

THE DEVELOPMENT OF ANIMATION VIDEOS BASED FLIPPED CLASSROOM LEARNING ON HEAT AND TEMPERATURE TOPICS

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ABSTRACT

The ability to solve physics problems is still relatively low. Students more often directly use mathematical equations without performing concept understanding analysis. Therefore, learning strategies and media are suitable for physics learning. The purpose of this research is to develop interactive animated videos combined with flipped classroom learning models. This research uses Research and Development (R&D) methods, with 4D development models. The average validation test results are 90,91%, with a good category. So, the animation physics video can use in a flipped classroom. This physics animation video makes it easier for students to learn temperature materials and their changes without being limited by space and time. These physics learning animation videos are highly interactive and can explain abstract physics concepts and integrate with flipped classrooms.

PENGEMBANGAN VIDEO ANIMASI BERBASIS PEMBELAJARAN *FLIPPED CLASSROOM* PADA TOPIK SUHU DAN KALOR

ABSTRAK

Kata Kunci:

Video animasi
Flipped Classroom
Pembelajaran fisika
Pemecahan masalah

Kemampuan menyelesaikan masalah fisika masih tergolong rendah, siswa lebih sering langsung menggunakan persamaan matematis tanpa melakukan analisis pemahaman konsep. Oleh karena itu diperlukan strategi pembelajaran dan media yang cocok digunakan dalam pembelajaran fisika. Tujuan penelitian ini untuk mengembangkan video animasi yang interaktif yang dipadukan dengan model pembelajaran *Flipped Classroom*. Penelitian ini menggunakan metode Penelitian dan Pengembangan (*Research dan Development/ R&D*), dengan model pengembangan 4D. Dari hasil rata-rata validasi diperoleh 90,21% dengan kategori baik. Sehingga video animasi fisika dapat digunakan dalam *flipped classroom*. Video animasi fisika ini memudahkan siswa untuk belajar materi suhu dan perubahannya tanpa dibatasi oleh ruang dan waktu. Video animasi pembelajaran fisika ini sangat interaktif dan dapat menjelaskan konsep-konsep fisika yang abstrak dan terintegrasi dengan pembelajaran *flipped classroom*.

1. INTRODUCTION

The development and application of physics concepts daily problems are part of the student's learning process [1][2][3]. Physics is a human activity and must be related to daily life phenomena [4][5]. However, physics in school tend to be taught using practical formulas in reality [6]. Most often, physics is not seamlessly associated with everyday life as should be experienced by the students [7][8][9]. Society, including the teachers generally does not regard physics to be related to daily life, and the learning of physics in the classroom can also be regarded with almost having no relation to daily life [10][11][12]. Learning process like this may significantly influence the students' ability to solve physics problems that relate to daily life [13][14][15].

The observation results for physics learning in several junior high schools in Jakarta and Depok, there are some weaknesses in the learning process. First, the learning model is still teacher-centered. The student's ability to solve physics problems is still relatively low. Students more often use mathematical equations without performing analysis, guessing the formula used, and memorizing examples of questions to work on other problems. The allocation of learning time in school in physics subjects in junior high school has only two meetings in one week still considered minimal, so the material cannot be conveyed entirely to students. According to Basriyah & Sulisworo suggested the appropriate strategies and learning methods using animation video for physics learning with flipped classroom models [16]. There are needed to develop student's thinking ability that oriented towards technical skills based on problem solving in daily life [17]. The flipped classroom and video animation are suitable for implemented in physics learning [18] [19] which physics learning associated with daily life as should be experienced by the students. Animation videos can represent a physical phenomenon daily in real time.

Flipped Classroom is a verbal preparation space as a stimulus to students, more to the preparation of students before entering the classroom and their involvement in the class [20] [21]. Therefore, to support the flipped classroom learning strategy, students are given video learning to be learned before classroom learning takes place. The implementation animation video into the Flipped Classroom learning process is proven to overcome the limitations of time in the classroom and improve students' problem-solving skills [22] [17]. In addition, if using animation video students can access learning materials flexibly [23][24]. Through videos, students are expected to be interested in physics learning, practicing the ability to think about physics phenomena that they often find in daily life so that students' problem solving ability can be improved [17] [25][26].

