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The "Sciencemopoly Game" to Improve Junior High School Students' Learning Motivation on the Digestive System Topic

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Abstract. This study intends to 1) develop teaching media "Sciencemopoly Game" for grade VIII students of SMP Al Qur'an Zaenuddin on the digestive system topic; 2) determine the feasibility of Sciencemopoly Game; 3) know the increase in students' learning motivation. This research is a research and development (R & D) using the 4D model. Questionnaires with the Likert scale were used as the research instrument, and the collected data were analyzed using the descriptive-statistics method. The results concluded that the Sciencemopoly Game is a suitable teaching media for science learning on the digestive system topic having an average expert validity score of 4,24. After being tested, the score of small-group product trial was 4,08 or in the 'excellent' category, and the field trial score was 4,39 or in the 'excellent' category. Further, the Sciencemopoly Game has been proven to increase students' learning motivation, from 3,76 in the 'good' category to 4,09 in the 'excellent' category. So that, this media can be used in supporting the learning process and forming joy class atmosphere.

INTRODUCTION

[1] stated that, according to Ausubel, "The most important single factor influencing learning is what the learner already knows. [2] concluded that at the heart of constructivism is the acknowledgement that knowledge is not an entity transferred in toto from teacher to learner, but rather that learning requires active assignation of the student's mind.

An effective learning process is surely needed to create purposeful learning as significance in learning will affect the results. Teachers, automatically, hold essential roles in it. Steps taken should be able to build innovative and creative learning to maximize the transfer of knowledge and value [3].[4] said that, many researchers generally reflect teaching and learning issues as if independent from physical environment, whereas physical conditions of teaching material play an important role in gaining knowledge; in learning. Thus, [5] said that the act of teaching and learning is mediated by different representations of the same knowledge: the teacher's, the student's and the teaching material.

One of the solutions to achieve meaningful learning is by developing exciting teaching media that could overcome students' boredom during learning. [6] concluded that the most useful starting point for any media teaching in the primary school and one that is free of any high-tech skills or specialist knowledge is to ask children what media they must enjoy. Game-based learning has been seen as one fascinating way to learn. [7] concluded that uninterested media could not help students understand the topics taught which results in decreasing learning outcomes. Moreover, [8] investigated boarding-based junior high school students and found that inhibiting factors affecting their learning motivation are needs, expectations, and ideals, while extrinsic factors include appreciation

and environmental conditions. [9] concluded that teaching strategies and techniques are vital in the transfer of new information into the memory in a form that is easily understood. The latter extrinsic factor could be overcome by the use of appropriate learning media. The right media will improve the learning experience, which then leads to an increase in learning outcomes, especially at the cognitive level. Moreover, [10] found that one way to improve student learning outcomes is through appropriate and exciting learning media using educational physics games, this can enhance student learning outcomes.

Based on the observations, through interviews, it was concluded that learning was still teacher-oriented, the use of media was still lacking, and the digestive system material was one of the materials that required strengthening the concept with the help of media. Al Qur'an Zaenuddin Junior High School is an Islamic boarding-based school containing more religious values than general knowledge. The pesantren (local term for Islamic boarding school) environment does not allow the use of cellphones, thus, forces teachers to be creative in delivering subject matter. [11], stated that the digestive system is an essential topic of science for Junior High School Grade VIII as students are demanded to understand dietary intake to protect the organs. [12] established that interesting and stimulating learning can expand student learning outcomes of the digestive system. Furthermore, this topic requires adequate learning media to provide a suitable learning experience for the improvement of their cognitive abilities. [13] thought that game-based approach will provoke more auspicious interaction in cooperative programming verbal learning. For that reason, game-based learning is seen to be an appropriate technique to teach the topic.

