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Submission date: 23-Jun-2021 01:58PM (UTC+0700)

Submission ID: 1610992675

File name: Saputra_2021_J._Phys._Conf._Ser._1823_012114.pdf (663.74K)

Word count: 3872

Character count: 21384

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To cite this article: Wahyu Budi Saputra *et al* 2021 *J. Phys.: Conf. Ser.* **1823** 012114

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Developing Culture-Based Mathematics Learning Media with Adobe Flash for JHS Students

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Abstract. This research aims to develop a mathematics learning media based on Yogyakarta culture using Adobe Flash CS 6 for seventh-grade Junior High School (JHS) students using Analysis, Design, Development, Implementation, and Evaluation (ADDIE) procedure. We evaluated the media based on its validity, practicality, and effectiveness. The validity of media was assessed by two qualified experts (content and media). The practicality was measured from a valid questionnaire from 30 Yogyakarta JHS students after using the media. Moreover, the effectiveness score was obtained from those students' test. As a result, the developed learning media fulfill the validity, practicality, and effectiveness criteria, which score 3.15 of 4 (content), 3.23 of 4 (media), 3.23 of 4, and 78.6 of 100, respectively.

Keywords: Learning Media, Mathematics Learning, Culture, Adobe Flash

1. Introduction

Science and technology are developing rapidly. Through technology, mathematics learning can be carried out actively, creatively, innovatively, and fun. With the right learning innovations, mathematics can be an easy and fun subject. But in reality, many students feel that mathematics is a difficult subject [1]. One of them is students feel mathematics far from everyday life.

Mathematics' material that is abstract and not given context or application in life makes students less aware of mathematics. Therefore, mathematics material should be arranged by utilizing the environment or culture that is around students. Learning Materials through cultural context can improve students' problem-solving ability and self-efficacy [2]. Furthermore, learning by socio-cultural activities can facilitate mathematics learning and make learning fun [3]–[5].

The use of culture around students does not mean glorifying the differences in each local culture. Culture offers the possibility of harmonious relations in human behavior and between humans and nature [6]. Furthermore, D'Ambrosio stated the ethics of diversity: respect for the other (the different); solidarity with the other, cooperation with the other. In other words, the diversity that exists in local culture has been done to achieve social equilibrium [6].

For students in Yogyakarta, learning can be arranged based on the culture in Yogyakarta. Learning based on Yogyakarta's cultural values is a learning model used by teachers to facilitate students in mastering a set of competency formulations by prioritizing and referring to Yogyakarta society's cultural values [7]. From this description, an outline can be drawn that culture-based education is indeed required to be implemented as an effort to achieve educational goals. One of the points that can be taken from the Provincial Regulation of DIY Number 5 of 2011 is that students are expected to be sensitive to the environment and cultural diversity. To achieve this, it is necessary to have learning



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innovations that prioritize and refer to cultural values, especially those that apply in Yogyakarta society. One effort that can be done in implementing culture-based education is the use of culture-based learning media. Learning media are all forms and means of delivering information created or used in accordance with learning theory, can be used for learning purposes in channeling messages, stimulating students' thoughts, feelings, concerns, and wishes so that they can encourage occurrence a deliberate, purposeful, and controlled learning process. Furthermore, mathematics learning media are all things that can channel messages and stimulate students' minds in the process of learning mathematics. The use of culture-based learning media can be done using objects created by humans as learning media. Yogyakarta culture can also be connected with mathematics, especially on quadrilateral material, such as the game *gobak sodor* which is formed from a rectangular structure, then various kinds of rectangular batik.