The purpose of this research is to develop animation video on heat and temperature topics combined with various cartoon animations and musical mix to improve student's problem-solving ability in learning physics with flipped classroom models. Rante & Ihsan in his research developing physics learning videos using interactive CDs. The learning video contains only concepts, and a few animations, for examples of questions and discussions, have not been shown [27]. Nuzuliana et al [28], make an animation video in physics learning, which are displayed in 2-dimension, just there are only pictures and writings, there is no animation or interactive section. The animation videos that researchers have made to look already displayed in 3-dimension so that, in it there are also many animations that are appeared. A complete learning animation video contains concepts, examples of questions and discussions, and abstract concept animations for students to understand. Moreover, this animation video essential to the students can have a better understanding of the concept of physics by applying more practical learning, which is carried out independently by students before the class started by giving the learning videos.

Learning videos become a stimulus to support flipped classroom learning, which is expected to increase students' interest in learning.

2. METHOD

In this study, we use research and development methods. Research & development is a research method used to produce a particular product, and test the effectiveness of the product [29]. This development research adapts the 4D development model, which consists of four stages, namely define, design, development, and dissemination. The flowchart of this research showed in Figure 1.

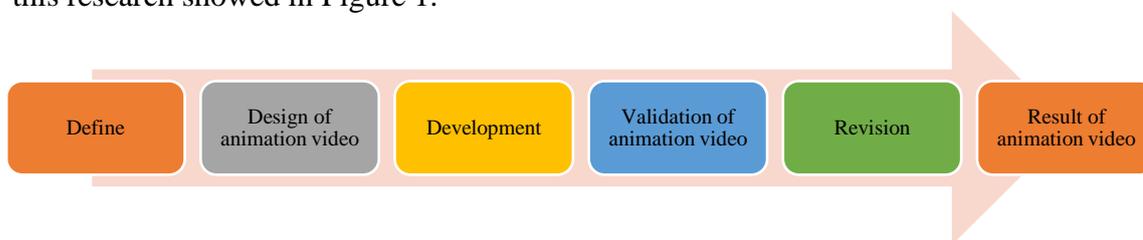


Figure 1. Research Flowchart

A research instrument is a tool used to measure the measurement of the products that have been produced [30]. Research instruments contain learning video validation sheets assessed by material experts, media experts, and language experts. Analysis of questionnaire instruments is used to test product feasibility. This instrument uses a likert scale. The categories of answers provided are Strongly Agree (ST), Agree (A), Disagree (D), Strongly Disagree (SD). Poll answers weighted 4,3,2,1 to positive statements and 1,2,3,4 to negative statements. Validation questionnaire instruments by media experts are arranged in accordance with the graphic aspects, program processing and use [31].

The results of the physics animation video that has been created will then be validated by experts, then analyzed and the suggestions made the basis for revising the animated video. Validation assessments are created on a percentage scale that has averaged scores from all validators. The eligibility criteria for animated physics videos can be seen in Table 1 [32].

Table 1. The Eligibility Criteria for Learning Media

| Category | Percentage |
|-----------------|---------------|
| Good | 80% - 100% |
| Enough | 60 % - 79,99% |
| Not good enough | 50% - 59,99% |
| Replace | 0% - 49,99% |

After the video was validated and revised according to the advice, the study tested small classes to grade VII students of SMP IT Nururrahman and SMP Negeri 103 Jakarta.

3. RESULTS AND DISCUSSION

The result of this study is a product that is an animated video of physics in the language of temperature and its changes for junior high school students grade VII. The implementation of this physics animated video will be applied in classrooms with flipped classroom models. This learning video creation uses Adobe Flash Professional CS6 app, Cyberlink Audio Director 9 (64 bit), and Camtasia. This learning video has interactive animations, so it can interest users to pay attention to temperature material. This learning video can be shared to students through e-learning so that students can access it via Mobile or laptop easily. This learning video can be learned anywhere and anytime.

