

# Physics Ludo Integrated With Scientific

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## Physics ludo integrated with scientific literacy as a Newton's law learning media

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**Abstract** Newton's Law, as a part of the topic in physics learning, is a fundamental knowledge that should be understood by students. However, most students find it hard to understand the material due to the lack of motivation to learn physics. The researchers proposed a famous game called physics ludo to solve the problem. The physics ludo game is a tool to know the feasibility and attractiveness of science because it contains problem formulation in Newton's Law material. The researchers investigate the students' responses to the media. The model used in this research is ADDIE (Analyze, Design, Development, Implementation, and Evaluation). The subjects of this study were 78 high school students from three different senior high schools. Instruments of data collection used were questionnaires given to the material expert, media expert, religious expert, teacher, and students to test the feasibility of the physics ludo game. The results of this study show that the media is highly feasible with a percentage of 87% from the material expert after being revised, the percentage from the media expert is 88% with a highly feasible category, the percentage from the religious expert is 95% with a highly feasible category, the percentage from the teacher is 89% with a highly feasible category, and the percentage from the students is 82% with a highly feasible category.

Keywords: Newton's Law, Physics Learning Media, Physics Ludo Game, Science Literacy.

### 1. Introduction

Bernie Trilling and Charles Fadel as one of the honorary members of the Partnership for 21<sup>st</sup>-Century Skills (P21) state that the important skills of the 21<sup>st</sup>-Century are creativity and innovation [1]. P21 is a non-profit organization of various elements consisting of educational thinkers, policymakers of National Education Association (NEA), to the world's leading information technology companies such as Apple Computer and Microsoft Corp[2]. Creativity is defined as the skills to find new things that did not exist before to reach new solutions to each original, varied, and unique problem. Creativity in using media for the learning process can support the achievement of learning objectives as well as to facilitate learning activities. [4], [5]

Learning media play an important role in preparing students to develop creativity skills especially in learning physics which is often deemed unattractive. Most teenagers, aged 15-20 years, prefer to play around rather than learning. For this reason, the development of instructional media in the form games is expected to increase students' interest in learning especially physics. The development of physics learning media through the ludo game is expected to be able to raise the enthusiasm in learning. Ludo



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game is popular among teenagers. In this study, the researchers developed a physics learning media called Physics Ludo. Through the development, it is hoped that students can help each other in learning [6]. Physics Ludo can be played by two to four students with the use of dice and pawns [7]. Physics Ludo is played by running a pawn from the starting line to the finish line [8]–[10]. The developed Physics Ludo is based on scientific literacy. Scientific literacy is an ability that must be possessed by students to be able to solve problems using scientific evidence [9], [11], [12]. Scientifically important evidence should be owned by students [13].

PISA (Program for International Student Assessment) measures the level of scientific literacy, mathematical literacy, and literacy in reading at critical ages of 15 or older [14], [15]. In the Physics Ludo, there are interesting materials and pictures and are equipped with Newton's Law questions. Physics Ludo aims to increase the knowledge of students and make them realize that physics is a subject that is closely related to everyday life. Scientific literacy is derived from a combination of two Latin words namely *litteratus* which means educated and *Scientia* which means to know [16][17]. Scientific literacy is also defined as an ability that allows a person to be able to solve a problem with the knowledge and concepts of knowledge [9][12]. Scientific literacy is scientific knowledge owned by someone and uses that knowledge to identify questions, gain knowledge, explain scientific phenomena, and describe scientific events (issues) using scientific (legal, principle, concept) evidence [8][9]. In a simpler sense, scientific literacy is the ability to use scientific knowledge, identify problems, and draw conclusions based on evidence to understand and make decisions about nature and its changes as a result of human activities. The researchers choose learning media of scientific literacy because students find it easier to understand classroom learning by using examples in daily life or with available scientific evidence. The use of instructional media can facilitate students in learning activities carried out in class.

Based on the description above, it is expected that the Physics-Ludo integrated with scientific literacy has the potential as a learning media. For this reason, this research was conducted to determine the feasibility and attractiveness of the media in learning physics, especially Newton's Law material. In the end, the contribution of this research is expected to be a general learning option so that students can easily participate in learning accompanied by examples in daily life.

