed that visual learning styles were more dominant than other learning styles.

Table 1. Student interest

| Category | Frequency | Presentation (%) |
|---|---|---|
| High interests | 18/25 | 72 |
| Low interest | 7/25 | 28 |

Table 2. Student motivation

| Category | Frequency | Presentation (%) |
|---|---|---|
| High motivation | 19/25 | 76 |
| Low Motivation | 6/25 | 24 |

**B. Learning objectives analysis**

The development of whiteboard animation learning media for science subjects on the theme of celestial bodies and members of the solar system aims to facilitate teachers and facilitate, and motivate students, by using images, audio, video contained in whiteboard animation learning media.

**3.1.2. Design**

There are two stages in program design, namely a flowchart that explains the sequence of processes and the relationship between the processes in detail in a program logically and interface design (face to face), then face-to-face design by visually describing the entire contents of the learning media using a storyboard.

**3.1.3. Development**

The development stage is a stage to realize from the design stages into a real and complete display using the VideoScribe software. Formative evaluation from the analysis phase led to the development of a tool, the employment resource book [17], that could be utilized by key stakeholders (providers, supervisors, and recipients) during any phase of employment (e.g., considering work, actively seeking employment, maintaining employment), and one module was developed to provide guidance about using this resource.

**3.1.4. Implementation**

Feedback from the usability testing phase is used to fix errors in navigation and improve user experience [15]. After usability testing issues were addressed, the modules were ready for implementation. The media that has been created are then applied in learning activities to determine the appropriateness of using the media. At the implementation stage, it was carried out on three experts, namely material experts, learning experts and media experts. After that, an individual test was also carried out on three grade VII students of SMP Padindi, Tangerang Regency to determine student responses to the media being developed. Then a small group trial was conducted on 9 students of class VII SMP Padindi, Tangerang Regency.

**3.1.5. Evaluation**

The summative evaluation consisted of quantitative and qualitative data and was guided by the Kirkpatrick model for training evaluation [18].

**A. Learning expert**

Table 3 show that the assessment of learning experts obtained an average value of 3.4 with a percentage of 85%, then with this value the media is said to be feasible for testing at a later stage.

Table 3. Results of the learning expert's assessment

| No. | Indicator<br>Learning aspects | Score | Criteria |
|---|---|---|---|
| 1. | The learning objectives presented are very clear. | 3 | Agree |
| 2. | The medium is easy to use in the learning process. | 4 | Strongly Agree |
| 3. | By using this media students easily understand the material. | 4 | Strongly Agree |
| 4. | The medium is very interesting to use. | 3 | Agree |
| 5. | With this media, the teacher is easy to convey material with. | 3 | Agree |
| 6. | By using the media, young teachers interact with students. | 4 | Strongly Agree |
| 7. | By using media students can be enthusiastic in learning. | 4 | Strongly Agree |
| 8. | The medium is easy to use in learning. | 3 | Agree |
| 9. | Students can do exercises and evaluations. | 3 | Agree |
| 10. | The examples given are in accordance with the existing material. | 3 | Agree |
| | The total value of all aspects | 34 | |
| | Average of all aspects | 3.4 | |
| | Presentation of all aspects | 85% | Well worth it |

**B. Media expert**

Based on the Table 4, the assessment of the media expert's assessment obtained an average value of 3.33 with a percentage of 83.33%, so this media is said to be feasible.

Table 4. Results of the media expert's assessment

| No. | Indicator | Score | Criteria |
|---|---|---|---|
| | Communication aspect | | |
| 1. | This medium is easy to use | 4 | Strongly agree |
| 2. | This medium is simple to use by students | 4 | Strongly agree |
| 3. | The language used is easy to understand | 4 | Strongly agree |
| | Technical design aspects | | |
| 4. | The text used is easy to understand | 4 | Strongly agree |
| 5. | This media display makes students interested | 3 | Agree |
| 6. | The image display used makes students interested | 3 | Agree |
| 7. | The animation used matches the material | 3 | Agree |
| | Aspect of display format | | |
| 8. | The material presented coherently | 4 | Strongly agree |
| 9. | The begsound used fits or fits | 2 | Disagree less |
| 10. | Selection of fonts according to student characteristics | 4 | Strongly agree |
| 11. | This media evokes a sense of enthusiasm in learning | 3 | Agree |
| 12. | Layout is appropriate / balanced | 2 | Disagree less |
| | The total value of all aspects | 40 | |
| | Average of all aspects | 3.33 | |
| | Presentation of all aspects | 83.33% | Well worth it |

**C. Material expert**

Result on the Table 5 show that the evaluation of material experts obtains an average value of 3.5 with a percentage of 87.5%, then the media used is declared feasible to be tested to the next stage. After the product is assessed by all experts, the next step is to conduct a one-to-one trial on 3 grade VII students of SMP Padindi, Tangerang Regency. Table 6 show that the product assessment in the individual test (one to one) obtained an average value of 3.48 with a percentage of 87.22% which is included in the feasible category for testing at a later stage. After conducting a one-to-one trial, the next stage was a small group trial which was conducted on 9 grade VII students of SMP Padindi, Tangerang Regency.

