Development of Physics Learning Multimedia with Tutorial Model Based on Local Wisdom '*Tebing Gerinting*' for Middle School

Linda Lia* & Sugiarti
Physics Education Study Program, Universitas PGRI Palembang, Indonesia
*Corresponding Author: lindalia@univpgri-palembang.ac.id

Received: 20 November 2022; **Accepted**: 20 December 2022; **Published**: 24 December 2022
DOI: http://dx.doi.org/10.29303/jpft.v8i2.4404

Abstract *- The research is aims to develop a physics learning multimedia with tutorial model based on the local wisdom of Tebing Gerinting in junior high schools which is valid, practical, and has potential effects. This type of research uses development research from Akker with Rowntree model which consists of planning, development, and evaluation. Tessmer's formative assessment is the one that is being used in this research. Data was collected by documentation, walkthroughs, interviews, questionnaires and tests. From the conclusions of the review by experts, it was obtained an average of 0.93 in the very valid category. From the one-to-one results, an average of 1 is in the very practical category. At the small group stage, 3.48 on averages, with a very practical category, was discovered. Field trials showed an average N-Gain percentage of 56.17%, which fits into the category of fairly effective results. Therefore, it can be concluded that the learning physics multimedia with tutorial model based on the local wisdom of Tebing Gerinting is very valid, very practical, and has a potential effect on learning outcomes. The average percentage of N-Gain, which is at a fairly effective level, and the improvement in student learning outcomes are two examples of the potential effect that show how successfully the multimedia products generated are used in learning.*

Keywords*: Multimedia; Local Wisdom; Tutorial Model.*

INTRODUCTION

The challenge in the field of education is to develop human resources (HR) who can compete on a global scale and change with the times. The industrial revolution 4.0, which is now moving toward the industrial revolution 5.0, as well as the need for students to acquire 21st century skills are among these challenges. In addition, the results of the PISA test which is held every three years by the OECD to measure the reading literacy, mathematical literacy, and scientific literacy abilities of 15-year-old students.

Indonesian students' scientific literacy scores are still relatively low compared to other countries. Based on data from PISA test for scientific literacy in 2018, Indonesian students obtained a score of 396 and ranked 70th out of 78 participating countries (OECD, 2019). This outcome serves as both an example of the science knowledge that Indonesian students possess and a reflection of the current, deficient condition of science education.

One of the subjects covered by scientific literacy is physics. Students view physics as a challenging topic (Samudra, Suastra, & Suma, 2014). According to the results of the survey, up to 51% of students said physics was difficult to understand because there were too many formulas, and up to 33% said it was very tough to master because physics principles are typically encountered in everyday life (Azizah, Yuliati, & Latifah, 2015).

Learning physics can be challenging for a number of various reasons, including challenges with math, understanding concepts, and formulas, as well as internal and external influences from students (Daun, Helmi, & Haris, 2020). Internal factors consist of interest, motivation, talent, and intelligence while external factors consist of family, teachers, and school (Kallesta & Erfan, 2017).

Students' difficulties in learning physics are a challenge for schools and teachers in preparing better physics lessons. Because physics examines natural elements and phenomena that occur frequently in daily life, physics education must be factually portrayed (Hernawati, 2018). Physics is also the basis for the development of science and technology (Khoiri, Wijaya, & Kusumawati, 2017).

Science includes physics. Learning that can lead to literacy is required for science or science-related courses (Afriana, Permanasari, & Fitriani, 2016). Local wisdom-based learning can be applied in one of this research. Local wisdom can serve as a source of physics literacy to help students learn the subject more effectively (W. Sari et al., 2020). Additionally, the learning process that integrated with local wisdom, will help students comprehend science and apply the concept in their daily lives (Atabikrifki, Martawijaya, & Jasaruddin, 2018).

There are many different types of local wisdom dispersed throughout South Sumatra. These local wisdoms include the *Limas* house, various traditional dances (*Gending Sriwijaya, Tanggai, Mejeng Basuko, Rodat Cempako, Tenun Songket,* etc), traditional clothes: Aesan Gede and Aesan Paksangko, traditional weapon such as Trident Spear, various folk songs (*Pempek Lenjer, Kabile-bile, Dirut, Dek Sangke*, etc), traditional foods (*Kemplang, Pindang, Burgo*, etc), various tribes and languages (Alimin, 2018). The diversity of local wisdom still has to be preserved and imparted to students in schools, among other things.