## 2. Method

The method used in this research is Research & Development. The development model used is the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation) [18], [19]. The data collection was carried out using non-test instruments in the form of validation sheets for material expert, media expert, religious expert, and student responses. Data analysis was performed to obtain the feasibility of the developed learning media after it was revised. The test instrument used was a questionnaire with Likert Scale. Likert scale was used to measure the attitudes, opinions, and perceptions of a person or a group about social phenomena [20] [21]. In this research, the scale of 1 to 5 was used with 5 as the highest score and 1 as the lowest score. The percentage of the validity results was obtained using the formula: [22]

$$V = \frac{T}{U} \times 100\%$$

Description:

V = Validity

T = Validity Score obtained

U = Maximum Validity Score

While the percentage of total assessment scores can be calculated using the following formula: [23]

$$P = \frac{\sum X}{\sum Xi} \times 100\%$$

Description:

P: Percentage

$\sum X$ : Number of respondent answers in one item

$\sum Xi$ : The ideal score of items

Then the percentage of validation criteria was calculated. The criteria can be seen in the following table.

**Table 1.** Scale Interpretation Criteria [24]

Criteria	Interval
Highly Not Feasible	$0 < X \leq 20\%$
Not Feasible	$20 < X \leq 40\%$
Quite Feasible	$40 < X \leq 60\%$
Feasible	$60 < X \leq 80\%$
Highly Feasible	$80 < X \leq 100\%$

### 3. Results and Discussion

This preliminary analysis stage was carried out by interviewing a teacher and distributing questionnaires to the tenth-grade students. The purpose of the preliminary study was to obtain preliminary data. Interviews were conducted with the teachers to find out the curriculum used in the schools. The curriculum used in the SMA Negeri 1 Way Kenanga, SMA Negeri 1 Banjar Agung, and SMA Negeri 1 Banjar Margo is the 2013 curriculum. Media analysis was conducted to find out the media used by the teachers for the learning process in the class. The learning process carried out in class still used printed media that are considered less attractive for students. This caused passive students when the learning process took place. The use of less interesting media causes the students to be lazy in learning.

Based on the observation of learning media used by the teachers, it was found that the teachers were not maximizing the use of media provided by the schools so that the learning process in class became boring. The teachers also never developed Physics Ludo equipped with questions related to everyday life.

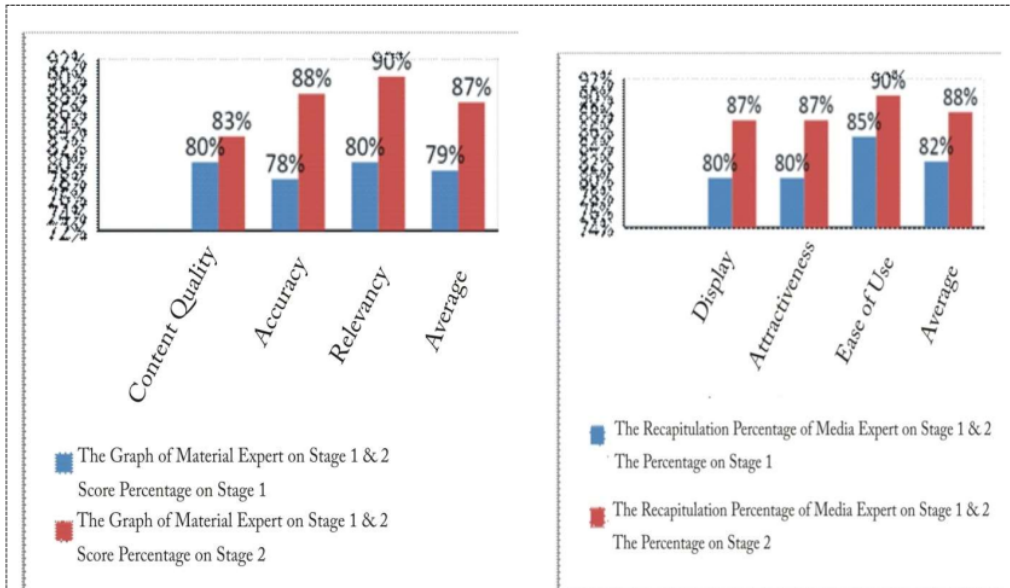
The needs analysis, the next stage was the design stage. Physics Ludo was designed using the Corel DrawX4 application with pawns as the medium for playing. The game is accompanied by a guidebook, answer key book and question card. In this learning media, there are interesting pictures and examples of activities in daily life that can make the learning media more interesting.

