PENSA E-JURNAL : PENDIDIKAN SAINS
https://ejournal.unesa.ac.id/index.php/pensa/

Vol. 8, No. 2
Hal. 194-203
Juli 2020

THE EXPEDIENCY OF LUDO GAME ON SUBSTANCE PRESSURE MATERIAL TO IMPROVE STUDENTS SCIENTIFIC LITERACY

Mas Al Fath Imru'ul Qais As-Syauqi[1], An Nuril Maulida Fauziah[2]
[1,2] Jurusan IPA, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Surabaya
*E-mail: annurilfauziah@unesa.ac.id

Abstract

This research aims to describe the feasibility of the ludo game on substances pressure material to improve students' scientific literacy skills based on validity, practicality, and effectiveness. This type of research is a developmental research using the ADDIE model. The research design used is one group pretest-posttest design conducted on 32 students of class VIII-I of SMPN 40 Surabaya. The results obtained are based on the validity of the ludo game getting the average percentage of 86.67% with decent category, the practicality of the ludo game in terms of the results of the students' responses obtained an average percentage of 99.73%, the results of the feasibility of learning obtain an average percentage of all phases of 92.59%, then the results of student activities that obtain an average percentage of 87.50%, the effectiveness of the ludo game in terms of the pretest results students get an average of 60.15, while the posttest results obtained an average of 84.30 with mastery learning outcomes of 71.87%, the completeness of the indicators on the posttest obtained results namely in the aspect of science content obtained a percentage of 91.40 %, in the aspect of the science context gained a percentage of 88.28%, and lastly in the aspect of science content obtained a press entage of 83.59%. The percentage increase in science literacy scores through the calculation of N-Gain scores obtained an average value of 0.59 in the medium category. Based on these results it can be concluded that the game of ludo on material pressure substances to improve students' scientific literacy skills is feasible based on validity, practicality, and effectiveness.

Keywords: Validity, Practicality, Effectiveness, Ludo Game, Scientific Literacy.

PRELIMINARY

A good science learning process can be happended when the teacher can deliver meaning to the students by actively involving them in the learning process(Mustofa & Dkk, 2017). This is in line with the statement of Rohmawati, et al. (2018), that natural science learning is something that must be done by the students, not something done to the students. In its application, the science learning process in schools tends to be done towards students rather than by students, this causes students to be less responsive and behave passively in learning process (Angelina, 2019).

Based on the 2013 curriculum, learning is done by strengthening learning patterns centered on the learners (Nurdiana & Widodo, 2018). This curriculum guides teachers to improve creativity and high-level thinking (High Order Thinking) in learning the implementation of science in the classroom, so they can improve their knowledge, attitudes, skills and the student-centered learning process (Student entered active learning) (Rohmawati et al., 2018). In achieving its objectives, the 2013 Curriculum supports the development of science literacy for students. Good scientific literacy skills can help students gain meaningful learning in science (Fitriani and Lestari, 2014).

The Program for International Student Assessment (PISA) (2015) stated that measurement of scientific literacy is multidimensional in nature which consists in the content, context, and process of science. Pravitasari (2015) also mentinoned the multidimensional nature of PISA, which are (1) scientific content is not only focused on the knowledge contained in the science school's curriculum, but also through knowledge gained integrally by linking scientific issues or natural phenomena that occur around, so the students can be motivated and actively involved in building their own knowledge. (2) The context of science in PISA is oriented towards linking various knowledge toward natural issues or phenomena that occur. (3) While the science process teaches the students about team work such sharing opinions, knowledge, and practicing problem solving skills by providing a logical explanation of natural issues or phenomena that occur or, by drawing a conclusion from the identification process that has been done. Based on these descriptions, it can be concluded that scientific literacy can provide meaning of learning for the students, so they can achieve their learning goals.

e-ISSN: 2252-7710

The results of pre-research at Surabaya 40 Public Middle School shows that most students still scored below the Minimum Mastery Criteria (KKM) on the substance pressure material and they also still have low scientific literacy skills. This is supported by the pre-research tests results of scientific literacy skills on substance pressure material on 32 students of class VIII-I at SMP Negeri 40 Surabaya who achieved scientific literacy skills on aspects of science content by 36.46%, aspects of science context by 23.44 % and aspects of the science process by 32.29%.

Sudirman et al in Mustofa & Dkk (2017), stated that the low scientific literacy skills of the students are influenced by several factors such namely the learning process that is irrelevant and less attractive to the students, not contextual, and not aimed at higher cognitive abilities. Kurnia et al., (2014)added that the existence of learning resources can also affect students' scientific literacy skills. The source of learning itself is everything in the form of data, objects, people, and certain forms that can be used by students in learning, both separately and in combination thus facilitating the students in achieving learning goals (Putri, 2017).