For local wisdom's principles to endure over time, it is crucial for students to understand it. Local wisdom is a way of thinking that is embraced, appreciated, ingrained, and practiced by a community, and the outcomes of these ways of thinking can also be produced by reasoning about causes and effects using scientific knowledge (W. Sari et al., 2020). Thus, a local wisdom can come from the results of scientific thinking.

Local wisdom can be taught in schools via a multimedia presentation. By using multimedia, students can learn to understand physical phenomena that originate from local wisdom. Multimedia is a tool for students to understand abstract physics material, especially contextual events in daily life. Multimedia has a significant effect on students' cognitive abilities (Khoiriah, Jalmo, & Abdurrahman, 2016). Depending on their different learning styles and paces, the usage of multimedia can aid students in understanding the topic.

Learning with multimedia can be made using the tutorial model. The tutorial model is a computer-based learning (CBL) model that can guide students in learning. The learning outcomes using the tutorial model of computer-based learning are slightly better than the CBL drill model (Desfiyani, Suyidno, & Hartini, 2014).

A physics learning multimedia model based on local knowledge in *Tebing Gerinting* can support students in understanding physics concepts by showcasing local knowledge in *Tebing Gerinting* Village. Students can review multimedia content again if they don't fully comprehend it. Additionally, multimedia can be used to give practice questions.

Studies that related to this research are: identification of the local wisdom of the province of South Sumatra as an object of scientific literacy (W. Sari et al., 2020); Development of Palembang local wisdom-based physics comics in high schools

(Wahyuni & Lia, 2020); Development of local wisdom-based physics student books (*Maja Labo Dahu*) at Islamic Senior High School 1 in Bima City (Atabikrifki et al., 2018); Development of local wisdom-based science learning multimedia in elementary schools (Andriana, Vitasari, Oktarisa, & Novitasari, 2017). Najib, Ulfa, & Sulthoni (2019) developed an interactive learning media for *Banyuwangi* local wisdom for fifth grade elementary school students.

Local wisdom serves as a source of contextual physics learning and provides intriguing research material that is then packaged as a multimedia learning tutorial model for use as a learning tool for students.

The aim of this research is to develop an effective, practical, and potentially effective multimedia tutorial model for teaching physics in junior high schools based on the local knowledge of *Tebing Gerinting*. The findings of this study also have theoretical and practical implications for educators, learners, and other researchers.

RESEARCH METHODS

The type of this research is a research development (RD) with Rowntree model (Akker, 1999; Prawiradilaga, 2015). The Rowntree model's stages, as shown in Figure 1, are as follows.

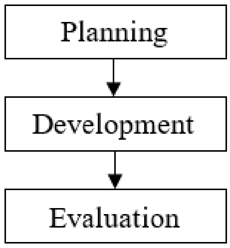

Figure 1. The Rowntree Model's phases

The Rowntree model consists of the following stages: (1) planning, which consists of analysis and determining objectives; (2) development, consists of drafting and producing prototypes; and (3) evaluation (evaluation) which used a formative evaluation cited from Tessmer (1993) depicted in a diagram as shown in Figure 2.

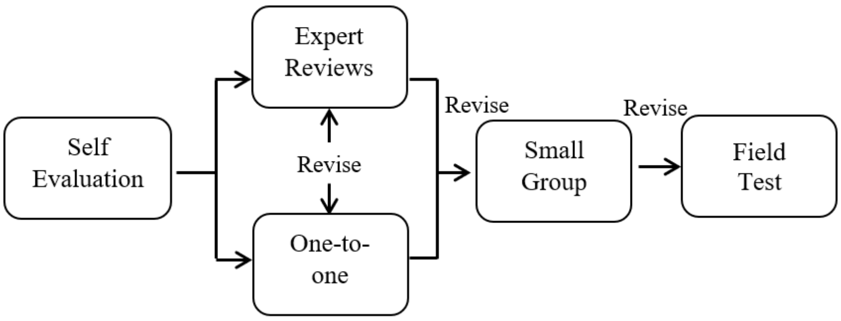

Figure 2. Tessmer Formative Evaluation Stages

Based on the figure above, Tessmer's formative evaluation consists of five stages, namely self-evaluation, expert reviews, one-to-one trials, small group trials, and field tests. Multimedia developers assess themselves by analyzing and scrutinizing early prototype drafts. Expert walkthrough evaluations were conducted by media and design professionals, materials experts, and language specialists. Three students representing the high, medium, and low learning groups participated in one-on-one trials on individual students. Nine persons were assessed in small groups for small group trials. Field tests were conducted in actual courses.