After the Physics Ludo has been designed, the next stage is the development stage. At the development stage, the researchers conducted a media feasibility test through product validation. Validation was carried out by five validators consisting of a material expert, two media experts, and one religious expert.

The result of the validation from the material expert at the initial stage was 79%. After the revision, the average percentage obtained was 87% with a highly feasible category which was measured from the level of content quality, the accuracy of the material, and the relevance of the material and questions. The details of the material expert validation data can be seen in Figure 1.

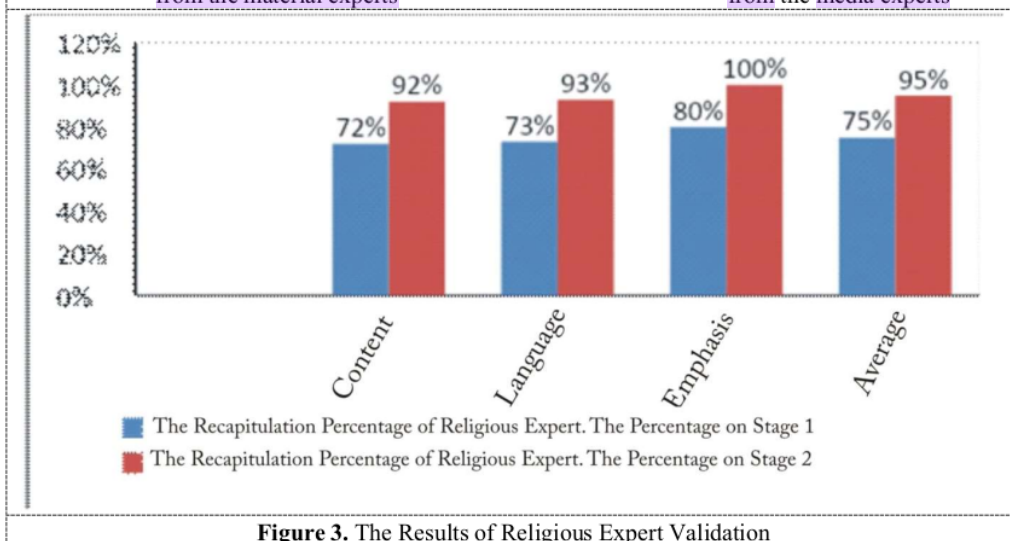
The result of the validation from the media experts at the initial stage was 82%. After the revision, the average percentage obtained was 88% with a highly feasible category which was measured from the level media display, media attractiveness, and ease of use. The details of the validation from the media expert can be seen in Figure 2.

The result of the validation from the religious expert at the initial stage was 75%. After the revision, the average percentage obtained was 95% with a highly feasible category which was measured from the level of content worthiness, language, and emphasis on the material. The details of the results of the validation from the religious expert can be seen in Figure 3.



**Figure 1.** The result of the validation from the material experts

**Figure 2.** The result of the validation from the media experts



**Figure 3.** The Results of Religious Expert Validation

After passing the validation tests from the experts, then developed media was tested on the teachers and students to get their responses. Based on the responses from all tenth-grade physics teachers from the three schools, the obtained percentage was 89% with a very good interpretation in all aspects measured. The aspects measured consisted of the display of the media, the use of Physics Ludo, the

usage instructions, the suitability of the images, the suitability of the concepts, the use of language, and the questions. The details of the percentage can be seen in Figure 5