The interview result of science teacher at Surabaya 40 Public Middle School shows that the learning process is more often centered on the teacher than the students. This problem causes a difficulty to the students to understand the concepts of teaching material. The achievement of learning outcomes is at the level of knowing in the form of memorizing concepts and fail to formulate and solve the problems in real life. The learning process is also still lacking in utilizing the learning media such as game and practicum activities.

Based on these results, it is necessary to develop learning media as a learning resource that supports to achieve learning goals for the students. Rohmawati et al., (2018) stated that instructional media has an important role in teaching and learning activities. The important role is as a carrier of information and prevention of an obstacle in students' learning process, so the learning environment can be created smoothly and conducive where the information can be distributed effectively and efficiently to the students (Rusdiyah, 2015).

The developed learning media in this study is ludo game, this selection is based on questionnaire results of the pre-research which are 90.62% of the students liked playing while learning and 81.25% of the students expressed interest in learning by using ludo game. According to Laraswaty, (2017), game is an appropriate method for learning a skill because game can create a relaxed and pleasant atmosphere. Game is able to actively involve students in the learning process (Sari, 2018). Ludo game itself is a traditional board game from India. According to Fauziah et al. (2018), traditional games have an advantage in the learning process, also can trigger the emergence of positive attitudes and behaviors such as giving critics and opinions in discussions. According to (M et al., 2017), through Ludo game, the students can understand, remember, think quickly, produce ideas according to context, practice cooperation and be able to improve literacy skills.

Substance pressure material was chosen to be this study's focus because this material was quite difficult for students to master. This is shown in the pre-research results where 15 out of 32 students or 46.87% of the students scored below the KKM and the interview results showed that the number of students who did not meet the KKM on the substance pressure material tended to be more than other learning materials. Most students find it difficult to understand the concepts, formulate and solve the problems related to substance pressure material. Teacher-centered learning was the main factor which causes the students to be more passive in learning process such in learning media and underutilized practicum activities.

Based on the description above, a study entitled "The Appropriateness of Ludo Game on Substance Pressure Material to Improve Students' Sciencetific Literacy" with the aim to determine the feasibility of the ludo game as a learning medium in terms of validity, practicality, and effectiveness. The review of the aspect of feasibility measurement is based on a statement by Nieveen who stated that the feasibility of instructional media must pay attention to aspects of validity, practicality, and effectiveness (Malang & Sjaifullah, 2008). Through the development of Ludo game as a learning medium on substance pressure material is expected to be able to provide learning motivation for the students, thus the students actively participate in the learning process and scientific literacy skills of students can be increased.

RESEARCH METHODS

This research is developmental research using ADDIE model which consists of Analysis, Design, Development, Implementation and Evaluations (Mulyatiningsing, 2012). Product trial design uses One Group Pretest-Posttest Design (Sugiyono, 415: 2012). The trial phase was carried out in March 2020 at SMP Negeri 40 Surabaya. The test subjects in this study are students of class VIII-I of SMP Negeri 40 Surabaya, 32 students in total.

The analysis phase is the observation phase which aimed at obtaining the potential and problems encountered by the students in their learning process. Observations are made through interviews with science teachers, the distribution of questionnaires and tests of literacy skills to the students. The design stage is the stage for designing new product concepts for the potentials and problems that have been obtained. The designed product in this study is Ludo game. The development phase is the stage of product realization and testing the feasibility of the product based on validity. Validity is obtained based on the results of the study and validity. The study was conducted by a lecturer at the Natural Sciences Faculty of Mathematics and Natural Sciences Unesa using a study sheet. The results of the Ludo game media review in the form of input / suggestions and analyzed descriptively qualitatively. The validity was carried out by three validators consisting of two lecturers from the Science Department of FMIPA Unesa and a science teacher at SMP Negeri 40 Surabaya by using the ludo game media

validation sheet. Validity assessment uses a Likert scale that is a scale of 1 to 5 with criteria values of 1: very bad, 2: bad, 3: enough, 4: decent, and 5: very feasible, and the scale of assessment criteria of mode, and ludo game media can be declared valid if percentage of average mode for all criteria assessed ≥ 61% with criteria of eligibility or very feasible (Riduwan, 2015).