Students in the seventh grade at one of the Palembang state junior high schools served as the research subjects for this study. The odd semester of the school year 2021–2022 was used for this study.

The research data was collected using documentation, walkthrough, interviews, questionnaires, and tests. Documentation is used to collect initial research data. Walkthrough is a validation carried out by experts. Interviews were used to carry out initial analysis and practicality of multimedia. Students were given questionnaires to complete in order to assess the effectiveness of multimedia. The product's potential impact on student learning outcomes is assessed using the exam.

The data obtained from the results of the *walkthrough* were analyzed descriptively and qualitatively. Scores obtained from expert reviews are averaged and grouped into five levels (modification from Widoyoko, 2012): very valid (range: 0,81 - 1,00), valid (range: 0,61 - 0,80), less valid (range 0,41 - 0,60), not valid (range 0,21 - 0,40), and very not valid (range: 0,00 - 0,20).

At the stage of the one-on-one test, interviews were held. The results of the one-to-one test were averaged and divided into five levels (modification from Widoyoko, 2012). These five levels are: very practice (range: 0,81 - 1,00), practice (range: 0,61 - 0,80), less practice (range: 0,41 - 0,60), not practice (range: 0,21 - 0,40), and very not practice (range: 0,00 - 0,20).

A Likert scale was used to evaluate the questionnaire that was given out during the small group test. The questionnaire's average score is divided into four levels: (modification from Widoyoko, 2012) very practice (range: 3,26 - 4,00), practice (range: 2,51 - 3,25), not practice (range: 1,76 - 2,50), and very not practice (range: 1,00 - 1,75).

The actual class was utilized throughout the field test phase. The possible impacts of multimedia on learning outcomes can be discovered through field tests. Scores from the field test's pre- and post-test findings were calculated with SPSS ver. 25 along with N-gain equation (Hake, 1999) below.

$$N\ Gain = \frac{Skor\ Posttest - Skor\ Pretest}{Skor\ Ideal - Skor\ Pretest} \quad \text{.........(1)}$$

According to the percentage of N-Gain outcomes, the effectiveness level category is divided into four categories: ineffective (score range 40), less effective (score range 40–55), highly effective (score range 56–75), and effective (range of values > 76) (Hake, 1999).

RESULTS AND DISCUSSION

Stage 1: Plan

The plan stage begins with the formulation of a needs analysis including media analysis, material analysis, and analysis of student characteristics. The media that has been used in junior high schools in this study has nothing to do with local wisdom. From the analysis of the material carried out, it was obtained that one of physics concept: ‘the heat and its transfer materials’ were integrated in the multimedia which is for seventh grade student.

The next step after the needs analysis are analyzing learning objectives including syllabus analysis, determining competency standards (SK) and basic competencies (KD), setting indicators and learning objectives. Learning indicators for physics concept ‘heat transfer’ include: (1) defining heat; (2) calculating a substance's heat; (3) describing the process of changing form according to *Tebing Gerinting* village local wisdom; and (4) calculating a substance's latent heat. 5) Recognize how heat is transferred by radiation, convection, and conduction.

Stage 2: Development

Drafting is the first step in the development stage. Drafting aims to create paper-based designs from multimedia and create evaluation tests instrument. Additionally, evaluation tests instrument in the form of questionnaires for expert validation, one-on-one interview sheets, small group questionnaire sheets, and pre- and post-test questions for the field test stage were produced.

The process of creating prototypes comes after drafting. The first iteration of a multimedia creation is called a prototype. The construction of the contested prototype include creating a computer-based design of multimedia employing electronic gadgets, elementary software like *PowerPoint*, and video editing software like *Adobe Premiere*.