The sciencemopoly game adopts the monopoly game yet customized according to its functions. How to play the sciencemopoly game in science learning in general is almost the same as when we play monopoly. This game can be played together, starting with rolling the dice, then the pawns will move according to the dice that appear in the question box. Each question must be answered by the dice shaker. Questions revolve around the digestive system. If the answer is correct, then the dice shaker will get paper money like a monopoly game. On the other hand, if you can't answer, you don't get money. This media tries to answer the questions on the cards so that they can increase students' learning motivation. The way to play is similar to the usual monopoly game. Several people are acting as bankers, observers, and a student as the judge. Each player is then given play money-capital which is used to limit the game. Each player who enters the question box must choose a question and answer it. The observers ask questions and write down answers from players and write down the scores according to the color of the questions selected. The sciencemopoly game can train accuracy and foster curiosity as it is adapted to the characters of junior high school children. [15] stated that the use of media is more effective than conventional learning methods. According to previous research from [16], that compared with more old-style instructional methods, Game-based e-learning (GbEl) possibilities a higher motivation of learners by presenting contents in an interactive, rule-based and competitive way. This opinion is reinforced by [17], claiming that game-based learning can increase the percentage of student learning completeness.

Based on the discussed explanation, efforts are needed to develop the sciencemopoly game and determine its feasibility in affecting the students' motivation profile.

METHOD

This research was conducted at SMP Al Qur'an Zaenuddin Tegal in the odd semester of 2021/2022. It is a research and development research (R &D) that adopted the 4D model (*Definition, Design/ Planning, Development, Dissemination*) by [18].

The procedure of R & D research using a questionnaire instrument. The instrument of data assembly uses three steps namely initial study, expert authentication, and product testing. [19] stated that, the following is a detailed explanation of the R and D research procedures (Figure 1).

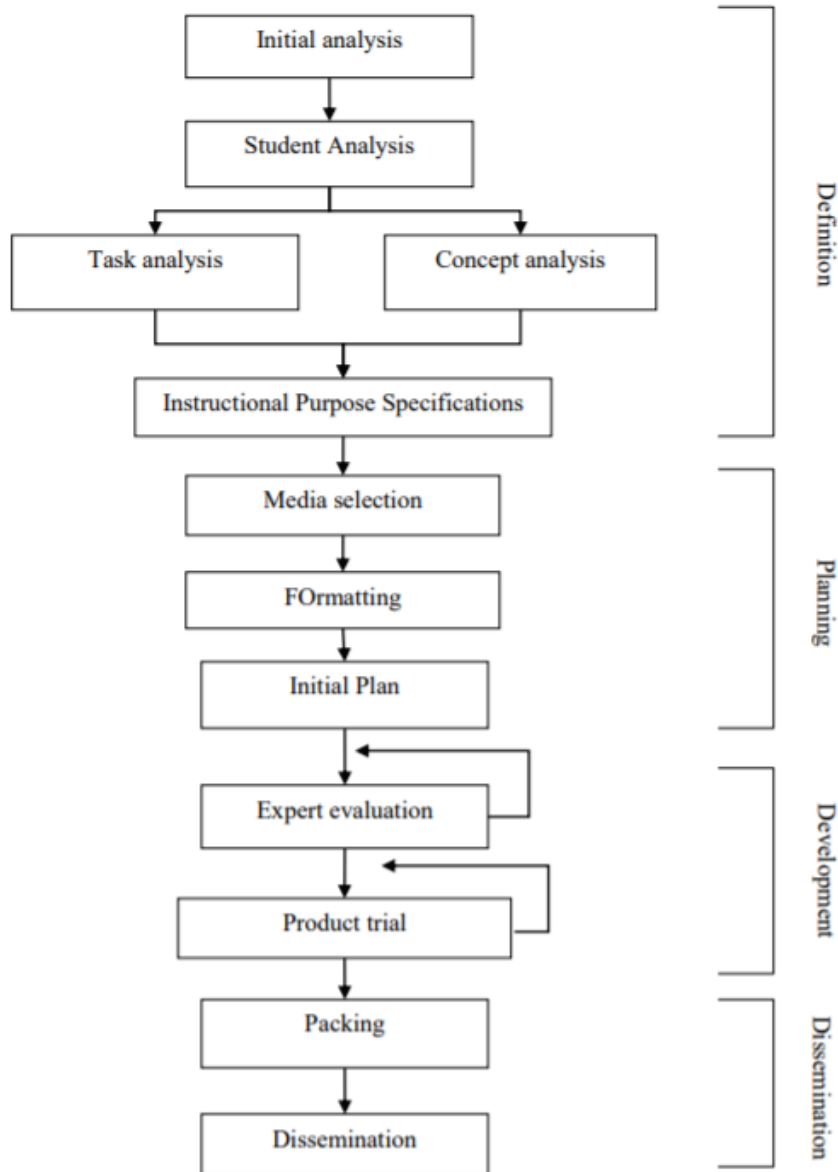


FIGURE 1. R and D Research Procedures [19]

At the beginning state, defining learning objectives, limiting the delivered subject matter, and studying learning requirements with the current syllabus. The analysis conducted on the development of Sciencemopoly game and the lack of understanding and application of concepts in digestive system. Task analysis is done by identifying the topic material that wants to be taught, including assembling and choosing relevant material. Concept analysis be subject to on the references used.