The implementation phase is the product trial phase to test subjects to test the product's feasibility based on its practicality and effectiveness. Practicality is obtained by using student response sheets, the feasibility of learning and student activities. Measurement of student responses, the feasibility of learning and student activities using the Guttman scale that is the question has the answer "Yes" and "no" with 1 score for "Yes" and 0 for "No", and Likert scale, as well as ludo game media developed were declared practical if the average percentage of all criteria assessed ≥ 61% with good or very good criteria (Riduwan, 2015). While effectiveness is obtained based on the results of students' scientific literacy skills tests. The results Analysis of scientific literacy skills tests obtained the data of mastery learning outcomes, mastery learning indicators and N-Gain score. Ludo game media can be said to be effective media if the percentage of mastery learning outcomes and mastery learning indicators ≥ 61%; N-Gain score ≥ 0.4 with moderate or high criteria (Riduwan, 2015). Mathematically the calculation of the gain score is written as follows:

$$<g> = \frac{Sp2 - Sp1}{Smax - Sp1}$$

(Riduwan, 2015)

Explanation:
<g> : normalized gain score
Sp1 : initial score (*pretest*)
Sp2 : final score (*posttest*)

Mathematically the calculation of the score analysis at the validation and practicality stages are written as follows:

$$P(\%) = \frac{F}{N} \; x\,100\%$$

(Riduwan, 2015)

Explanation:
P : percentage
F : total score obtained
N : maximum number of scores

The evaluation phase is the stage describing the improvement of student competencies and product development goals that are developed through analysis of the data obtained. The results of the analysis are also used to perfect the product that being developed.

RESULTS AND DISCUSSION

The results obtained by using the ADDIE research procedure are as follows:

1. Analysis

   Based on the results of the distribution of questionnaires to 32 students of class VIII and the science teacher interviews it was found that as many as 15 out of 32 students or 46.87% of students on material pressure scores under KKM. While the results of the spread of science literacy skills tests on material pressure obtained the results that the achievement of scientific literacy skills on aspects of science content was 36.46%, the context of science was 23.44% and the process of science was 32.29%. So it can be concluded if the majority of students have relatively low scientific literacy skills. Material pressure material including difficult material, most students find it difficult to understand concepts, formulate and solve problems related to material pressure material. The factors that cause this are teacher-centered learning so students tend to be passive in implementing learning and learning resources such as instructional media and practicum activities are underutilized. The learning described is not good to apply. Learning is considered good if learning is able to provide challenges, fun and motivation to students to actively participate in learning (Permendikbud No. 103 of 2014). Most students like to play while learning. This is supported by the acquisition of pre-research questionnaire results which show that as much as 90.62% of students like learning while playing and 81.25% of students are interested in learning by using the ludo game.

2. Design

   Based on the analysis of pre-research results to several VIII-I grade students and science teachers at SMP Negeri 40 Surabaya, the solution obtained to improve science literacy skills and completeness of student learning outcomes is through the development of learning media in the form of ludo games. The Ludo game design is described as follows:

   a. Guidebook

      Guidebooks are used to help students use Ludo games. The guidebook contains the objectives, rules and components of the game and how to play.

Figure 1. Guidebook Design
Source: Personal Documentation

   b. Board Game

      Board games are used as boards for playing ludo games. The front of the board there are four colors namely red, blue, yellow and green and there are pictures regarding the application of pressure substances such as divers and hydraulic pumps. The back of the black board with ludo game logo. The board measures 30 cm x 30 cm and has 60

step plots, 4 finish plots and 4 home plots. Each plot has readings and questions on the card.

Figure 2. Board Game Design
Source: Personal Documentation

c. Game Card

Ludo game cards consist of a reading side on the front and a question side on the back. Readings and questions are oriented towards the dimension of scientific literacy. Cards measuring 8 cm x 13 cm and totaling 60 pieces.

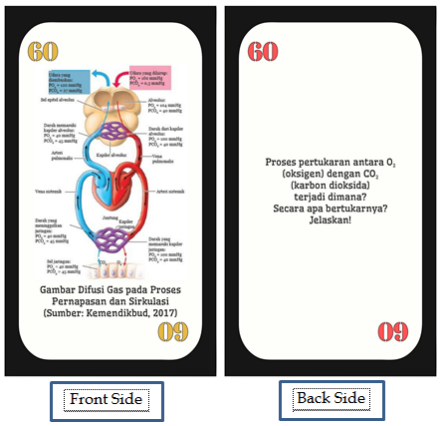

Figure 3. Game Card Design
Source: Personal Documentation

3. Development

Based on the design stage, the ludo game begins to be realized. After being realized, the ludo game will be tested for eligibility based on validity. Validity is obtained based on the results of the study and validity. The results of the study and validity are described as follows:

a. Results of The Study

The results of the study and the improvements are presented as follows:

Table 1. Results of the study of Ludo

No.	Suggestions / Feedback	
Readings should be more informative by reflecting the dimensions of scientific literacy		
1.	**Before revision**	**After revision**
	In muddy terrain it is recommended to use boots.	In taking muddy terrain on foot, it is advisable to use boots instead of wearing footwear. The use of boots is intended to make it easier to walk on muddy terrain.
Questions do not yet reflect students' critical thinking		
2.	**Before revision**	**After revision**
	Based on these readings, is it true that using boots is easier to walk on muddy terrain than without wearing footwear?	Based on these readings, why using boots is easier to walk on muddy terrain than without wearing footwear?