In the current era of the development of science and technology in education technology, it can be said to be adequate to support the sustainability and success of education in every education unit. Computer laboratories in schools and projectors in each class are actually very sufficient to organize active learning, fun, and media-based learning. The learning media that the author will develop is Yogyakarta-based ICT learning media. The choice of media is because it is considered effective, practical, and efficient in supporting the process of teaching and learning activities. In this study, researchers will develop Yogyakarta-based learning media with Adobe Flash for JHS students. Adobe Flash is an animation program that also supports programming with Action Script [8]. This learning media is a learning media developed to facilitate students' learning of mathematics by upholding Yogyakarta's cultural values, especially on the subject matter of a quadrilateral. By using this media, students can learn quadrilateral concepts with more fun but still meaningful because in this learning media, there are several objects in the form of artifacts and are easily found by students in their lives. Human work objects from Yogyakarta Culture are sketched off from the surface to obtain artifact pieces from the objects and used as a contextual example of the Yogyakarta Culture-based quadrilateral learning. This paper aims to explain the process of developing research and describe the quality of instructional media in terms based on validity, practicality, and effectiveness.

10. Method

Research and Development (R&D) is a research method used to produce certain products by testing the effectiveness of these products [9]. The procedure of developing instructional media is based on research and development steps using the ADDIE (Analyze, Design, Development, Implementation, Evaluation). ADDIE is programmed in a systematic sequence of activities to solve learning problems related to learning resources that are appropriate to the learner's needs and characteristics [10]. The ADDIE model consists of five steps, i.e: 1) Analysis, at this stage an analysis of the curriculum, characteristics of students, and situations is carried out; 2) Design, at this stage, the determination of products developed the preparation of flowcharts, storyboards, and research instruments; 3) Development, at this stage the learning media will be developed using the application Adobe Flash CS 6; 4) Implementation, at this stage the application of learning media developed is carried out; and 5) Evaluation, conducted to collect data at each stage used for improvement and determine its effect on student learning outcomes and the quality of learning broadly.

We carried out our research at SMP Negeri 7 Yogyakarta. This study's subjects were material experts, media experts, one reviewer of mathematics teachers, and 30 students of grade VII of SMP Negeri 7 Yogyakarta. After the trial is conducted, we asked students to fill out a questionnaire in response to students who have made the media.

1 The instruments used in this study were the observation sheet of the implementation of learning, material expert validation questionnaire, media expert validation questionnaire, reviewer questionnaire, student response questionnaire, and test instrument for pretest and post-test. Data analysis techniques used in this research development include validity analysis, practical analysis, and effectiveness analysis.

2.1. Validity Analysis

We obtained data on media evaluation questionnaires from media experts and material experts. The collected data is then calculated the amount and the average of the score. After that, quantitative data is converted into qualitative data. Guidelines for converting quantitative data to qualitative are as follows [11].

Table 1. Validity Criteria Based on Expert Validation

Score (i)	Category
$x > 3,40$	A Very Valid
$2,80 < x \leq 3,40$	B Valid
$2,20 < x \leq 2,80$	C Sufficient Valid
$1,60 < x \leq 2,20$	D Less Valid
$x \leq 1,60$	E Very Poor Valid

Description: Maximum score = 4, minimum score = 1, x = average score

Based on Table 1, Validity Criteria Based on Expert Validation, the result is valid if they get valid material experts and media experts' valid categories.

2.2. Practical Analysis

We analyze student questionnaire data. We calculated the number and the average, and then the average score was converted by the conversion guidelines as follows [11].

Table 2. Criteria Practicality Based Student Response

Score (i)	Category
$x > 3,40$	A Very Practical
$2,80 < x \leq 3,40$	B Practical
$2,20 < x \leq 2,80$	C Practical Fair
$1,60 < x \leq 2,20$	D Less Practical
$x \leq 1,60$	E Very Less Practical

Based on table 2, learning media is practical if at least a practical category. Aside from the student response questionnaire, we saw the practicality from the results of learning observations. The percentage results are converted using the following criteria in Table 3 [12].

Table 3. Learning Implementation Assessment Criteria

Execution Percentage	Criteria
$p \geq 90$	Very Good
$80 \leq p < 90$	Good
$70 \leq p < 80$	Sufficient
$60 \leq p < 70$	Less
$0 \leq p < 60$	Very Less

In this study, the feasibility of learning carried out at least fulfills the good criteria.