The media was tested in small-group trials by 30 students of SMA Negeri 1 Banjar Agung, SMA Negeri 1 Banjar Margo, and SMA Negeri 1 Way Kenanga. The percentage obtained was 78% with the good (Interesting) category in all aspects measured. The aspects measured consisted of the media display, the use of Physics Ludo, instructions, the suitability of concepts, the suitability of images, use of language, and questions, usefulness, and curiosity encouragement. The details of the percentage of small group trial can be seen in table 2. Furthermore, the results of field trials conducted at the same school with a total of 78 students from all three schools obtained a percentage of 82% with excellent (Very Interesting) category. The aspects measured consisted of the media display, the use of Physics Ludo, instructions, the suitability of concepts, the suitability of images, use of language, and questions, usefulness, and curiosity encouragement. Students' responses toward the learning media were very good and they were also very enthusiastic. These results indicate that the Physics Ludo integrated with scientific literacy was accepted by the students to be used as a media for classroom learning activities. The details of the percentage of the field trials can be seen in Figure 5.

After getting the teachers' and the students' responses, revisions were carried out. Thus, it can be said that Physics Ludo integrated with scientific literacy has been completed and can be considered as the final product. Table 4 contains the product design.

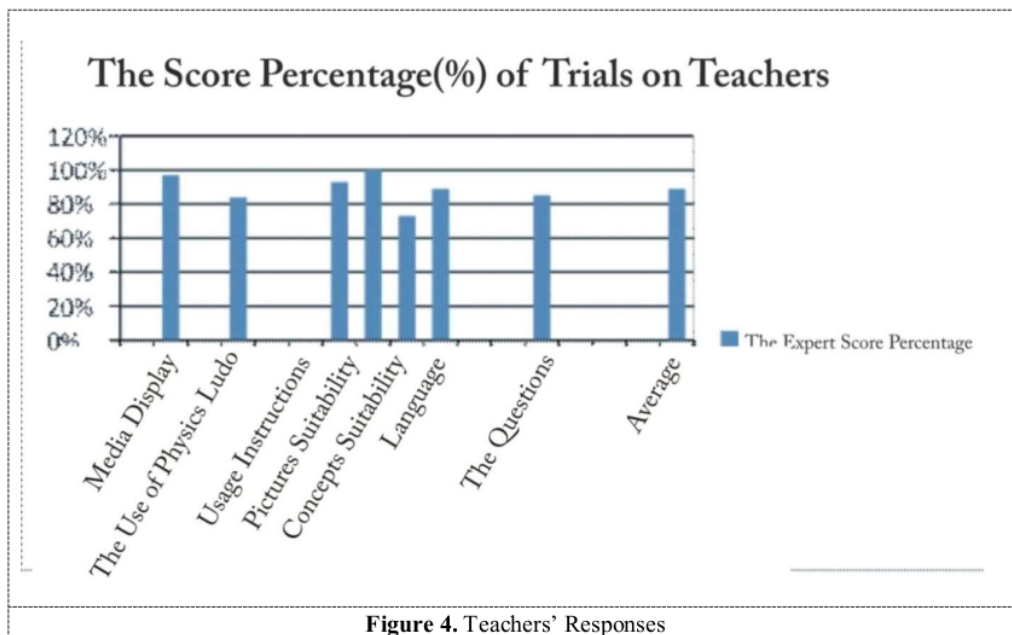
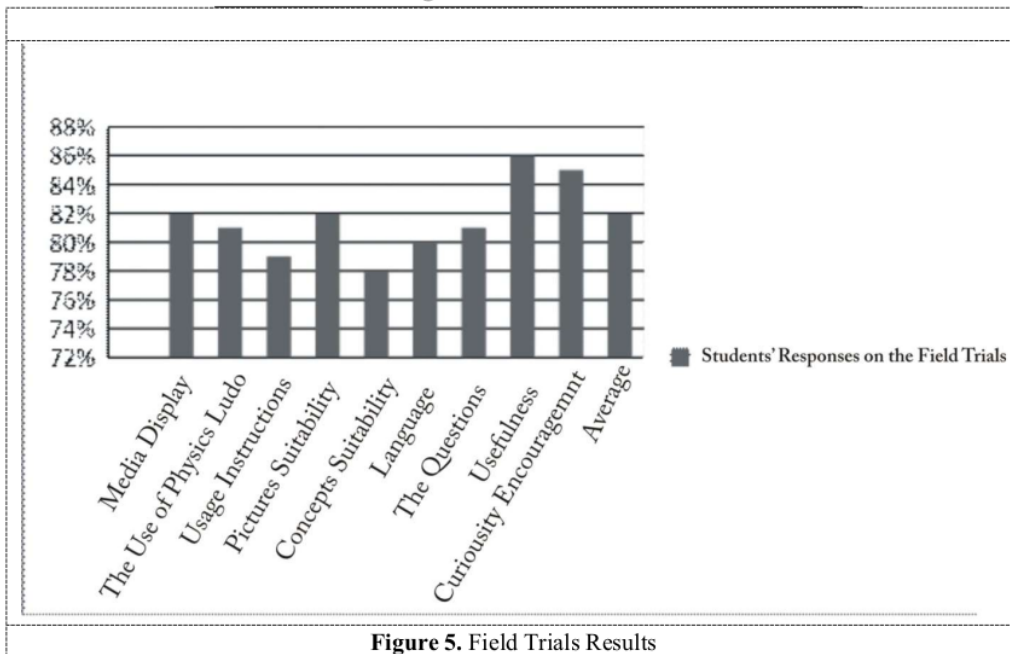