The development of this learning medium uses a 4D model consisting of define, design, develop, and dissemination. The define stage, the analysis stage in the research of the development of interactive learning media consists of material analysis and analysis of learning media. At the analysis stage there is material that needs to use media as a teacher's tool in conveying the material, the material is the temperature and the change, because the temperature material and its changes require experimentation to facilitate students in understanding. The help of this interactive learning medium, can help teachers in conveying temperature material and its abstract changes. In accordance with the 2013 curriculum on temperature materials and changes are found in grade VII junior high school, with Kompetensi Dasar 3.4. Analyzing the concepts of temperature, fertilization, calorific, calorific displacement, and its application in daily life including mechanisms to maintain body temperature stability in humans and animals.

The design stage, at this stage designing and creating physics animation videos using a wide range of software, including Adobe Flash Professional CS6, Cyberlink Audio Director 9 (64 bit), and Camtasia. AAdobe Flash Professional CS6 is used to create animations (moving images) and create the contents of the video such as images, text, and backgrounds. The Cyberlink Audio Director 9 (64 bit) application is used to fill audio or sound recordings on animated videos. While camtasia application to convert from swf to mp4 to make it look in the form of video. This learning medium features animations and videos that match the materials that teachers and students can apply. In addition, at this stage, a validation sheet is created by media experts and materials experts. The development stage, the result of the development stage is a physics animation video whose contents consist of the opening page, basic competencies, indicators and objectives, teaching materials, animations in the form of images, experimental videos and practice questions. At this stage, an assessment of the physics animation video was also conducted by experts, which later advice and input from experts was used for the feasibility of this physics animation video before it was disseminated or applied to students. This research is only in the development stage, because the purpose is only to know the feasibility of animated videos being created.

In Table 2 describes the content of flipped classroom-based physics learning animation videos. There is a physics animation explaining the concept of temperature and its changes. This animated video aims to be a learning resource for students independently.

Table 2. The Multimedia Storyboard

| No | Visual | Explanation |
|----|---|--|
| 1 |  | In the first minute, the video introduces the material's title, namely the temperature and the change. |

2



At 0.44 - 2.02 minutes, the video displays basic competencies and indicators.

3



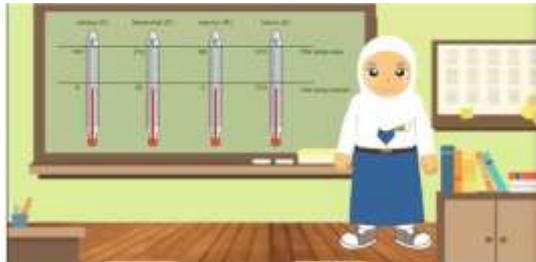
At 2.10 - 4.30 minutes, the video conveys an apperception about temperature and describes the purpose of learning. The video's perception activity explains that the senses of taste are not the right temperature gauges, but rather thermometers are the suitable temperature gauges.

4

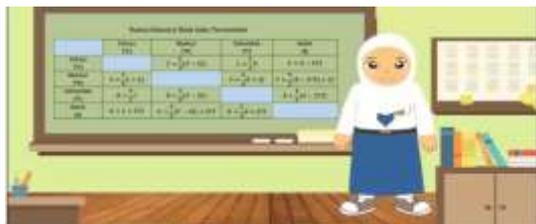


At 4.30- 08.00 minutes, this video explaining the types of thermometers. Different kinds of thermometer examples display the explanation.

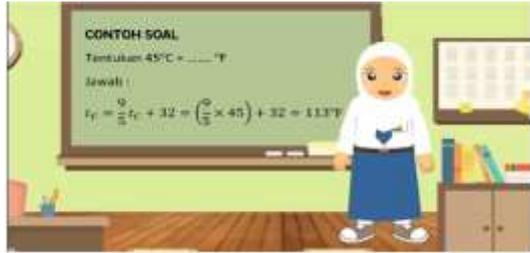
5



At 09.38 – 11.44 minutes, the video explains the thermometer's temperature scale and presents the temperature scale conversion formula on the thermometer displayed in the table's summary.