Table 5. Results of the material expert's assessment

| No. | Indicator | Score | Criteria |
|---|---|---|---|
| | Aspects of eligibility of material content | | |
| 1. | The material presented is in accordance with the subject curriculum | 3 | Agree |
| 2. | Presentation of material in accordance with existing learning objectives | 4 | Strongly agree |
| 3. | The material presented covers the subjects | 3 | Agree |
| 4. | The content of the material presented is clear and in accordance with what was learned | 3 | Agree |
| 5. | The material is presented sequentially | 4 | Strongly agree |
| 6. | The material presented is concise and clear | 4 | Strongly agree |
| | Aspects of feasibility of illustration | | |
| 7. | The material presented gives enthusiasm for learning | 3 | Agree |
| 8. | The language used by young people is absorbed and understood | 4 | Strongly agree |
| 9. | The media used gave good responses from students | 4 | Strongly agree |
| 10 | The format of writing material uses fonts and is attractive | 3 | Agree |
| | The total value of all aspects | 35 | |
| | Average of all aspects | 3.5 | |
| | Presentation of all aspects | 87.5% | Well worth it |

Table 6. Results of the one-to-one assessment

| | Instrument items | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Respondent | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| Muhammad Nabil | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 3 | 2 | 50 |
| Febriyanti | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 54 |
| Desi Devita | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 53 |
| The total value of all aspects | | | | | | | | | | | | | | | | 157 |
| Average of all aspects | | | | | | | | | | | | | | | | 3.48 |
| Presentation of all aspects | | | | | | | | | | | | | | | | 87.22% |

Based on the Table 7, the product assessment in the small group trial obtained an average value of 3.57 with a percentage of 89.44% which is in the feasible category. Thus, the results of all trials and assessments that have been carried out by experts can be concluded that the whiteboard animation media is in the feasible category.

Table 7. Results of small group trials

| | Instrument items | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Respondents | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| Muhammad Nabil | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 3 | 2 | 50 |
| Febriyanti | 4 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 54 |
| Desi Devita | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 53 |
| Muhammad | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 54 |
| Siti Munah | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 54 |
| Ali Gufron | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 4 | 54 |
| Ahmad Rizky | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 55 |
| Annas | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 54 |
| Nabila | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 55 |
| The total value of all aspects | | | | | | | | | | | | | | | | 483 |
| Average of all aspects | | | | | | | | | | | | | | | | 3.57 |
| Presentation of all aspects | | | | | | | | | | | | | | | | 89.44% |

### 3.2. Model effectiveness

#### 3.2.1. Individual trial (one to one) against experts

Result in Table 8 revealed that all the assessments above, it can be concluded that learning experts get an average percentage of 85% which is included in the feasible category. Then the media expert in Table 9 obtained an average percentage value of 84.44% which is also included in the feasible category. Material experts in Table 10 get an average percentage value of 87.5% which is included in the feasible category.

– Learning expert test results

Table 8. Results of the learning expert feasibility test

| No | Aspect | Appropriateness (%) |
|---|---|---|
| 1. | Learning aspects | 85 |

– Media expert test results

Table 9. Results of the media expert feasibility test

| No | Aspect | Appropriateness (%) |
|---|---|---|
| 1. | Communication aspect | 83.25 |
| 2. | Technical design aspects | 100 |
| 3. | Aspect of display format | 70 |
| | Average | 84.44 |

– Material expert test results

Table 10. Results of the material expert feasibility test

| No | Aspect | Appropriateness (%) |
|---|---|---|
| 1. | Aspects of eligibility of material content | 87.5 |
| 2. | Aspects of feasibility of illustration | 87.5 |
| | Average | 87.5 |

#### 3.2.2. Individual trial (one to one) against 3 students

Details of the assessment in Table 11 can be concluded that the individual trial (one to one) obtained an average percentage value of 88.84 which is included in the feasible category.

Table 11. One to one feasibility test results

| No | Aspect | Appropriateness (%) |
|---|---|---|
| 1. | Material Aspects | 97.16 |
| 2. | Learning Aspects | 84.9 |
| 3. | Media Aspects | 84.46 |
| | Total | 88.84 |

### 3.2.3. Small group trial

Based on the details of the assessment in Table 12, it can be concluded that the small group trial obtained an average value of 90% which was included in the very feasible category. Thus, the results of all trials and assessments that have been carried out by experts can be concluded that the whiteboard animation media is in the feasible category.