Figure 4. Teachers' Responses

**Table 2.** Small-Group Trials Results

Aspect Of Assesment	Scoring Percentage (%)
Media Display	79%
Usage Of <i>Physics Ludo</i>	77%
Instructions	77%
Figures Suitability	80%
Concepts Suitability	75%
Language Use	80%
Questions	78%
Utilization	78%
Curiosity Encouragement	75%
<b>Average</b>	<b>78%</b>



**Figure 5.** Field Trials Results

Based on the trials, the researchers can see that students' enthusiasm towards the learning media was excellent. Developed learning media can make it easier for students during the learning process. This was achieved because the use of existing examples in everyday life so that the students can learn and play which ultimately affects the students' level of scientific literacy.

PISA defines scientific literacy as a scientific knowledge possessed by a person and uses that knowledge to identify questions, gain knowledge, to explain scientific phenomena and describe scientific events (issues) using scientific evidence (laws, principles, concepts) [8]; [25] The criteria for the implementation of the scientific literacy level can be seen in the following table 3,



**Table 3.** Criteria of the Scientific Literacy Implementation [25]

No	Mastery Level (%)	Score	Category/Predicate
	86-100	A	Excellent
	76-85	B	High
	66-75	C	Moderate
	55-65	D	Low
	≤ 54	E	Poor

The data shows that the students' score is above 81<sup>12</sup> which means the students' scientific literacy level is excellent<sup>12</sup>. If the score is in the range of 76-85, it is categorized as high. If the score is in the range of 66-75 it is categorized as moderate. If the score is in the range of 55-65, it is categorized as low and if the score is less than 54, it is categorized as poor.[26]

The product trials were accompanied by questions to see the students' scientific literacy level. The following are the results of the students' scientific literacy level.


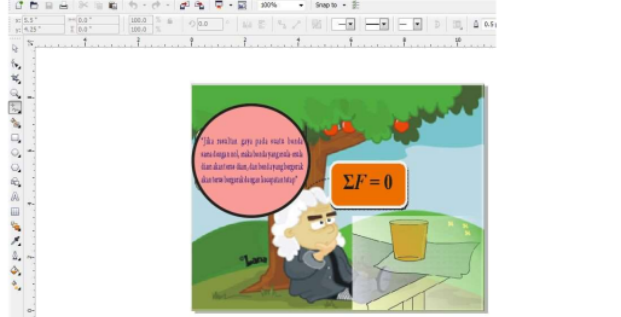
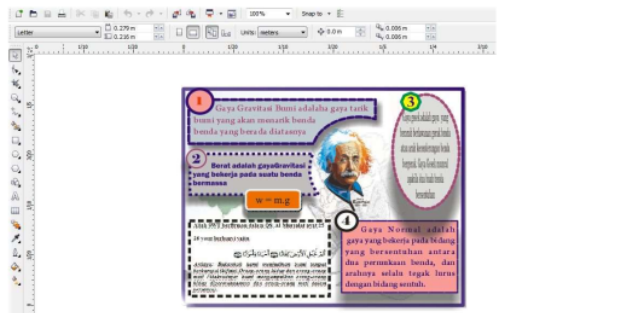
**Table 4.** The Average Score of Students at 3 Schools