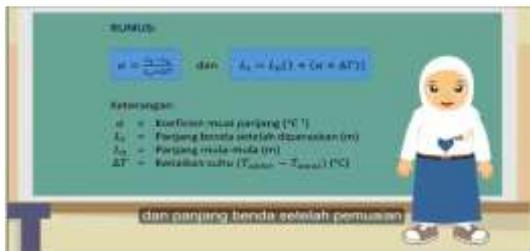
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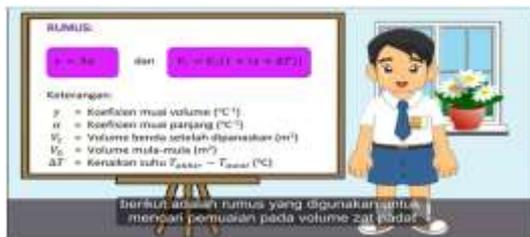
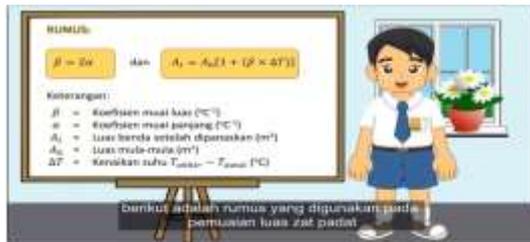
At 11.45-12.58 minutes, the video explains the example of the temperature conversion question and discussion. Then there are three questions about training questions for students to work.



7



At 12.59-18.55 minutes, the video describes changes in temperature due to long fertilization, widespread breeding, and volume growth in solids, liquids, and gases.



8



At 6.56-7.20 minutes, the video explains exercise for students to work on and discuss with the teacher.

9



At 19.21-20.21 minutes, it contains the closing video.

After the learning video creation stage is completed, the product is then validated by media experts and materials experts. The test of materials experts and media experts was conducted by indraprasta university physics lecturer. Based on the products that have been created, the following validation results by media experts, and material experts.

Table 3. The Result of Material Experts

| No | Indicators | Percentage scores |
|----------------|----------------------------------|-------------------|
| 1 | Conformity of basic competencies | 96,43% |
| 2 | Conformity of material | 87,50% |
| 3 | Image illustration | 87,50% |
| Average scores | | 90,48% |

Table 4. The Result of Media Experts

| No | Indicators | Percentage scores |
|----------------|--------------------|-------------------|
| 1 | Graphics | 91,67% |
| 2 | Processing program | 92,86% |
| 3 | Use | 91,67% |
| Average scores | | 92,06% |

Table 5. The Result of Language Experts

| No | Indicators | Percentage scores |
|----------------|-------------------|-------------------|
| 1 | Linguistics | 90,27% |
| 2 | Spelling accuracy | 90,16% |
| Average scores | | 90,21% |

Table 3-5 shows the validation of animated video physics learning on material experts by 90,48%, media experts by 92,06 %, and language experts by 90,21%. The average of all three validations is 90,91%, and belongs to a good category. So the development of video-based learning media animated temperature material and its changes is worth using by students and teachers in teaching and learning activities.

The main purpose of this development research is to create animated physics videos for flipped classroom learning on temperature materials and their changes that have been feasibility tested through expert validation tests. The video was developed with the aim of being one of the students' guides in carrying out learning. Once the product is finished, the product is ready to be tested. in the testing process, the product is subject to validation tests (experts and practitioners). The purpose of validation tests by experts is to obtain an assessment so that the level of validity of the product can be known and to know the level of interest, convenience, and efficacy of the product, as well as to know the weaknesses of the product by asking for improvement advice from the validator for the improvement of the developed product. Furthermore, suggestions from validators and students will be used as a reference in revising the product to make it better.