The first suggestion or input from the review of the Ludo game is that the reading must be more informative by reflecting the dimensions of scientific literacy. Substitution of revised reading, namely changing the reading by adding more detailed information on natural phenomena or issues that occur in life that are in accordance with the dimensions of scientific literacy set by PISA (Toharudin in Pravitasari, 2015).

The second suggestion is that the questions listed on the Ludo game card should potentially make students think critically. The questions were corrected by adding instruction sentences so that students were able to provide good and logical explanations, this improvement was adjusted to the indicators of critical thinking skills ie students were able to provide simple explanations (Angelina, 2019). Science literacy skills with critical thinking have a strong correlation (Rahayuni, 2016), scientific literacy skills will increase if critical thinking skills are trained (Cahyana et al., 2017).

b. Validation Results

The validation results of the Ludo game are presented as follows:

Table 2. Results of ludo game play

No.	Assessment Criteria	Assessment			Average Mo percentage (%)
		V1	V2	V3	
1.	Topic criteria / material in Ludo game	4	4	5	86,67
2.	Criteria for evaluation questions on Ludo games	4	4	5	86,67

3.	Criteria for requirements and utilization of educational media	5	4	5	93,33
4.	Criteria for media appearance	3	4	5	80,00
5.	The suitability of the media with scientific literacy	4	4	5	86,67
Average					**86,67**

Explanation:
V1 : validator 1
V2 : validator 2
V3 : validator 3

Based on Table 2, the results of the validation of all criteria obtained an average percentage mode ≥ 61 with a good category for phase 4 and a very good category for phases 1, 2, 3 and 5. Based on these results, the developed ludo game can be said to be feasible as an educational medium oriented literacy science (Riduwan, 2016).

The suggestions or input provided by the validator are enlarging the size of the writing on the card and the ludo game manual, adjusting the color of the writing with the background on the card and the ludo game manual, and changing the ludo game handbook design from the cover to the last page presented in Table 3.

Table 3. Feedback on Ludo Game Validation

No.	Suggestions / Feedback	Before revision	After revision
1.	Increase the font size of the writing on the ludo game card		
2.	Improve the ludo game guide design		
			

These suggestions are intended to make it easier for students to read and understand the contents written when using ludo cards and guidebooks in learning so that learning using ludo games can be meaningful to students, and aims to attract students' interest in the learning process (Rusdiyah, 2015).

The final results of the developed ludo game are presented in Figure 4 as follows:

Figure 4. The Final Result of The Development of Ludo Game; (a) Board games, (b) Pawns, (c) Game Cards, (d) dice, and (e) Game Guides
Source: Personal Documentation

4. Implementation

The implementation phase is a trial phase aimed at testing the feasibility of the Ludo game in terms of practicality and effectiveness.

a. Practicality

Practicality of Ludo game media includes the results of student responses, the implementation of learning, and student activities.

1) Respon Siswa

The results of the responses of students who chose the answer "Yes" to each component are presented in Table 4.

Table 4. Results of Student Responses to Ludo Games

No.	Components assessed	Percentage (%)
1.	Media appeal	100
2.	Ease of use of media	98,95
3.	Presentation / display of Ludo game	100
4.	Linkages with scientific literacy	100
Average		**99,73**

Based on these results, it can be concluded if the majority of students give positive responses to the developed ludo game.

2) Implementation of Learning

Learning is carried out using cooperative learning models of teams game tournaments (TGT) with a scientific approach. Learning is divided into three stages with six activity phases, beginning with a preliminary stage that contains motivating activities and

communicating goals to students (phase 1), followed by a core phase of providing information activities (phase 2), guiding students to form learning groups (phase 3) , and guide the group to learn and work (phase 4), and end with a concluding phase that contains evaluation activities (phase 5) and gives rewards (phase 6). The results of the implementation of learning are presented in Figure 5 below:

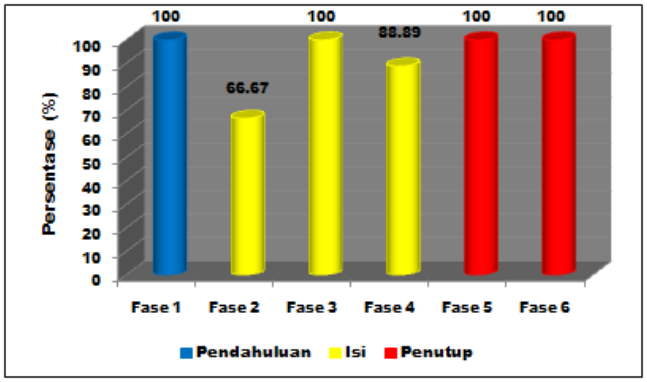

Figure 5. Graph of learning outcomes
Source: Personal Documentation

Based on Figure 2, the results of the implementation of learning get an average percentage of all phases of 92.59% with a very good category. These results indicate that learning is carried out interactively, inspiratively, and fun so that students are more motivated and show active participation (Asmani in Mustofa & Dkk, 2017). The results that did not reach the percentage of 100% were due to the fact that some students joked with each other so that the information provided by the teacher was not conveyed properly so that the students did not participate maximally in group discussions. So it can be stated if the learning uses ludo game with the TGT type cooperative learning model and the scientific approach is implemented well.

