Development of Physics Mobile (Android) Learning Themed Indonesian Culture Hombo Batu on the Topic of Newton’s Law and Parabolic Motion for Class X SMA/MA

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Abstract. This study aims to generate and know the feasibility of Physics Mobile Learning with the theme of culture Hombo Batu. The development of this research using Four-D model (Define, Design, Develop and Disseminate). The definition stage aims to define the needs of learning in schools by doing class observation, interviewing teachers & students and searching for information and references related problems found. Media is designed by making the initial appearance of the media in the form of storyboards and Poweppoint. Learning media designed as attractive as possible by integrating the Hombo Batu. Media was developed using Adobe animate and Coreldraw X7 applications. The stages of dissemination will be carried out by distributing final products to high schools in Yogyakarta and Nias, because the integrated culture is universal and familiar. Learning media validated by experts judgment (Lecturer, Physics Teacher and Peer review). Media trials were conducted in two stages: limited testing (small group) and field test (one class) with one group pretest-posttest design. The result of analysis and discussion, it can be concluded that Physics Mobile (Android) Learning is very feasible to be used with a validity of Aiken V score 0.95 (valid) with the result of gain score 0.66 in medium category.

1. Introduction

Ristekdikti [1] shows that 25% of Indonesia’s 65 million people use smartphones in their everyday activities and 87% of users in the world are teenagers of 12-15 years old who use them as a means of sending and receiving messages [2] [3]. Other surprising facts reveal that smartphone use spends and wastes student time in vain. This fact shows that how familiar the smartphone among students (Junior High School & Senior High School) as well as a digital challenge that must be considered in the world of education.

Based on the above facts then the smartphone (Android) is an opportunity for education to take advantage of the progress of the digital era in the learning process. Many strategies or ways can be used to use smartphones in enhancing and support learning [4]. Mobile learning can be used as an emerging tool (media of learning) for educational systems (teaching and learning process) [4] [5], deliver and support learning [6]. In addition, cultural integration can be given in learning, so that education, technology, and culture is a unity in the new learning strategy and transformative experience [7].
One of Indonesian popular culture is Hombo Batu or stone jumping tradition. This tradition originated from the island of Nias coinciding in the village of Bawomatatu, Teluk Dalam district [8]. Siregar [9] declared the tradition of hombo batu or stone jump is a unique local tradition and attracts the attention of the world that has lived for generations on the island of Nias, North Sumatra, Indonesia. Hombo Batu has the value of fighting how the soldiers protect their village [10]. It is interesting that from this culture we can study physics such as Newton's Law of motion, parabolic motion, work and energy, impulse-momentum and others. One such example is learning newton's law when youth runs, jumps and flies, the footsteps against the ground. Studying parabolic motion at the moment the parent jumps in the air. This activity can be an example in the application of physics concept.

The question that arises is how to collaborate on education, culture, and technology. The solution that can be offered is by constructing media learning with the integration between the three. So the outcomes are obtained not only on knowledge but encompassing the students' own ICT skills, understanding their culture globally and growing and recognizing their own national identity through cultural preservation.

The need for learning media and educational challenges in the 21st century is an important point in balancing the progress of the digital age in order to maximize the learning experience of the classroom as well as outside the classroom. The development of a learning environment that integrates education, culture, and technology (mobile learning) is an innovation in strengthening learning styles, new learning experiences, deliver and support learning, participation, and contribution to culture locally and globally [5-7].

2. Research Method
This research is a research and development (R & D) which aims to develop learning media by collaborating technology, education and culture of Physics Mobile (Android) Learning themed Hombo Batu on Newton Law material and Parabolic Motion. This instructional media development refers to steps of the 4-D model (Define, Design, Development, Disseminate)[11]. Sampling technique using cluster sampling, so that from 8 class X SMA N 6 Yogyakarta available then the researcher take two classes. The subjects were high school students of SMA N 6 Yogyakarta with a limited trial group of 10 students (from one class) and a field trial group with one pretest-posttest group consisting of one class with 22 students.

Instruments in this study include media validation sheet and student response questionnaire to media. The validation sheet is divided into two types: validation sheet for material experts who assess the media in terms of physics content, materials, grammar and validation sheet for technology experts (media IT) to assess the design of graphic media (audio-visual), technological engineering, and aspects operational use of media. Questionnaire student response is used to know the student's response to media usage in the learning process. This validation sheet and questionnaire use a Likert scale (1-5).

