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# Development of interactive multimedia for learning physics based on traditional games

K. Wiyono<sup>1\*</sup>, I. Ismet<sup>1</sup>, S. Saparini<sup>1</sup>

<sup>1</sup>Physics Education Department, Universitas Sriwijaya, Palembang, South Sumatra, Indonesia

\*Corresponding author's email: [ketangw.fkipunsri@gmail.com](mailto:ketangw.fkipunsri@gmail.com)

**Abstract.** This study aims to produce interactive multimedia based on valid and practical traditional games on impulse and momentum material, as well as the effective use of interactive multimedia. This research implements Rowntree development model which consists of planning stage, development stage and evaluation stage. The evaluation stage uses Tessmer formative evaluation (include of self evaluation, expert review, one-to-one evaluation, small group, and field test. Data collection techniques used were expert validation form, student response questionnaire, and learning outcome test. The results of expert validation obtained content validity by 81.56% the category is valid and layout validity 91.87% the category is very valid. The practicality test results at one to one stage were 96.21% the category was very practical and the small group stage was 92.42% the category was very practical. Furthermore, the effectiveness of the use of interactive multimedia developed to learning outcomes is obtained through the field test stage with an n-gain of 0.51 including the medium category. Based on this study it can be concluded that interactive multimedia based on traditional games as an innovation to preserve local wisdom in impulse and momentum materials worthy of use.

## 1. Introduction

The innovation in technology, the new system of telecommunication information network, and the economic growth of the world-wide capitalist countries in the world through cooperation with various nations form an *international division of labor* known as a result of globalization [1]. No doubt if globalization will greatly affects the development of society, especially in the 21st century [2]. The globalization plays a role in linking the process of mutual relations between technological, economical, political and cultural interrelationships [3]. Illustrated that globalization has a direct relation to modernization which gives profound effect in changes of cultural values [4]. As a consequence of modernization creates a barrier between traditional and modern society.

Indonesia is a country which rich in diversity, with 34 provinces, 416 districts, and 98 cities then subdivided into various ethnic groups makes Indonesia having a various cultures which has its uniqueness [5]. The various cultures itself includes traditional houses, indigeneous songs, traditional dance, traditional dress, traditional food, historic sites, customs, traditional games, and so on [6]. The amount of traditional Indonesian games refers to the book written by KPA Koesomadiningrat titled *Serat Saraja* mentioned that traditional games played by children in Indonesia amounted to 60, while in other sources mentions that the number of children's traditional games in Indonesia amounted to 241 [7, 8].

The modernization causes the existence of traditional games began to shift due to the existence of technology which develop the game to be modern in the current global era. The advancement of



technology makes it easy for children to access the internet and easily enjoy modern games such like on line games, video games, etc [9]. The development in modern era also led to the erosion of traditional art including traditional games [10]. The reasons why traditional games needed to be preserved is regarding the various noble meanings that contained in traditional games; such as religious values, educative values, norms, and ethics, which those are [11]. These noble values then embodied in a definition called *local wisdom* that plays a role in regulating the life of Indonesian society [12].

Physics concepts in traditional game, furthermore, provide a potential to be enhanced in such learning media (especially interactive multimedia) through combining the information and communication technology. The technology, academic process in classroom tend to be an inquiry-based learning by providing vary types of references, and engaging students in expressing their own opinions [13]. The use of technology in classroom during learning performance might encourage students to participate directly in teaching-learning process and to comprehend the material faster [14]. Technology might also enable educators to provide feedback to pupils during learning process [15]. During learning activities in class, technology is usually used as a tool to access information resources rather than as a process-based tool for knowledge building [16]. By developing a traditional games-based interactive multimedia, it is an innovation for learning activities—through integrating science and technology in order to understand the physics material and also an effort to preserve the values of local wisdom. Therefore, the purpose of this study is to produce a valid and practical learning media and can be adjusted to students' needs. This study aims to develop a traditional games-based interactive multimedia which further will be validated, assessed, tested, and revised in order to know the quality of interactive multimedia for those material.

Due to several kinds of ethnic games in South Sumatera, this research attempts to enhance a technology-based material in physics learning by involving those phenomenon as real concepts. This product developed might improve student knowledge not only in academic aspect but also local value. Furthermore, culture literacy tends to be prominent for pupil's nationalism. By providing integrated learning with local wisdom, student's awareness in local culture identity are indirectly built.