At design/ planning state, we prepare product prototypes, specifications, and instruments for the feasibility test. This step is done by media, setup, and preliminary selection.

At the development state, the product manufacturing stage. The recognized media then went to a feasibility test through product validation sheets from content and media experts in the individual and small-group trials. The developed product is called the sciencemopoly game- a modified monopoly game, media quality instrument, and learning motivation assessment instrument. This study was a 4D modified, which has three stages of trials. There were three stages of trials: individual, small group, and field trials. According to Dick and Carey, each trial scale consists of, respectively, 1-3 participants, 6-8 participants, and 15-30 participants[20].

The research model was selected based on the limits of the researchers' level of understanding and ability in terms of developing learning media. The study focused on establishing a teaching medium and testing its feasibility.

The research subjects comprised two content experts, one media expert, three students at the individual trial, 7 students at the small-scale trial, and 20 students at the field-scale trial. The investigated object was the quality of the developed media which consists of learning, media, and visual-communication aspects.

The instruments used in this research were: (1) Media expert validation sheet; (2) Content expert validation sheet; (3) Test sheet questionnaire; and (4) Motivational questionnaire. Furthermore, the data were gathered using several techniques: (1) Questionnaires with a Likert scale; (2) Documentation; and (3) Device validation.

The data were analyzed using the descriptive analysis technique. The product feasibility was examined employing the following steps:

1. Transforming qualitative assessment into a quantitative score, provided that the scoring conditions:

TABLE 1. Score on Instrument

| Classification | Score |
|----------------|-------|
| Excellent | 5 |
| Good | 4 |
| Fair | 3 |
| Poor | 2 |
| Bad | 1 |

Source: [21]

2. Calculating the scoring average
3. Summing up the average score of each aspect
4. Converting the average score of each aspect qualitatively

TABLE 2. The Conversion Formula for the Average Scores on a Five Scale

| Score | Formula | Value | Category |
|-------|---|-------|-----------|
| 5 | $M_i + 1,50S_{bi} < X$ | A | Excellent |
| 4 | $M_i + 0,50S_{bi} < X = M_i + 1,50S_{bi}$ | B | Good |
| 3 | $M_i - 0,50S_{bi} < X = M_i + 0,50S_{bi}$ | C | Fair |
| 2 | $M_i - 1,50S_{bi} < X = M_i - 0,50S_{bi}$ | D | Poor |
| 1 | $X = M_i - 1,50S_{bi}$ | E | Bad |

Source : [21]

Information:

X = total of average score

Ideal maximum score = number of indicators x highest score

Ideal minimum score = number of indicators x lowest score

M_i (Ideal Mean) = $1/2$ (ideal max score + ideal min score)

S_{bi} (ideal standard deviation) = $1/6$ (ideal max score + ideal min score)

Henceforth, the scores were converted into values with five categories.

TABLE 3. The Guidelines for Converting the Assessment Results into Scores in Five Categories

| Score | Formula | Value | Category |
|-------|----------------------|-------|-----------|
| 5 | $X > 4,01$ | A | Excellent |
| 4 | $3,34 < X \leq 4,01$ | B | Good |
| 3 | $2,26 < X \leq 4,01$ | C | Fair |
| 2 | $1,99 < X \leq 2,26$ | D | Poor |
| 1 | $X \leq 1,99$ | E | Bad |

The developed media will be declared “feasible” if it is in the “good” category. Meanwhile, the increase in motivation is seen from the average motivation score before and after using the media.

There are seven categories in the questionnaires rated on the Likert scale. The seven indicators are (1) Perseverance; (2) Tenacity; (3) Interests; (4) Independence; (5) Argument; (6) Confidence; and (7) Problem-solving.

RESULTS AND DISCUSSION

This study aims at developing a product, examining its feasibility, and determining students' motivation after using the media. The following are the explanations of every stage.