Stage 3: Evaluation

Self Evaluation

After the original product is created, self evaluation is conducted. A number of elements were changed as a result of the multimedia's self-evaluation, including the color of the multimedia, which was initially dominating and changed from light brown to blue.

Figure 3. Initial Appearance

Then, we can reposition the multimedia navigation buttons as they do not correspond to their current location. Prototype 1 is the name of the first multimedia item. Here is an image of the original multimedia display before it was changed.

Figure 3 shows how the multimedia originally looked before the self-evaluation was revised. The navigation buttons are on the right, and the predominant hue is brown. But subsequent revision of the multimedia display as depicted in the following figure.

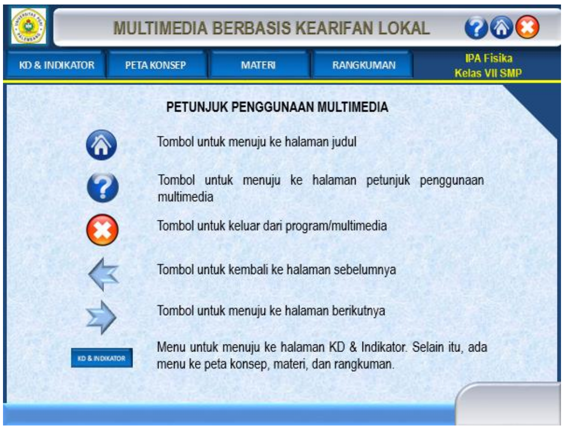

Figure 4. Multimedia Appearance After Revision

Figure 4 demonstrates how blue color is utilized most frequently. The top of the page has the navigation buttons. In comparison to the initial presentation made before the self-evaluation was completed, this show is excellent and more captivating.

Expert Review

Expert review is carried out by validating prototype 1. The following is the questionnaire instrument specification used in expert validation.

Table 1. Expert Validation Questionnaire Specification

Aspects	Indicators	Number of Item
Concept	Conformity of material description with basic competence	1, 2, 3
	Actuality of Material	4, 5, 6, 7, 8
	Learning support materials	9, 10

Aspects	Indicators	Number of Item
Media and Design	Display technique	1, 2
	Display advisability	3, 4, 5
	Graphic advisability	6, 7, 8
Language	compatibility with students' developmental stage	1, 2
	Communicative	3, 4, 5, 6, 7, 8
	Integrity and coherence of the thinking process	9, 10

(Zunaidah & Amin, 2016)

Based on the previous specifications, validation by professionals includes linguists, media and design experts, and material experts. There are indications for each facet, which are then converted into several statement items. There are 10 statement items in the material aspect, eight statement items in the media and design aspect, and ten statement items in the language aspect. The outcomes of the expert review of prototype 1 are summarized in the sentences that follow.

Table 2. Results of Expert Review Recapitulation

Aspect	Average Score	Category
Material	1	Very Valid
Language	0,8	Valid
Media & Design	1	Very Valid
Average Score	0,93	Very Valid

Table 2 provides the average value of the assessment results at the expert validation stage, which is 0.93. Prototype 1 falls under the extremely valid group, according to this value.

Comments from material experts, namely prototype 1, are very interesting and contextual for use in learning. Media and design experts also provide advice regarding videos used in multimedia.

One to One

Three students with talents in the high, medium, and low categories were interviewed in one-to-one trials. The student tried prototype 1 before being interviewed after viewing and viewing it.

The interview guide was created using three indicators of students' attitudes toward multimedia (as modified by Widoyoko, 2012), namely: (1) understanding or cognition, which totals five statements; (2) expressing enjoyment or interest or affection, which totals four statements; and (3) tendencies to act or conation, which totals one statement.

The outcomes of the one-to-one studies are summarized here in Table 3.

Table 3. One-on-one Trial Results

Students	Average	Categories
1	1	very practical
2	1	very practical
3	1	very practical
Average	1	very practical

An average value of 1 was established in the one-to-one experiment based on the previous data. This demonstrates that prototype 1 fits under the heading of being really useful. Additionally, student 1 makes the idea that the material's formula be further clarified through video demonstrations.