The validation sheet was analyzed using the V Aiken formula [12]. Questionnaire responses of students were analyzed using a scale of five. Both of these formulas are described as follows:

Media validity using V'Aiken test [12] :

\[ V = \frac{\sum s}{n(c-1)} \]  \hspace{1cm} (1)

\[ s = r - Io \]  \hspace{1cm} (2)
Note:
- $I_0$ = the lowest validity score
- $c$ = highest validity score
- $r$ = numbers given by the researchers
- $n$ = number of appraisers

Questionnaire analysis of student responses based on score classification [13]:

| No | Average Score Range | Quality Category |
|----|----------------------|------------------|
| 1  | $X \geq X_i + 1,8 \, SB_i$ | Very Good |
| 2  | $X_i + 0,6 \, SB_i \leq X < X_i + 1,8 \, SB_i$ | Good |
| 3  | $X_i - 1,8 \, SB_i \leq X < X_i + 0,6 \, SB_i$ | Not Good |
| 4  | $X < X_i - 1,8 \, SB_i$ | Very Not Good |

Media is assessed by three expert lecturers consisting of 2 lecturers of Physics Education experts to assess the media from aspects of physical content. IT media lecturer to assess media on aspects of engineering technology, operations, audio-visual design. Then a Physics teacher, as well as three colleagues with a background in Physics Education. The criteria for invalid or invalid decision making of a product refers to Aiken [12] compares the value of $V$ obtained by computation with a value of $V$ based on table $V$ 'Aiken. Valid if the value of $V$ count is greater than the $V$ table.

3. Result and Discussion

3.1 Define, Design, Development, Disseminate of Product

The defining stage aims to define a problem or need to be experienced in the current learning. The defining stage is done by observation of school and class, literature study, teacher and student interview. Facts obtained that smartphone users are teenagers aged school 12-15 Years. Recent research reveals the need for learning strategies with educational, cultural and technological collaboration [4-7] [14-23]. Lack of teacher's ability to develop Android-based learning media. Collaboration on cultural and technological education has not been applied in the learning process. The culture used in this medium is the Hombo Stone culture (Jumping Stone) from Nias, North Sumatra Island [9-10]. The tradition of Hombo Batu is a very popular and familiar Indonesian cultural identity in the international arena but among students of this culture is less publicized (the results of student interviews). For this reason, the media is very interesting if it collaborates with Hombo Batu culture. The analysis of physics concept in Hombo Batu culture (Jumping Stone) is described in the following table:

| Phenomena on Hombo Stone | Material | Class / Semester |
|--------------------------|----------|------------------|
| Pyramidal stones remain firmly standing | Law I Newton | X/II |
| the youth ran towards the rocks with the speed of change | • Law II Newton | X/II |
| | • Work and energy | |
| | • GLBB | |
| Youth jumped over rocks with parabolic motion | Parabolic Motion | X/II |
| Footstool style that encourages youth to jump | Law III Newton Momentum impulse | X/I&II |
| Youth move in style from the starting point to the stone pedestal and land. | Work and energy | X/II |
Phenomena on Hombo Stone  

| Material                  | Class / Semester |
|---------------------------|------------------|
| Piles of stones that have different masses | X/I              |
| The height of the stones plus the humans who sleep on it | X/I              |

Products are designed with the creation of Storyboard media, and media models in the form of powerpoint. The collection of material, image, video, and animation content is done at this stage. Media development is done by using Adobe Animate and CorelDraw X7 applications. Media development only covers Newton's Law material and Parabolic Motion. Disseminate stage is done by giving the product in the form of application to the schools in SMA N 6 Yogyakarta.

3.2 Product Validation

Media validation was conducted with 3 Lecturers of Physics Education, 1 Physics Teacher, 3 Peer reviewers. The validation score can be seen in the following table.

| Table 3. Validation Scores |
|-----------------------------|
| Category | Aspect | Mean of V’ Aiken | Validation category | Skor Penilaian | Category |
|----------|--------|------------------|---------------------|----------------|----------|
| Content | Learning | 0,89             | Valid               | 22,83          | Very good |
|         | content of physics | 0,93             | Valid               | 47,50          | Very good |
| Program (IT) | Audio-Visual | 0,94             | Valid               | 53,60          | Very good |
|         | Software engineering | 0,98             | Valid               | 24,40          | Very good |
| Average | 0,95 | Valid             |                     |                |          |

The table above shows the validation results performed by 7 validators who indicate that Physics Mobile learning is a valid media in the category of content as well as from the category of IT programs. The results of the assessment from the expert reviewers obtained that the learning media Physics Mobile (Android) learning Theme of Hombo Batu is an excellent learning media both assessed in aspects of learning, the content of physics, audio-visual and software engineering. It can be concluded that Physics mobile learning media learning media is feasible (valid) and very good to be used as support learning, tool of learning, learning media that collaborate education, culture, and technology.

3.3 Revised Product

Media revisions were made to comments, criticisms, and suggestions provided by experts on improvements in this instructional medium. These improvements are seen in Table 4 and Picture 1.

| Table 4. Revision of Product |
|-----------------------------|
| Category | Revision                          |
| Content (Curriculum) | • Writing Title Error 1,2,3 Newton on each title |
|                   | • Addition of Newton's Law animation |
|                   | • Addition of material explanation of Law 1 Newton |
|                   | • Giving style information on style charts |
|                   | • Addition of Newton's Law 3 application example on Stone Jump |
|                   | • In the youth scene, a parabolic motion should be a long diagram of the different Vx and Vy styles at each point so that the big difference looks its style |
| Program (IT) | • Provide a video source |
The addition of scenes how to draw freestyle diagrams on a physics masala
At the time the youth animation landed should the youth movement not back and forth
Added reference menu
The youth's running speed in the animation should be different for each given style.
The youth movement while pushing the rock should look hard pushing
Giving music to learning media

Figure 1. The form of learning media menu display : Menu before revision
Figure 2. The form of learning media menu display Menu after revision

3.4 Small Grup and Field Grup Trial
In limited product, trials tested to grade XI students with heterogeneous ability. Students are required to use the media in learning and fill out student response sheets. From this trial found that the media fits with android smartphone students with various brands of Mobile. Media can be used easily and well without any obstacles such as bugs, errors, and slow at the time of running the application. Interesting display and good animation make the media a choice of learning Physics wherever and whenever. The result of the students’ response to the media was 87 with a very good category.