2.3. Effectiveness Analysis

The effectiveness of learning media is obtained based on student learning outcomes tests (post-test). The average student learning outcomes are converted based on criteria, as shown in Table 4 [11].

Table 4. Qualification Test Score

Score Range	Criteria
$80 < n \leq 100$	Very Effective
$60 < n \leq 80$	Effective
$40 < n \leq 60$	Sufficient Effective
$20 < n \leq 40$	Less Effective
$0 < n \leq 20$	Very Poor Effective

Based on table 4 it can be seen that the learning media developed are said to be effective if the minimum effectiveness qualifications obtained are effective.

3. Result and Discussion

The results of the development research carried out in the form of Yogyakarta-based mathematics learning media product using Adobe Flash CS 6, which was published into .exe extensions on rectangular material especially square, rectangular, and diamond-shaped for JHS students of Class VII. The Yogyakarta Culture-Based Mathematics Learning Media was developed using Corel Draw X6 application, Format Factory, Voice Recorder, AVS combined with Adobe Flash CS 6 to facilitate Class VII Middle School students on quadrilateral. This learning media development uses the ADDIE development model, which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation.

3.1. Analysis

3.1.1. Curriculum Analysis. Based on observations carried out in Yogyakarta 7 Public Middle School 2018/2019 related to the curriculum implemented in Yogyakarta 7 Public Middle School, information was obtained that the JHS applied the 2013 curriculum.

3.1.2. Analysis of Student Needs. Based on the results of observations in class and the disclosure of one of the mathematics teachers at SMP Negeri 7 Yogyakarta, information is obtained that the use of instructional media can attract students' interest and attention in participating in mathematics learning. Therefore it is necessary to have learning media that is able to facilitate students to be active in learning; of course, the learning media is expected to be practical and not burdensome for the teacher in preparing it.

3.1.3. Situation Analysis. Based on observations and statements from mathematics teachers at SMP Negeri 7 Yogyakarta, information was obtained that SMP Negeri 7 Yogyakarta is a child-friendly school, a culture-based school, and an Adiwiyata School. In addition, this school also implements government regulations related to the zoning system in the world of education, so that it is certain that most students come from the Special Region of Yogyakarta, especially the City of Yogyakarta. Other information obtained from the same source explains that SMP Negeri 7 Yogyakarta students are allowed to carry a laptop to support teaching and learning activities.

3.2. Design

The planning phase is the follow-up stage of the analysis phase.

3.2.1. Determination of Products Developed. The learning media developed was titled "Yogyakarta Culture-Based Quadrilateral Learning".

3.2.2. Flowchart and Storyboard. The compilation of learning media flowcharts and storyboards aims to facilitate the development of instructional media.

3.2.3. *Research Instruments.* The instruments' preparation in this study resulted in several instruments that were suitable to be used, namely: the observation sheet of the implementation of learning, the material expert instrument, the media expert instrument, the student response questionnaire, and the Posttest Instrument. Before all instruments are used, the instrument was validated first by Mathematics Education Lecturer on Universitas PGRI Yogyakarta and got a "Good" rating with the statement "Eligible to be used without revision".

3.3. Development

At this stage, a learning media development was developed using the Adobe Flash CS 6 application. Then validation was carried out by material and media experts. Display learning media as follows.