Prototype 1 is improved using the findings of expert validation and one-on-one testing as a foundation. Additionally, the restored version of prototype 1 becomes prototype 2.

Small Group

With the help of nine students with high, medium, and low ability levels, small group trials were conducted. Prototype 2 is presented to the student, who is then required to respond to a questionnaire.

The one-on-one trial interview specification and the small group questionnaire specification both included the same indications, but the statements of the indicators varied. There are five statements each for the cognition indicators, five statements each for the affective indicators, and five statements each for the conation indicators. There are fifteen statements in all in the small group questionnaire.

The findings of small group trials are summarized here in Table 4.

Table 4. Results of a Small Group Trial

Student	Average	Categories
1	3,07	Practice
2	3,67	Very Practice
3	3,33	Very Practice
4	3,60	Very Practice
5	3,60	Very Practice
6	3,33	Very Practice
7	3,73	Very Practice
8	3,47	Very Practice
9	3,53	Very Practice
Average	3,48	Very Practice

The average score from the preceding table is 3.48, which places prototype 2 in the very practical category. Prototype 3 is an upgraded version of prototype 2 that was created following the small group experiment. Next, a field test is conducted with prototype 3.

Field Test

Field tests are conducted in actual classroom settings. Class seven-five, which has a total of thirty two students, is the one being used.

Before using prototype 3 to implement learning, students must respond to pre-test questions. Students also receive post-test questions after utilizing prototype 3. The average of the pre-test and post-test findings is as follows.

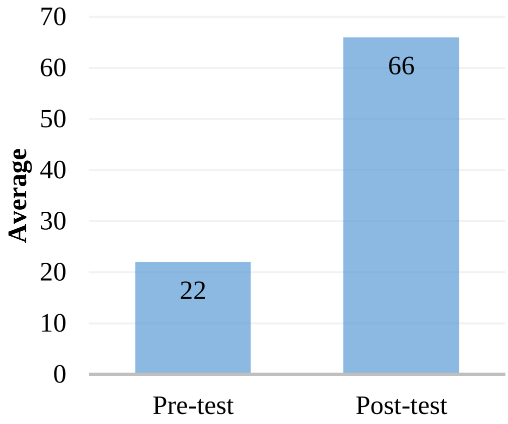

Figure 5. Comparison of Pre-test and Post-test scores

The pre-test average was 22 and the post-test average was 66, as seen in the figure above. The average value of 44 has increased as a result of these findings. Additionally, the percentage value of N - Gains formula is used to process the pre-test and post-test results. The outcome of using the SPSS 25 program to group the proportion of N-Gain values is shown in the table below.

Table 5. N-Gain Values Categories

	Frequency	%	*Valid %*	*Cumulative %*
<40% = Ineffective	6	18.8	18.8	18.8
40-55% = Less Effective	8	25.0	25.0	43.8
56-75% = Moderately Effective	14	43.8	43.8	87.5
>76 = Effective	4	12.5	12.5	100.0
Total	32	100.0	100.0	

According to the data in Table 5, 6 students fall under the "ineffective" category for N-Gain scores, 8 students fall under "less effective," 14 students fall under "moderately effective," and 4 students fall under "effective." The information can then be created as a bar graph as seen below.

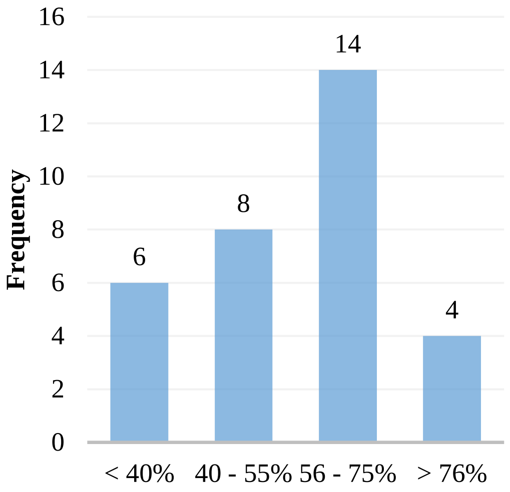

Figure 6. N-Gain Value Percentage Grouping

The bar graph in the image above with a slightly effective category shows the frequency of the largest percentage of N-Gain values in the range of 56 to 75%. The results of using SPSS 25 to determine the average percentage of N-Gain values is as follows.