Define

This stage contains a preliminary analysis like defining learning objectives, limiting the delivered subject matter, and studying learning needs with the current curriculum [22]. The problem identification unveiled that the students' main issue on the digestive system topic was the lack of understanding and application of concepts. The students tended to be lazy to learn because they think it is less meaningful, in addition to pesantren's learning system which places the priority of the religious subject being higher than general knowledge.

These problems became the basis for choosing attractive teaching media in the form of a monopoly board that was modified into the Sciencemopoly Game. The game is intended to increase student learning motivation.

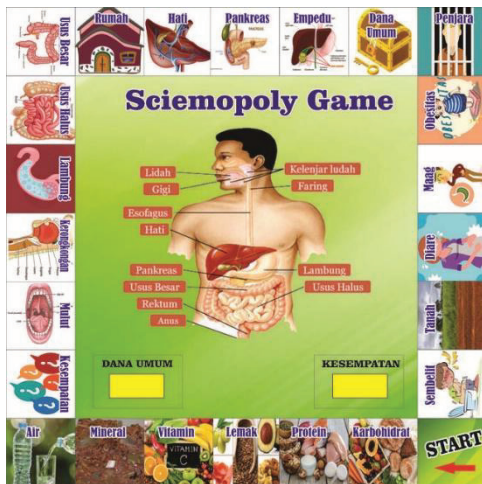
Design

This stage objects to prepare product prototypes, specifications, and instruments for the feasibility test. Since this media is adopted from the monopoly game, the product design is also made to resemble a monopoly game, the rules, and the accompanying devices (dice, play money, and so on).

Develop

This is the product manufacturing stage. The established media then went to a feasibility test through product validation sheets from content and media experts in the individual and small-group trials.

The sciencemopoly game, as a whole, discusses the materials for the human digestive system in class VIII semester 1 along with the competencies that must be achieved by students. The materials are explained through pictures, descriptions of questions, opportunity cards, and general fund cards.

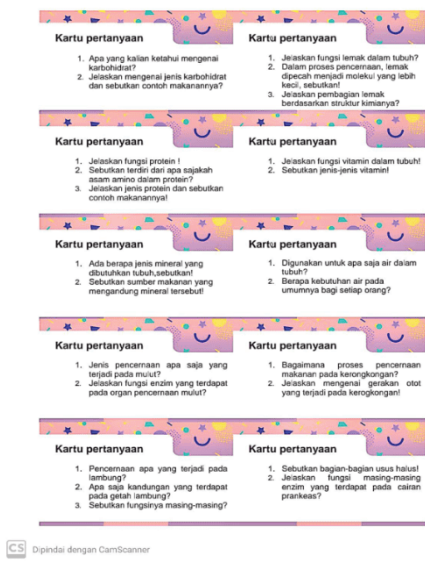


(a)



(b)

FIGURE 2. (a) The Visual Design of the Sciencemopoly Game Board; (b) The Sciencemopoly Game Dice



(a)



(b)

FIGURE 3. (a) The Question Card; (b) The Play Money



FIGURE 4. The Pawns

The game has various tools including:

1. A board game equipped with material competency tiles
2. Two dices
3. Question cards based on the basic competencies
4. Play money as a source of wealth
5. Pawns depicting scientists

This stage intends to establish a product, then be validated by the content and media experts. After being declared valid, the product must undergo developmental testing which is divided into several parts.

a. Validation by Content experts

The content experts consisted of fellow lecturers and science teachers who have competencies according to the mastery of subject matter. The data were taken using Likert scale questionnaires with five scales as presented in the following Table 4.

TABLE 4. The Data of Validation Results by the Content Experts

| Statement | Score Average | Criteria |
|--|---------------|----------|
| The suitability of materials with the basic competencies | 4 | Good |

| Statement | Score Average | Criteria |
|---|--------------------------|-----------------|
| The suitability of materials with the indicators | 4 | Good |
| The suitability of materials with the learning objectives | 4 | Good |
| Students' interaction with the media | 4 | Good |
| The increase in learning motivation | 4 | Good |
| Actualization of the presented materials | 4 | Good |
| Sufficiency of question number | 4,5 | Excellent |
| Completeness of question coverage | 4,5 | Excellent |
| Questions' difficulty level based on the materials | 4 | Good |
| Questions' depth based on the materials | 4 | Good |
| Understandable questions | 4,5 | Excellent |
| Clarity of learning directions | 4 | Good |
| Accuracy of statements and terms | 4,5 | Excellent |
| Total of average score | 54 | |
| Average score | 4,15 | Excellent |

(Source: Primary Data)

The followings are comments and suggestions proposed by the experts: (1) Several questions should be more specific to avoid ambiguity; (2) Several questions need reductions; (3) Generally, the questions are good and innovative.