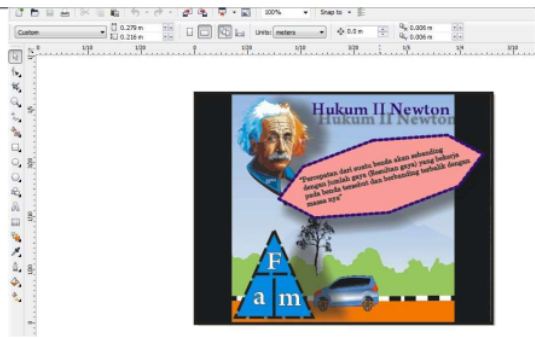
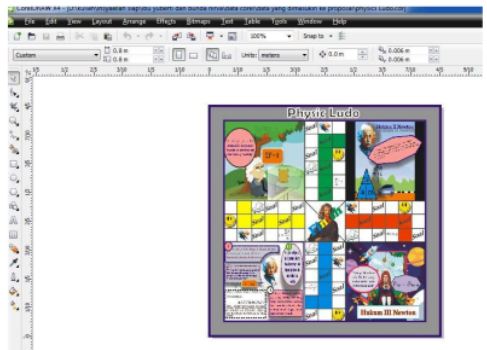
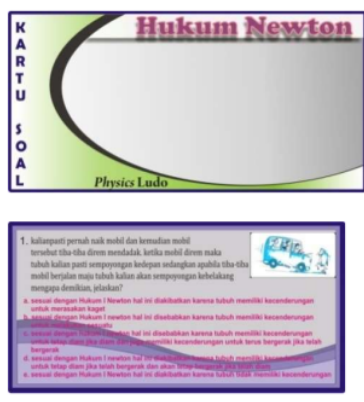
Schools	Score	Percentage (%)	Criteria of Scientific Literacy
SMA Negeri 1 Banjar Agung <sup>5</sup>	86.84	86%	Excellent
SMA Negeri 1 Banjar Margo	90	90%	Excellent
SMA Negeri 1 Way Kenanga	84.81	85%	High

In a simplistic sense, scientific literacy is the ability to use scientific knowledge, identify problems, and draw conclusions based on evidence to understand and make decisions about nature and its changes as a result of human activities.<sup>26</sup>

Based on the data in table 4, the percentage of the level of students' scientific literacy in physics, especially Newton's Law material, at SMA Negeri 1 Banjar Agung is 86% which belongs to the excellent category. The percentage of the level of students' scientific literacy in physics, especially Newton's Law material, at SMA Negeri 1 Banjar Margo is 90% which belongs to the excellent category. The percentage of the level of students' scientific literacy in physics, especially Newton's Law material, at SMA Negeri 1 Way Kenanga is 85% which belongs to the high category.

**Table 5.** The Design of the Developed Physics Ludo

No	Tampilan <i>Physics Ludo</i>	Keterangan
1.		The design of the home section to place the red pawn
2.		The design of the home section to place the yellow pawn
3.		The design of the home section to place the blue pawn

No	Tampilan <i>Physics Ludo</i>	Keterangan
4.		The design of the home section to place the green pawn
5.		Final Product Design
6.		Questions Cards

#### 4. Conclusion

Using the ADDIE model steps of research and development (Analyze, Design, Development, Implementation, and Evaluation), the researchers have successfully developed a learning media in the form of *Physics Ludo* integrated with scientific literacy in Newton's Law material. The obtained average percentage score based on the validation from the material expert is 83%, the obtained average percentage score based on the validation from the media experts is 85%, and the obtained average

percentage score based on the validation from the religious expert is 85%. The average score obtained from the physics teachers at the 3 schools is 89%. The average score obtained from the small-group trials is 78% and 82% in the field trials with a very interesting category.

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