Table 6. N-gain Percentage Average Score

		Statistic	Std. Error
N-Gain Percentage	Mean	56.1722	2.81626
	95% Confidence Interval for Mean — Lower Bound	50.4284	
	95% Confidence Interval for Mean — Upper Bound	61.9160	
	5% Trimmed Mean	56.1754	
	Median	57.5368	
	Variance	253.803	
	Std. Deviation	15.93119	
	Minimum	25.37	
	Maximum	85.71	
	Range	60.34	
	Interquartile Range	14.29	
	Skewness	-.071	.414
	Kurtosis	-.135	.809

It is seen from the following table that the percentage of N-Gain ranges from 25.37% to 85.71% at its lowest and highest values, respectively. Additionally, the average N-Gain value of 56.1722% fits into the category of being highly effective. This demonstrates that prototype 3, which was put through field trials, was quite effective for learning, indicating that the multimedia employed might have an impact on the outcomes of learning in the cognitive domain.

According to N. Sari, Suryanti, Manurung, & Sintia, (2017), The use of multimedia in the learning process increases efficiency and effectiveness in reaching the targeted learning objectives. Additionally, using multimedia helps lower learning hurdles and boost enthusiasm for learning (Wei, He, & Huang, 2018). Multimedia aids in subject matter comprehension for students (Rahmi, Hartini, & Wati, 2014). Additionally, multimedia benefits pupils' capacity for scientific literacy (Agustina, Andinasari, & Lia, 2020).

Students are very eager to learn how to use this multimedia resource based on local wisdom. It is believed that due to the fact that they may observe actual phenomena, learning media can grab students' interest and enhance learning results (Tazkia, Sahyar, & Juliani, 2019). Wardani & Endahati (2019) Because multimedia includes audio, video, images, and text that can be seen and heard, explaining it to student might pique their curiosity or enthusiasm in learning. A computer acts as the driver for a variety of media that are combined to form multimedia (Widodo, An'nur, & Mahardika, 2017).

In this study, multimedia is utilized in a computer-based learning tutorial format. In comparison to the drill model, the results indicated that students performed better while using the tutorial model of computer-based learning (Desfiyani et al., 2014).

The following is one of the pictures from the developed local wisdom-based multimedia.

Figure 7. Multimedia Based on Local Wisdom

Figure 7 shows how the multimedia created is based on *Kemplang Tunu*, a type of local knowledge. A specialty of *Tebing Gerinting* Village in South Indralaya District, *Ogan Ilir* Regency, South Sumatra, is *Kemplang Tunu*. Additionally, the residents of *Tebing Gerinting* Village have been passing down their knowledge of *Kemplang Tunu* as a home-based business from generation to generation.

In the multimedia, we also insert a video that explains how to process *Kemplang Tunu*, which means the process of making *kemplang* dough, boiling kemplang, drying kemplang, and baking kemplang. In addition of this, the multimedia also provides the information about the correlation between heat and displacement materials with the *Kemplang Tunu*.

Integrating local wisdom in learning as an effort to preserve local wisdom can facilitate and attract students' attention (Andriana et al., 2017). With this, the interactive learning tools for local wisdom from Banyuwangi produced fairly impressive test results (Najib et al., 2019).

There are a lot of benefits in using multimedia for learning. However, the developer's design for the multimedia ultimately determines how well multimedia is used in education (Gunawan, Harjono, & Imran, 2016).

CONCLUSION

The average value of the expert's evaluation results at the expert validation stage was 0.93, with a very valid category. The findings of the one-to-one experiment indicate that the very practical category has an average value of 1. The average score in the extremely practical category for the small group trials was 3.48. The average N-Gain score in the field experiments was 56.17%, which is extremely successful and indicates that the created multimedia may have an impact on learning outcomes. The result reached is that the multimedia physics learning tutorial model developed in junior high schools based on the traditional knowledge of the *Tebing Gerinting* is declared to be extremely valid, extremely useful, and may have an impact on learning outcomes.

The design of multimedia could be more appealing, and it should consider the selection criteria for educational media. Other scholars can add additional, more varied local wisdom content if they want to create multimedia based on local wisdom.

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