3) Student Activity

The results of student activities are presented in Table 5 as follows:

Table 5. Results of Student Activities

No.	Student activities when using Ludo games in learning	Percentage (%)
1.	Students form 4 small groups consisting of 2 students	100
2.	Students read or observe readings on game cards to get information	93,75
3.	Students read the questions on the game cards in a clear voice, can be heard by players and referees, are orderly, and use good and correct Indonesian	84,37
4.	Students discuss with classmates to answer the questions they got	87,50
5.	Students can associate answers with information from readings or concepts in substance pressure learning	71,87
Average		**87,50**

The lowest percentage was obtained in activity number 5 with a large percentage of 71.87%. The low acquisition is due to the fact that there are some students who do not follow the instructions given by the teacher namely the activities contained in numbers 2 and 4. Based on these results, overall shows that students tend to participate actively when participating in learning.

b. Effectiveness

The effectiveness of Ludo games is obtained from the tests of scientific literacy skills. The test consists of two stages: pretest and posttest. Pretest and posttest questions are in the form of multiple choice that refers to the dimensions of scientific literacy and is also adjusted to the indicators that have been made on the material pressure of matter, and totaling 10 items. The results of the scientific literacy skills test are presented in Table 6.

Table 6. Pretest and Posttest scores

Student Number	Pretest Scores	Posttest Scores	N-Gain
Student 1	52,5	90	0,79
Student 2	62,5	82,5	0,53
Student 3	60	67,5	0,19
Student 4	62,5	82,5	0,53
Student 5	62,5	100	1,00
Student 6	62,5	90	0,73
Student 7	62,5	70	0,20
Student 8	62,5	70	0,20
Student 9	62,5	65	0,07
Student 10	62,5	80	0,47
Student 11	62,5	67,5	0,13
Student 12	62,5	67,5	0,13
Student 13	70	100	1,00
Student 14	62,5	75	0,33
Student 15	62,5	87,5	0,67
Student 16	62,5	67,5	0,13
Student 17	62,5	77,5	0,40
Student 18	10	82,5	0,80
Student 19	17,5	100	1,00
Student 20	62,5	70	0,20
Student 21	62,5	100	1,00
Student 22	85	100	1,00
Student 23	85	100	1,00
Student 24	62,5	70	0,20
Student 25	62,5	92,5	0,80
Student 26	62,5	90	0,73
Student 27	62,5	100	1,00
Student 28	62,5	87,5	0,67
Student 29	62,5	77,5	0,40
Student 30	62,5	87,5	0,67
Student 31	62,5	100	1,00

Student 32	62,5	100	1,00
Average	60,15	84,30	0,59
Completeness (%)	6,25	71,87	

The results of completeness in the pretest get a percentage of 6.25% with the category of not good, as many as 2 students declared complete with a value ≥ 75 in accordance with the value of the Minimum Mastery Criteria (KKM) for natural science subjects applicable at SMP Negeri 40 Surabaya, while 30 people other students do not complete with a value <75 according to the KKM value. Whereas in the posttest getting a percentage of 71.87% with a good category, as many as 23 students were declared complete with a value of ≥ 75 in accordance with the KKM value, while 9 other students were incomplete with a value <75 in accordance with the KKM value. Achievement of 9 students who still did not complete the scientific literacy ability test with each score 67.5, 70, 70, 65, 67.5, 67.5, 67.5, 70, and 70. The results of completeness at the stage the posttest is greater than the pretest stage. This shows if the understanding of the material pressure of substances and scientific literacy skills of students increases. The improvement of science literacy skills of 32 students based on N-Gain scores obtained an average of 0.59 in the medium category.