The validation process of the product developed by the researcher is carried out three times, until the validator finally states that the product developed is worth using and testing to the learner. In the product validation process, researchers obtained many improvement suggestions from validators. Once the product is repaired, the product is again given to the validator and begins to be assessed. Animated videos developed obtained an average eligibility for video validation above 90% with very valid qualifications and worth using.

Animation learning media is one of the interesting media, because students are brought into real experience in daily life. This kind of learning media is expected to make students more interested and motivated in the subject matter delivered by the teacher [33][34]. Video is a technology medium in the 21st century that supports student-centered learning [35]. Video animation in ICT-based learning can visualize abstract processes that are impossible to see or imagine and capable of re-airing the necessary information [36]. The use of ICT learning in physics is very helpful for students in understanding abstract concepts. Learning with the help of technology allows students to be active [37] [38] .

Based on the due diligence that has been done, it can be concluded that flipped classroom learning devices on temperature materials and their changes are feasible for use in physics learning. Products developed certainly have advantages and disadvantages. The advantages of development products for students are that they can train students in self-reliance through video and train participants' ability to use ICT facilities (laptops, notebooks, or smartphones) owned. According to Basal research [39] which states that flipped classroom consists of two important components: (1) the use of computer technology such as video lectures and (2) interactive learning activity engagement.

Another advantage of this product is that it can improve participants' ability to observe the phenomena and explanations of the material presented in the learning video, provide good initial knowledge before the material is delivered in the classroom, and the teacher does not need to explain the material as a whole, but only material that is considered difficult by the learner when face to face. In addition, flipped classroom learning methods in the classroom can be more optimal. According Knutas et al [40] which states that the use of flipped classrooms is able to improve students' learning outcomes, by flipped classroom students can independently focus on reviewing theory for as long as they need, teachers can concentrate on helping students solve the actual problems that students encounter. The other research that supports Nouri & Mayer research[41] which states that students give positive responses to videos, increased learning motivation, more effective learning, and improved learning outcomes [42]. Students appreciate learning through video, opportunities to learn tailored to their own speed, flexibility and mobility of accessible learning videos, and easier and more effective learning using flipped classrooms.

In addition to the advantages, the flipped classroom learning device developed also has some drawbacks, namely that it takes a long time for teachers to prepare materials in the form of videos. This is because it takes a long time in the collection of materials and applications used in video creation. If implemented, not all students have the necessary facilities, such as laptops, notebooks, or smartphones or adequate internet access, and not all students have the motivation to study independently at home. According to wulandari which states that not all students have the motivation to study independently at home [43], especially against material that has not been conveyed by the teacher, so that the motivation of the teacher is always needed, so that the learner is accustomed to learning the subject independently, before the material is delivered by the teacher in the class, and it takes a long time for the teacher to prepare the material in the form of a video, especially teachers who are not used to making learning videos. In addition, the products developed

have not been implemented (product trials) in the classroom so the level of effectiveness of the product has not been tested.

The application of flipped classroom learning models makes teachers more interactive with students and able to create a variety of conditions and situations in learning both at home and in the classroom in order to produce changes that fit the purpose, both the results of learning and thinking abilities (cognitive, affective, and psychomotor)[44]. Flipped Classroom learning forms interaction between students and students and between students and teachers. [45]. Flipped classroom emphasizes on learning activities that promote critical thinking and motivation among the students with the assistance of technology [21]. Implementation of the flipped classroom method could change the direction of the current traditional class and shape the students' learning.

4. CONCLUSION

The development of video-based learning media animated material temperature and its changes are made using Adobe Flash Professional CS6 app, Cyberlink Audio Director 9 (64 bit), and Camtasia. After the video has been created, validation tests are conducted to media experts and materials experts. The average validation test results are 90,91%, with a good category. So, the animation physics video can use in a flipped classroom. In addition, animated video-based learning media has the advantage of being easy to access and learn anywhere at any time. Making it easier for users to learn the temperature material and its changes without being limited by space and time. Based on the due diligence that has been done, flipped classroom learning devices are eligible for use in physics learning.

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