Development research of interactive multimedia based on traditional games as an innovation media for preserving local wisdom in impulse and momentum is a continuation of previous research with additional material. This research attempts to develop a valid and practical interactive multimedia using traditional games-based that capable for every physics material taught in secondary schools.

## 2. Method

This study uses Research and Development method which consists of three stages planning, developing, and evaluating for which formative evaluation by Tessmer is conducted [17]. The research was conducted in SMA Negeri 1 Sirah Pulau Padang Distrik of Ogan Komering Ilir with purposive sampling technique. The research sample was class X MIA 3 SMA Negeri 1 Sirah Pulau Padang consist of 32 students.

Types of data that obtained from the study in the form of qualitative and quantitative data. Quantitative data was obtained through the results of the questionnaire at the expert review stage and student feedback questionnaire using the Likert scale in order to define the validity and practicality level of interactive multimedia developed based on traditional games. Data collection to determine the effectiveness of using interactive multimedia based on traditional games using tests. While the qualitative data obtained through suggestions and comments are considered for revising purpose.

Data collection instruments were carried out using test sheets, questionnaires, observation sheets, and expert judgment sheets. Qualitative data to determine the validity and practicality of the product were analyzed by finding an average value and then categorized according to the level of validity and practicality [18][19]. Data analysis to determine the effectiveness of using interactive multimedia based on traditional games of impulse material and momentum through determination of N-gain [20].

## 3. Result and Discussion

### 3.1. Planning Stage

At this stage the traditional games are analyzed regarding physics content in order to find concepts and principles of physics which further is adjusted to the material of physics in accordance with the high school curriculum. The focus criterion of this study is only a game that uses tools when playing it. Mapping the traditional game on several physics concept is outlined in Table 1.

**Table 1.** Mapping the traditional game on the concepts of impulse and momentum

No	Physics Material	Traditional Games	Amount	Percentage
1.	Kinematics	Gasing, Egrang, Boi-Boian, Marbles, Bekel Ball, Gatrik, Kasti, Lenggang Rotan, Pa'raga, Pletokan, Mallogo, Begelindingan Ban, Ketapel	12	24.49%
2.	Dynamics	Gasing, Boi-Boian, Marbles, Gatrik, Kasti, Kite, Lenggang Rotan, Ngadu Muncang, Mallogo, Begelindingan Ban, Bakiak, Tarik Tambang	13	26.53%
3.	Work and Energy	Boi-Boian, Marbles, Bekel Ball, Gatrik, Kasti, Kite, Pa'raga, Pletokan, Mallogo, Begelindingan Ban, Ketapel	11	22.45%
4.	Momentum and Impulse	Boi-Boian, Marbles, Bola Bekel, Gatrik, Kasti, Ngadu Muncang, Pletokan, Mallogo	8	16.33%
5.	Equilibrium Rigid Body	Gasing, Egrang, Lenggang Rotan,	3	6.12%
6.	Heat and Temperature	Meriam Bambu	1	2.04%
7.	Elasticity	Ketapel	1	2.04%
	Sum		49	100%

Based on Table 1 it is apparent that the dominant physics material can be found in traditional game are: dynamics, kinematics, and work and energy with proportion by 26.53%, 24.49% and 22.45% respectively. Based on the curriculum component in high school, the majority concepts and principles of physics that exist in the traditional game were in class X and XI. Table 2 presents the proportion of physical materials that contained in traditional games based on curriculum component in terms of their basic competencies [21].

Table 2 presents the proportion of physics material in classes X and XI based on the basic competencies of physics subjects in the class, then states the relevance of the concept with traditional games in the form of percentages. Based on the data in Table 2 it is obtained that for: 1) class X, the concept of dynamics and effort and the most energy is found in traditional games at 22.92%; 2) class XI, the concept of the most rigid body balance in traditional games is 75%.

**Table 2.** Proportion of physics material based on basic competency (BC) in high school.

Class X				Class XI			
BC	Material	Amount	%	BC	Material	Amount	%
3.4		9	18,75%		Equilibrium		
3.5	Kinematics	4	8,33%	3.1	Rigid Body	3	75%
3.6		4	8,33%				
3.7	Dynamics	11	22,92%	3.2	Elasticity	1	25%

3.9	Work and Energy	11	22,92%			
3.10	Momentum and Impulse	9	18,75%			
	Sum	48	100%	Sum	4	100%

Apparently from data supplied, some traditional games can perform as an example during learning physics. Some physics materials that can be associated with traditional games are kinematics and dynamics which include straight motion materials, circular motion, projectile motion, Newton's Law and impulse momentum. Therefore, those materials are involved in developing an interactive multimedia based on traditional game with impulse and momentum material.