The completeness of the learning indicators in terms of the test (posttest) oriented dimensions of scientific literacy, namely content, context, and science processes based on their conformity with the material learning indicators of pressure substances are presented in Table 7:

Table 7. Completeness of Learning Indicators

No.	Literacy Aspects	Completeness (%)
1.	Science Content	91,40
2.	Science Context	88,28
3.	Science process	83,59

The results of completeness in the aspect of science content obtained a percentage of 91.40% with a very good category. This aspect consists of two learning indicators namely 1) explaining the pressure characteristics of solids, liquids, and gases from an experiment or phenomenon that occurs in daily life and 2) completing a calculation of the pressure concept through a case study. In the aspect of science context, it gets a percentage of 88.28% with a very good category. The context aspect of science consists of one learning indicator that is analyzing the application of the concept of pressure in life, and the aspect of the science process gets a percentage of 83.59% with a very good category. The science process aspect consists of two learning indicators, namely 1) designing a simple experiment that proves the concept of solid, liquid, and gas pressure and 2) solving a problem that arises from an experiment or natural phenomenon related to the concept of pressure.

5. Evaluation

Based on the analysis on the development and implementation stages, it shows that the ludo game on the developed substance pressure material improved students' scientific literacy skills effectively. The statement is based on the increasing completeness of student learning outcomes from the results of the pretest which obtained a percentage of completeness by 6.25% to 71.87% on the posttest results. There were students who could not complete the pretest because they have not been trained in science literacy-based questions and also the students' reading interest is still low. Whereas there were students who did not complete the posttest because they did not concentrate and participate in conducting discussions with their groups when learning using ludo game. These causes are supported through the observation of student activities that do not reach an average percentage of 100%. Student activities when using ludo game only obtained an average percentage by 87.50% with a very good category. This shows if there are some students who are less than optimal when carrying out activities in learning.

The effectiveness of the ludo game is also supported by the development of ludo game which is oriented on the dimensions of scientific literacy such content, context, and the process of science based on scientific literacy published by PISA. The completeness results of the indicators are the evidence of the ludo game development, such the aspect of science content gets a percentage by 91.40% with a very good category. This result proves that the material contained in the Ludo game is closely related to scientific literacy, the knowledge gained is not only focused on the knowledge contained in the science curriculum at school, but also through knowledge obtained integrally by linking scientific issues or natural phenomena happened around (OECCD, 2017). Thus, students can be motivated and actively involved in building their own knowledge and the meaningfulness of learning will be more felt by students because of applying phenomena that can be seen or felt directly (Pravitasari, 2015). This is in line with the cone theory of Edger Dale's experience in (Lee in Olusegun, 2015), learning outcomes can be obtained through concrete things (direct experience) that start from the reality around a person and then through artificial objects to through abstract things starting from symbols verbal to other things that are increasingly abstract as the journey to the top of the cone. The learning process and teaching interactions do not come entirely from direct experience, but can be started through the type of experience which is adapted to the abilities and needs of a group of

students by considering the situation / conditions of learning.

In the context of science, a percentage by 88.28% is categorized as very good, showing ludo game can help the students to link the various knowledge that has been held by discussing about natural issues or phenomena that occur, so learning becomes meaningful for the students (Pravitasari, 2015). Where the issues or natural phenomena occur in the fields of life (health), the environment, and technology (OECCD, 2017). This is in line with meaningful learning theory, according to Ausubel in Vallori (2014), he stated that the meaningfulness of learning is a process of linking new information to old concepts owned by a person then creating a relation with one another.

In the aspect of the science process, it obtained a percentage by 83.59% with a very good category. Based on these results, it can be said that Ludo game can improve students' scientific processes, such working in groups by sharing opinions, knowledge, and practice problem solving skills by providing a logical explanation or drawing a conclusion from the identification process that has been done (Pravitasari, 2015). This is in line with constructivism learning theory which explains the students are able to solve problems through their thought processes by searching for ideas and making decisions, because students are actively involved to foster new knowledge (Bada in Olusegun, 2015).

The data validation results, student responses, the implementation of learning and student activities also show that ludo game is effective to improve students' scientific literacy skills. The results of the validation on the criteria of the linkage of ludo games with scientific literacy showed the acquisition of a mode percentage of 86.67% with a feasible category. Based on these results, it can be seen that the compatibility of Ludo games with the dimensions of scientific literacy has been achieved.

Furthermore, the results of student responses get an average percentage by 99.73% with a very good category. These results indicate that the majority of students gave positive responses to the developed ludo game. Obtaining a positive response has a good impact on improving students' scientific literacy skills (Angelina, 2019).

Likewise, the results of the implementation of learning using the developed ludo game obtained an average percentage of all phases by 92.59% with a very good category. These results indicate that learning using a scientific approach which is well implemented, can support the improvement of students' scientific literacy skills. This is in line with Lazim's expression in Safitri (2016), that learning with a scientific approach is able to train and strengthen students' scientific literacy skills, where part of literacy instilled early on is content, context, and the process of science.

The results of student activities obtain an average percentage by 87.50% with a very good category. This proves that most students follow the learning by using the ludo game well and actively. This student activity encourages students to hone their scientific literacy skills by answering questions on the ludo game card through discussion with the group.