In field trial that is the subject of one class XI MIPA 7 SMA N Yogyakarta consists of 22 students with heterogeneous ability. Before the students ‘learning is given a pretest to measure students’ early skills. Then the students follow the learning with Newton's Law material by using Physics Mobile Learning as well. End of student learning is given posttest to the assessment of their learning outcomes. In this learning, all types of android support learning media when installing on student mobile phones. Its use is very good, there is no bug, error or lag when used. Overall there is no comment and criticism from students on learning. Data on the pretest-posttest result of students is presented in table 5.

| Table 5. Pretest-Posttest Result |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Pretest         | 30,28           | unfinished      | N-Gain          | Category of gain |
| Score           | Category        |                 |                 |                 |
| Posttest        | 76,10           | finished        | 0,66            | medium          |

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The students' pretest value is 30.28 (unfinished) while their posttest value is 76.10 (finished). This shows an increase in student learning outcomes with learning using Physics mobile learning [4-7]. This can be seen in figure 1.

4. Final Product Review
Learning media Physics mobile learning is a learning medium that collaborates physics, culture (Hombo batu) and technology (Android). These media were analyzed and revised from expert tests, limited testing until field trials. Overall after the revised learning media has been feasible and very well used in learning. The researcher reviews and corrects again as a whole for this learning medium to be ready for use. The dissemination of learning media is done by providing a compact disk containing the application of learning media with apk extension and flash extension. So it can be operated on Android and personal computer.

5. Discussion
Physics mobile learning is an Android-based physics learning medium with the Hombo Stone theme that is feasible and is very well used as a revolution of learning media [24]. This validity was obtained after being assessed and revised through discussions with experts, physics teachers, and peer reviewers. Validity value obtained after analyzed by V 'Aiken test is 0.95 (valid). This validity shows that physics mobile learning can be used as a learning media that can improve student performance in learning.

In small-scale group tests and student responses provided that learning media need to be developed and published. Overall it can be concluded that students enjoy and be helped by the existence of this
learning media. Then there is no problem either in the form of bugs, errors, or slow in running the animation.

The collaboration of physics education, culture (Hombo Batu) and technology (Android) is expected to support learning and enhancing learning [4] [6]. In addition, with the Physics mobile learning is expected to be used emerging tool for learning and enhance learning experience [5]. Based on field tests, Physics Mobile Learning can improve student learning outcomes as seen from students' pretest and posttest results, this is consistent with several studies showing that mobile learning positively provides significant impact and difference in outcomes of student performances [24-25].

The integration of Hombo Batu culture deeply motivates students in learning Physics with a new style. Students not only learn physics but they also know and learn about their own culture. So the convergence between the development of digital technology and culture remains balanced. Then with the element of culture on the learning of physics provide the latest support for teachers to convey physics in a unique and interesting way. This is supported by Siregar's research [9] which reveals that the story of this "hombo batu" will give pride and inspiration to plant positive values in the tradition, such as dexterity, courage, courage, nationalism,

This learning media facilitates students to think critically because it provides some questions that can train students in critical thinking. In addition, this media also presents Newton's Law and parabolic motion into animation and interactive simulation. So those students are motivated in learning. Style diagrams and speed diagrams, accelerations are well represented in the form of animation that helps students in training their diagram representations. For example, the concept of parabolic motion can be explained when the hombo youth phenomenon of stone jumps over the rock so that the path formed is a parabolic path with a speed that changes at any time. Newton's concept of youth running, jumping and landing. This is in line with the results of research Liliarti [26] which states that Android-based mobile learning can improve the ability of student diagram representation.

6. Conclusion

Physics Mobile Learning Development is developed by utilizing android media as delivery and tool in learning. In addition, the cultural elements used in the theme of Physics learning is something new for students in learning Physics. Physics Mobile Learning can be used as a medium in learning Newton's Law material and Parabolic Motion with animation and simulation that themed Hombo Batu's culture. Physics mobile learning is able to improve student performance in learning by showing improvement of student learning outcomes. Physics mobile learning can be used as a new learning strategy for teachers by using Android as a delivery system and gives the view that physics learning can be taken from the problems of everyday life or through the local and universal culture that match the material. The conclusion that can be drawn from this research is, Physics Mobile Learning get feasibility / valid with the category very well to be used as a medium of learning physics and support learning material Newton Law and Parabolic Motion.

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