### 3.2. Developing Stage

The design development stage is preceded by finding the initial interactive multimedia design draft include: (1) preparation the draft of physics learning by making material analysis and concept analysis; (2) the preparation of learning strategies with the utilization of interactive multimedia based on traditional games to improve the mastery of student concepts; (3) preparation of evaluation instruments: objective tests, observation guidelines, questionnaires for lecturers, teachers and students.

The next stage of development is the production of interactive multimedia prototypes using Adobe Flash Professional CS6. The product developed in the form of interactive multimedia based on traditional game of impulse material and momentum is then referred to as prototype 1 before proceeding to the evaluation stage.

### 3.3. Evaluating Stages

*Self-Evaluation.* Through this stage, the initial product named as prototype 1, is self checked before entering the expert review stage. Several errors founded regarding the animation motion and text. Those faults are personal revised and checked by expert in further stage.

#### 3.3.1. Expert review.

Traditional games-based interactive multimedia products that have been developed then validated by experts that include content experts and layout experts. A validation questionnaire filled by experts will determine the validity of the interactive multimedia. In addition, feedbacks and suggestions are obtained for revising the developed interactive multimedia furthermore labelled as Prototype II. In the lesson of impulse momentum material, for instance, it is needed to add a relation between  $I$  and  $\Delta t$  through line graph, clarify the concept of  $\Delta p$ , and fix the page consist image of car that crashing against the wall. Those experts' suggestions then used for revision reference. Validation results are showed in Table 3.

**Table 3.** Validity of interactive multimedia based on traditional games in impuls and momentum material.

	Content	Layout
<i>Percentage</i>	81.56%	91.87%
<i>Category</i>	Valid	Very Valid

### 3.3.2. One to One and Small Group Evaluation.

In one to one evaluation stage, the initial product is tested to three students by providing a questionnaire containing indicators on interactive multimedia assessment. Furthermore, students' comments on the one to one evaluation stage are used for revising purpose further named as Prototype II. Small group stage, therefore, aims to determine the response to the developed interactive multimedia in small scale consists of nine students.

**Table 4.** Practicality results of developed interactive multimedia in impuls and momentum material.

	<i>One-to-One Evaluation</i>	<i>Small Group</i>
Percentage (%)	96,21%	92,42%
<i>Category</i>	very practical	very practical

### 3.3.3. Field test.

The valid and practical traditional games-based interactive multimedia on impulse and momentum material are tested to research's subject for determining the product effectivity.

**Table 5.** Effectivity of interactive multimedia-based on traditional games for impulse and momentum materials.

Stage	Pre-test	Post-test	N-gain
Score	44,63%	75,46%	0,51
		category	medium

Interactive multimedia based on traditional games of impulse and momentum material that is valid, practical and effective has been successfully developed. Previous researchs state that incorporating ideas about local wisdom through problem identification, wisdom recovery, and integrating knowledge is one of the important steps to face the era of globalization that is happening faster in the fields of science and technology [22, 23]. Further research related to the analysis of the need to use various media in the form of audio, visual and narrative as well as physical content related to local wisdom that is packaged into a related unit in the form of multimedia learning moduls and the results are obtained that teachers and students are equally interested in learning to use media which has been developed [24].

The results of subsequent studies obtained that the Android-based learning media with local content in the form of othok-othok games can improve the competence of diagrammatic and argumentative representation in physics learning [25]. Similar research shows that local wisdom-based learning media have been developed that are feasible to use and are able to improve vector representation and diagram representation ability [26]. In addition, performs a research regarding indigeneous games-based learning in physics, and shows that it could influences pre-service teacher in term of conceptual changes and way of thinking [27]. This research conducted by involving 28 prospective teachers group of physics education departments' collegian at the University of Philippines, in purpose to examine the relation between combined traditional Filipino games in learning process with collegians' understanding in Newton's Law concepts. Although previous studies have discussed local wisdom, there have not been many studies that have focused on traditional games, especially in various regions in Indonesia as part of that local wisdom.

#### 4. Conclusion

In summary, it can be concluded that interactive multimedia based on traditional games as an innovation to preserve local wisdom in impulse and momentum materials are valid, practical, and effective categorized.

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