The results of students' scientific literacy skills tests were quite satisfying considering the scientific literacy skills achieved by Indonesian students are relatively low. PISA survey results (2015) prove that the scientific literacy score in 2015 achieved by Indonesia is 403, this score makes Indonesia ranked 64 out of 70 countries (OECCD, 2017). The results of limited trials with the results of the PISA survey have a large difference. According to Inzanah and Widodo (2013), the difference was due to limited trials conducted on a relatively small scope when compared to the scope of PISA. Although the results are different, but the results of limited trials are still sufficient to be considered supportive of students' scientific literacy skills. Angelina (2019) in her research shows that an effective result of the use of learning media-oriented learning cards for scientific literacy. The results of the study stated that through these media the literacy ability of students has increased by obtaining an average student pretest score of 64.4 and at the level of scientific literacy level 4, while the average posttest score of students is 80.3 and at scientific literacy level is level 5. The amount of N-Gain score between pretest and posttest is 0.43 with the medium category. Other in lijne reseach is the use of a socio-Scientific-Issues-oriented weblog media by Rohmawati et al. (2018). The results of the study stated that through these media the literacy ability of students has increased by obtaining an average student pretest score by 64.4, while the average posttest score of students is 80.3 and an increase in students' scientific literacy ability by an average of 54,24.

Improvement of students' scientific literacy skills in terms of the N-Gain score calculation of 32 students obtained an average value of 0.59 in the medium category. The increase in the medium category was due to the minimal use of instructional media, which was only two meetings with a duration of 5 x 40 minutes. The input obtained from the student response questionnaire sheet as a refinement of the Ludo game that is enlarging the game board along with other game devices to facilitate playing with many people. Based on the description, the time in using the ludo game media must be added and the magnification of the ludo game device, so the improvement of students' scientific literacy skills can be better and it can be used in further research.

CLOSING

Conclusion

Based on the results of this research above, it can be concluded that the application of ludo game on the substance pressure material is appropriate as a learning medium because it improves scientific literacy skills of

the students, where the feasibility is reviewed based on validity, practicality, and effectiveness.

1. The validity of the ludo game on the substance pressure material obtained an average percentage of all criteria of 86.67% with a very decent category.
2. Practicality of ludo game on the substance pressure material in terms of the results of student responses obtained an average percentage of 99.73% with a very good category. The results of the learning implementation obtained the average percentage of all phases of 92.59% with a very good category. Then, the results of student activities obtained an average percentage of all student activities by 87.50% with a very good category.
3. The effectiveness of ludo game on the substance pressure material in terms of the pretest results of the students obtained an average score of 60.15, while the posttest results obtained an average value of 84.30 with completeness of learning outcomes of 71, 87% with a good category and completeness of the indicators at the posttest obtained results, namely in the aspect of science content obtained a percentage of 91.40%, in the context of science context obtained a percentage of 88.28%, then in the aspect of science content obtained a percentage of 83.59%. The increase in science literacy scores through the calculation of N-Gain scores obtained an average value of 0.59 in the medium category.

Sugestion

Based on this research that has been done, regarding the development of Ludo game on the substance pressure material to improve students' scientific literacy skills, there are suggestions from the researchers for further research as follows:

1. The use of ludo game in improving students' scientific literacy skills is not yet fully effective if only practiced in two meetings, so it needs to be trained through an iterative process to obtain more effective and better results.
2. The use of Ludo game in learning process takes up a lot of time, so the need for design with mature modeling.

REFERENCE

Angelina, N. (2019). Kelayakan Validitas Kartu Belajar untuk Meningkatkan Literasi Sains pada Materi Tata Surya SMP. E-Jurnal Pensa,https://jurnalmahasiswa.unesa.ac.id/index.php/pensa/article/view/27985.

Cahyana, U., Kadir, A., & Gherardini, M. (2017). Relasi Kemampuan Berpikir Kritis Dalam Kemampuan Literasi Sains Pada Siswa Kelas Iv Sekolah Dasar. *Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan*, *26*(1), 14–22. https://doi.org/10.17977/um009v26i12017p014

Fauziah, A. N. M., Purnomo, A. R., Fathonah, N., & Khusaini. (2018). The use of monopoly-like game (MLG) to promote qualified scores for three student competencies. *Jurnal Pendidikan IPA Indonesia*, *7*(3), 280–285. https://doi.org/10.15294/jpii.v6i2.8183.

Fitriani, W., Hairida, dan Lestari. (2014). *Deskripsi Literasi Sains Siswa dalam Model Inkuiri pada Materi Laju reaksi di SMAN 9 Pontianak (Hal. 2-4)*,http://download.portalgaruda.org.