Media validation was done by the media expert, i.e., fellow lecturer. Two instruments were used in the aspect of media engineering and visual communication. The validation data on the earlier aspect are presented in Table 5.

TABLE 5. Media Validation Results by Media Expert on the Engineering Aspect

| Statement | Average Score | Criteria |
|---------------------------------------|--------------------------|-----------------|
| Effectiveness in use | 4 | Good |
| Development efficiency | 4 | Good |
| Reliability | 4 | Good |
| Maintainability | 4 | Good |
| Usability | 4 | Good |
| Accuracy of media selection | 4 | Good |
| Accuracy of instruction for media use | 4,5 | Excellent |
| Variety of game tools | 4,5 | Excellent |
| Reusability | 4 | Good |
| Total of average score | 37 | |
| Average score | 4,1 | Excellent |

(Source: Primary Data)

The validation data on the aspect of visual communication are presented in the following Table 6.

TABLE 6. Media Validation Results by Media Expert on the Visual Communication Aspect

| Statement | Average Score | Criteria |
|---|----------------------|-----------------|
| Communicative (easy to understand, using good, correct, and effective language) | 4 | Good |
| Creative and innovative (new, flexible, fascinating, intelligent, and unique) | 4 | Good |
| Simplicity | 4 | Good |
| Font selection | 4 | Good |
| Font size selection | 4 | Good |
| Image display | 4 | Good |
| Suitability of images supporting the materials | 5 | Excellent |
| Layout settings | 5 | Excellent |
| Design neatness | 4 | Good |
| Total of average score | 38 | |
| Average score | 4,2 | Excellent |

(Source: Primary Data)

The followings are comments and suggestions proposed by the experts: (1) Pictures and writings are out of focus, a bit clumsy; (2) Pictures and text do not overlap

Following the suggestions given, the product was revised soon after so that the final design could be achieved as presented in Figure 1.

After the product has been validated, trials were carried out three times: individual, small-group, and field trials based on three aspects, including learning materials, media engineering, and visual communication aspects.

a. Individual Trial

This test is limited to three students selected randomly based on the level of report cards. The average scores of the three aspects are shown in Table 7.

TABLE 7. The Average Scores of the Individual Trial

| Aspect | Average |
|----------------------|----------------|
| Media engineering | 3,08 |
| Visual communication | 3,3 |
| Learning materials | 3,5 |
| Rata-rata | 3,29 |
| Category | Good |

(Source: Primary Data)

b. Small-Group Trial

This trial aims at identifying the shortcomings of the product when tested on an individual. There were seven participants whose average scores are displayed in Table 8.

TABLE 8. The Average Scores of the Small-Group Trial

| Aspect | Average |
|----------------------|----------------|
| Media engineering | 3,96 |
| Visual communication | 4,11 |
| Learning materials | 4,17 |
| Rata-rata | 4,08 |
| Category | Excellent |

(Source: Primary Data)

c. Field Trial

This last trial means the final stage of the product development. Twenty students participated in it and split into groups of four. The trial's scores were to create a feasible final product. The results are shown in Table 9.

TABLE 9. The Average Scores of the Field Trial

| Aspect | Average |
|----------------------|-----------|
| Media engineering | 4,43 |
| Visual communication | 4,44 |
| Learning materials | 4,32 |
| Rata-rata | 4,4 |
| Category | Excellent |

(Source: Primary Data)

All three trial results are depicted in the following chart.