Figure 1. The main menu of learning media



Figure 2. Display video introduction of rectangular material

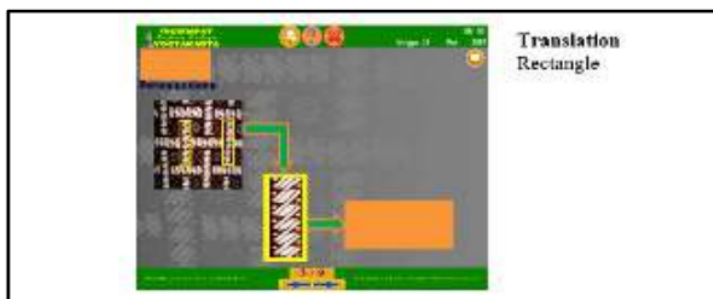


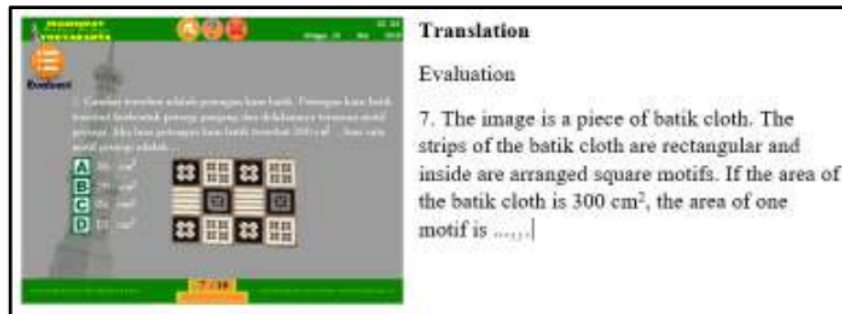
Figure 3. Display similarity between cultural and rectangular elements



Translation

The perimeter and area of the square
Fill the rectangle frame by clicking on the tile below starting from the right and fill in the available fields!]

Figure 4. Display command for how to study the perimeter and area of a square



Translation

Evaluation

7. The image is a piece of batik cloth. The strips of the batik cloth are rectangular and inside are arranged square motifs. If the area of the batik cloth is 300 cm², the area of one motif is ...]

Figure 5. Display evaluation questions

3.4. Implementation

At this stage, we carried out the application of instructional media to teachers and ⁸⁾ students in Mathematics Subjects for Class VII C of SMP Negeri 7 Yogyakarta. It is carried out to find out the practicality and effectiveness of the developed mathematics learning media. The implementation of the product, pretest, and post-test on this learning media can be seen in the Table 5.

Table 5. Research Activity Schedule

Number	Day, Date	Time	Material
1.	Tuesday, April 2, 2019	1 x 40 minutes	Pretest
2.	Wednesday, May 8, 2019	3 x 40 minutes	Square, Rectangle, and Rhombus
3.	Friday, May 10, 2019	1 x 40 minutes	Posttest

3.5. Evaluation

At this stage, an evaluation is carried out ¹⁾ to determine the mathematics learning media's final value. The mathematics learning media "Quadrilateral Based Yogyakarta Culture," which was developed, was of high quality because this learning media had gone through all development stages and fulfilled valid, practical, and effective criteria.

3.5.1. Validity Analysis. Validity analysis ¹⁾ is based on the assessment of material experts and media experts. The material validation was carried out by one Mathematics Education Lecturer of

Universitas PGRI Yogyakarta. Validation of this material aims to get comments and suggestions for the lack of learning media, especially in the material presented. So that improvements can be made to the mathematics learning media developed before conducting product trials to students. The results of the evaluation of learning media by material experts can be seen in the Table 6.

Table 6. Material Expert Validation Results

No	Aspect	Average value	Criteria	Score
1.	Learning	3,22	Valid	29
2.	Material	3,10	Valid	34
Total Score		6,32		63
Average		3,15	Valid	
Validity			Valid	

Based on the table above known aspects of learning and material aspects respectively get an average score of 3.22 and 3.10, overall the score obtained from the material experts is 3.15. Based on Table 1, the learning media material experts' validation is valid criteria, so the material is declared valid. Meanwhile, media validation by media experts is done after the development process is complete. This media validation was conducted by Mathematics Education Lecturer of Universitas PGRI Yogyakarta. This media validation aims to get comments and suggestions for the lack of learning media. So that improvements can be made to the mathematics learning media developed before conducting product trials to students. Data on the results of the material validation questionnaire by media experts are presented in the Table 7.