Inzanah dan Widodo, W. (2014). Literasi Sains Mahasiswa Program Studi S1 Pendidikan IPA Universitas Negeri Surabaya (Hal. 3-4). Makalah disajikan dalam *Prosiding Semnas Pensa VI "Peran Literasi Sains"*(ISBN 978-979-028-686-3),http://repository.unesa.ac.id/info/371/literasi-sains-mahasiswa-program-studi-s1-pendidikan-ipa-universitas-negeri-surabaya.html.

Kurnia, F., . Z., & Fathurohman, A. (2014). Analisis Bahan Ajar Fisika Sma Kelas Xi Di Kecamatan Indralaya Utara Berdasarkan Kategori Literasi Sains. *Jurnal Inovasi Dan Pembelajaran Fisika*, *1*(1), 43–47.

Laraswaty, V. G. (2017). *Pengembangan Media Pembelajaran Biologi Berbentuk Permainan Ular Tangga Pada Materi Keanekaragaman Hayati Untuk Siswa Kelas X SMA*. 1–125.

M, N. A., Reski, A., & Yusman, A. (2017). *Jelajah Sejarah Melalui Ludo Carpet : Upaya Mewujudkan Generasi Nasionalis Bagi Anak Sekolah Dasar*. *20*, 122–126.

Malang, P. N., & Sjaifullah, A. (2008). *Developing Speaking Materials for the Students of Mechanical Engineering At State Polytechnic of Malang*. 1–2.

Mulyatiningsih, E. (2012). *Pengembangan Model Pembelajaran*. Yogyakarta: Universitas Negeri Yogyakarta. http://staff. uny. ac. id/sites/default/files/pengabdian/dra-endang-mulyatiningsih-mpd/7cpengembangan-model-pembelajaran. Pdf.

Mustofa, A. (2017). Keefektifan Lks Berbasis Model Pembelajaran Discovery Learning. *E-Journal Pensa*, *05*, 27–32.

Nurdiana, U., & Widodo, W. (2018). Keefektifan Media Permainan Tradisional Congklak untuk Meningkatkan Hasil Belajar Siswa. *E-Journal-Pensa*, *06*(02), 161–164.

OECCD. (2017). PISA 2015 Assessment and Analytical Framework. In *Evolution.*

Olusegun, S. (2015). Constructivism Learning Theory: A Paradigm for Teaching and Learning. *IOSR Journal of Research & Method in Education Ver. I*, *5*(6), 2320–7388. https://doi.org/10.9790/7388-05616670

Pravitasari, O. T. (2015). Pengembangan media Pembelajaran Blog Berorientasi Literasi Sains pada Submateri Perpindahan Kalor. E-Jurnal Pensa,https://jurnalmahasiswa.unesa.ac.id/index.php/pensa/article/view/12427.

Putri, N. H. (2017). Efektivitas Perpustakaan sebagai Sumber Belajar. Yogyakarta: Universitas Ahmad Dahlan.http://eprints.uad.ac.id/5235/1/Efektivitas%20Perpustakaan%20Sebagai%20Sumber%20Belajar.pdf.

Rahayuni, G. (2016). Hubungan Keterampilan Berpikir Kritis Dan Literasi Sains Pada Pembelajaran Ipa

Terpadu Dengan Model Pbm Dan Stm. *Jurnal Penelitian Dan Pembelajaran IPA*, *2*(2), 131. https://doi.org/10.30870/jppi.v2i2.926

Riduwan. (2015). Skala Pengukuran Variabel-variabel Penelitian. Bandung: Alfabeta.

Rusdiyah, E. F. (2015). Media pembelajaran (Implementasi untuk Anak di madrasah Ibtidaiyah). Surabaya: IAIN Sunan Ampel Surabaya.http://digilib.uinsby.ac.id/id/eprint/20040.

Rohmawati, E., Widodo, W., & Agustini, R. (2018). Membangun Kemampuan Literasi Sains Siswa Melalui Pembelajaran Berkonteks Socio-Scientific Issues Berbantuan Media Weblog. *Jurnal Penelitian Pendidikan IPA*, *3*(1), 8. https://doi.org/10.26740/jppipa.v3n1.p8-14.

Safitri, A. (2016). *Pendekatan Saintifik untuk Meningkatkan Literasi Sains SMP*. E-Jurnal Pensa,https://jurnalmahasiswa.unesa.ac.id/index.php/pensa/article/view/14663.

Sari, D. P. (2018). Peningkatan Pemahaman Konsep Siswa dengan permainan Ular Tangga pada materi getaran dan Gelombang. E-Jurnal Pensa,https://jurnalmahasiswa.unesa.ac.id/index.php/pensa/article/view/14651.

Sugiyono. (2012). Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta.

Vallori, A. B. (2014). Meaningful Learning in Practice. *Journal of Education and Human Development*, *3*(4), 199–209. https://doi.org/10.15640/jehd.v3n4a18