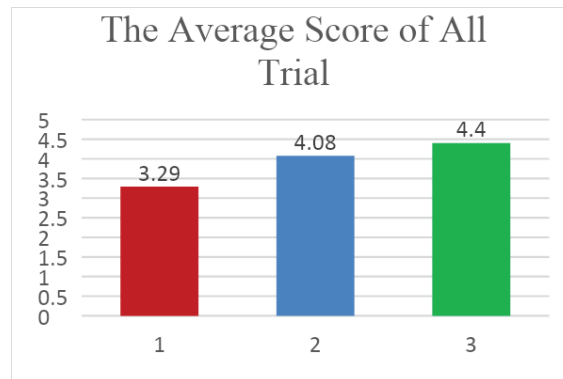


FIGURE 5. The Average Score of All Trial

Disseminate

Time constraints and research locations make the dissemination stage unable to be carried out. Nevertheless, the established product is distributed in a small scope at the research site.

However, to determine the effect of the sciencemopoly game on learning motivation, it is necessary to measure students' learning motivation before and after using the product through questionnaires with eight indicators whose results were spelled out into twenty statements. The eight indicators including 1) persistence in doing tasks; 2) tenacity in facing problems; 3) getting interested in learning; 4) enjoying independent working; 5) getting bored with routine tasks; 6) defending opinion; 7) being a person of principle; and 8) finding of looking for and solving problems.

The results of the questionnaire measurements are summarized in Table 8.

TABLE 10. The Questionnaire Results Before and After Using the Sciencemopoly Game

| Implementation | Average Score | Category |
|----------------|---------------|-----------|
| Before | 3,76 | Good |
| After | 4,01 | Excellent |

Figure 6 is the depiction of the questionnaire results.

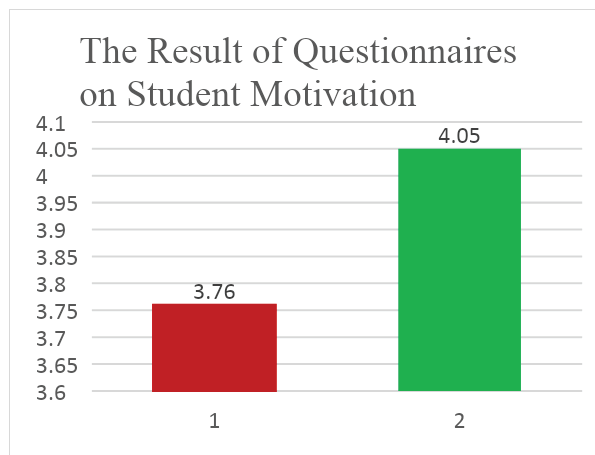


FIGURE 6. The Results of Questionnaires on Student Motivation

The questionnaire results are in line with the statement by [22] that the effect of a new media environment on middle school will enhance students' motivation and their science learning experience. Interactive media, as stated by [23], will escalate students' learning motivation. Moreover, [24] stated that with a variety of instructional media offered to educators, selecting the suitable instructional format is a critical decision to stimulate learner motivation. [25] said that learning by game can promote the students' learning enthusiasm. [26] investigated the perceptions of students regarding the combination of the game into science learning as well as the educational aids of the game with regard to learning act These facts indicate that the interactive media "Scienemopoly Game" can be used on other materials so that it can be developed on a wider scale.

[27] found that there is a significant difference in students' intrinsic motivation, where the intrinsic motivation of extroverted students is higher than introverted students. [28] stated that using the Monopoly board game earlier in the course elicits a positive motivation and students' usually ask —when are we going to play again. Moreover the Monopoly approach can be used to capture and hold the attention of students until the desired skills can be achieved. However, the use of educational games must also be careful as students may tend to be more interested in the game than learning activities. Scienemopoly Game as an adoptive monopoly game is more effective to enhance learning outcomes, because according to previous research, [29] concluded that throughout the game, whenever students are unable to respond to questions correctly, they receive direct remedial coaching specifically for that question.

CONCLUSION

The developed "Scienemopoly Game" for class VIII students of SMP Al Qur'an Zaenuddin on the digestive system topic has been categorized as appropriate to use with an average expert validity score of 4.24. The game's feasibility on the individual product trial was 3.29 in the 'fair' category, while the result of small group product trials was 4.08 in the 'excellent' category, and the field trial score was 4.39 in the 'excellent' category. The game escalated the students' learning motivation, from 3.76 in the 'good' to 4.09 in the 'excellent' category. It is clear that motivation and the learning process have a deep connection [30]. The "scienemopoly game can improve student learning outcomes, however [31] stated that, the cooperative model of monopoly media helped TGT type takes a while to study for considerable.

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