Table 7. Media Expert Validation Results

Number	Aspect	Average Value	Criteria	Score
1.	Quality of content and purpose	3,40	Valid	17
2.	Instructional quality	3,14	Valid	22
3.	Technical quality	3,50	Very Valid	14
4.	Display quality	3,14	Valid	22
5.	Culture	3,00	Valid	9
Total Score		16,18		84
Average		3,23	Valid	
Validity			Valid	

Validity analysis of learning media assessed from media experts based on aspects of content quality and objectives, instructional quality, technical quality, display quality, and culture respectively get an average score of 3.40, 3.14, 3.50, 3.14, and 3.00, overall the score obtained from the media experts was 3.23. According to media experts' validation, the learning media has valid criteria following the conversion guidelines used in the proof of the material so that the media is declared valid. This validity analysis was supported by the opinions of 5 peer reviewers who stated that in terms of learning media material obtained an average score of 3.11 with valid criteria and in terms of media, getting an average score of 3 with valid criteria. Other data obtained from the mathematics teacher at SMP Negeri 7 Yogyakarta also supports this learning media's validity, namely in terms of material getting an average score of 3.25 with valid criteria and media getting an average score of 3.58 with very valid criteria.

3.5.2. Practical Analysis. A product is said to be practical if it provides convenience and usefulness. Furthermore, the aspects of ease and usefulness are strengthened by obtaining data from opinions or responses from learning media users. The aspects of usefulness include the ability of learning media to

provide learning assistance to users and provide significant results to student learning outcomes. Learning media facilitates students to construct their knowledge with a series of well-structured activities and practice questions. This is useful for students because students are able to learn in groups about square, rectangular, and diamond-split material. It is also beneficial for teachers because teachers are able to maximize activities in the classroom as student-centered learning activities because students have learning media that can be operated on their own with clear guidelines. The calculation of the percentage of learning outcomes per aspect is 80% opening, 100% core, and 75% closing, so the average percentage of learning implementation is 89.47% with good category.

The results of the practicality questionnaire filled out by students through the student response questionnaire also determine the practicality of the learning media and can be seen in Table 8.

Table 8. Percentage of Student Responses to Learning Media

Number	Aspect	Average Value	Criteria	Score
1.	Ease	3,22	Practical	579
2.	Victory	3,16	Practical	569
3.	Usefulness	3,10	Practical	838
Total Score		9,48		1986
Average		3,15	Practical	

Based on student response questionnaire data obtained based on aspects of convenience, attractiveness, and usefulness respectively get an average score of 3.22, 3.16, and 3.10, overall the data obtained from the student response questionnaire gets an average score 3.15 which has practical criteria so that this learning media is practical. Students give a good assessment of this learning media so that this learning media also gets a practical assessment, it can be concluded that this learning media is able to provide convenience and usefulness for students who after using this learning media.

3.5.3. Effectiveness Analysis. A product is said to be effective if it can facilitate the learning process to achieve the expected learning objectives. Quantitatively, the developed media has met effective requirements. This can be seen from the number of students who have completed the post-test or learning achievement test. The average post-test score of students is 78.60, according to the qualification of test scores according to Tabel 4, the post-test of students is included in the effective criteria.

Based on the validity, practicality, and effectiveness analysis, it can be concluded that the Culture-Based Mathematics Square Learning Media Yogyakarta for grade VII students has been developed under the theories and procedures and fulfills valid, practical, and effective qualifications.

4. Conclusion

Media mathematics "Yogyakarta Culture-Based Quadrilateral Learning" developed by the development model ADDIE which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation, has been declared qualified because this learning media has gone through all stages of development and fulfills valid, practical, and effective criteria. The media has been assessed by material experts and gets an overall score of 3.15, which is a valid criterion; the assessment of media experts gets an overall score of 3.23 with valid criteria, so the mathematics learning media is declared valid. Based on the questionnaire data, the students' responses to the mathematics learning media get an average score of 3.15 with practical criteria, so that the instructional media is declared practical. Mathematics learning media developed have been declared effective with an average score post-test student of 78.60.

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