Table 12. Small group due diligence results

| No | Aspect | Appropriateness (%) |
|---|---|---|
| 1. | Material aspects | 92.60 |
| 2. | Learning sspects | 90 |
| 3. | Media aspects | 87.70 |
| | Total | 90 |

## 4. DISCUSSION

In terms of the aspect of learning media, learning videos based on micro learning principles have very good validity. This is influenced by the suitability of visuals to clarify learning material. This is evidenced by the results of the assessment given by learning media experts on instrument items related to visual suitability, the percentage of which was 83.33% with very good qualifications, and the evaluation results of material experts obtained a percentage of 87.5%. The assessment obtained from the small group trials obtained an average value of 90% which was included in the very decent category as explained by [19] the visual aspect of learning videos, they are able to clarify learning material and help students understand the material presented.

The development of students' self-potential will run more effectively if a teacher uses the right learning media [20]. Teachers must have the ability in making nor developinstructional media, good using technology or not [21]. One of the learning media that utilizes technology is interactive multimedia. Interactive multimedia is an intermediary tool that conveys messages with collaboration from various elements that are able to create active learning so that the message of the information conveyed can be well received. Interactive multimedia also requires students to be active in participating in learning, in which students will be asked to interact directly in using interactive multimedia. Interactivity in multimedia provides a limitation that users are involved in interacting with application programs and aims to assist students in obtaining learning information [22].

This is in line with previous study who stated that abstract and long description is more straightforward to be understood if it is visualized with some pictures because the picture helps the students to memorize messages [23]. The presentation of material on the video learning based on the micro-learning was suitable with the demand of basic competence, indicator, and learning objectives that were required to be achieved by the students [24]. The results of this study are also in accordance with previous research which stated that several meta-analyses have shown that technology can enhance learning (e.g., [25]), and multiple studies have shown that video, specifically, can be a highly effective educational tool (e.g., [26]). Video may have particular value for student preparation in biology classes, in part because students may find it more engaging [27] and because it can be well suited to illuminating the abstract or hard-to-visualize phenomena that are the focus of so many natural science classes.

This product has several advantages and disadvantages. The advantages of this product are: i) this product is easy to use anywhere both independently and in class; ii) this product can make it easier for teachers to teach science subjects in class; iii) can save teachers time to explain subject matter; and iv) this product can attract the attention of students in the learning process. This research is in line with previous research which stated that the local potential-based natural science learning video river tubing was able to improve students' critical thinking skills. The use of science learning videos is moderate, so students can think critically. The average student response was around 85% which showed that the use of River Tubing's local potency-based science learning videos was very effective [28].

Although digital media is generally used in academic circles, its role in the academic environment and its relevance to academic achievement have not been explored in depth [29]. Learning media has an important role in the implementation of learning in the current era of globalization. Therefore, we need an interactive learning media that can improve student learning outcomes [30]. While the shortcomings of this product are: i) if electronic devices (PCs, laptops, and smartphones) do not exist then this learning media cannot be used and ii) in terms of content, this learning product contains only one sub-theme so it cannot facilitate one main theme.

## 5. CONCLUSION

The learning media for whiteboard animation in science subjects for the seventh-grade solar system members can make it easier for teachers and students in learning activities. This is based on the positive response obtained from the results of field trials conducted on students. Overall, whiteboard animation learning media can be said to be suitable for use in learning activities. This is based on the results of individual trials conducted by 3 experts, namely material experts who obtained an overall assessment result of 87.5%, teaching experts who obtained an overall assessment result of 85%, and media experts who obtained an overall assessment result of 84.44%. In addition, an individual test was also conducted on 3 students with a total assessment of 88.84% and a small group test for 9 students with an overall assessment of 90%.

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## BIOGRAPHIES OF AUTHORS

**Partono Siswosuharjo** is an Assistant Professor and Teacher Educator at the Information Systems Study Program, Faculty of Engineering, Muhammadiyah University of Banten. He has been a lecturer since 2001. He completed his Doctoral degree in Educational Management from Nusantara Islamic University in 2014. He has a passion for improving the quality of teaching and student learning as well as their development at school and in higher education environments. His research interests are educational management, information technology education. He can be contacted at email: partonosiswosuharjo@stmikmbanten.ac.id.

**Al-Bahra** is an Associate Professor and Teacher Educator at the Information Technology Education Study Program, Faculty of Science and Technology, Raharja University. He has been a lecturer since 1994. He completed his doctorate in Educational Technology from Jakarta State University. He is passionate about improving the quality of teaching and student learning and their development in schools and in higher education settings. His research interests are educational technology, educational management, health education, information technology education. He can be contacted at email: albahra@raharja.info.

**Po Abas Sunarya** is an Assistant Professor at the Retail Management Study Program, Faculty of Economics and Business at Raharja University. He has served as a lecturer since 2001. He completed his Doctorate in Public Administration from Pasundan University, Bandung in 2017. He has a passion for improving the quality of teaching and student learning as well as their development in the higher education environment. His research interests are public administration, information technology and management. He can be contacted at email: abas@raharja.info.