



Developing Science Monopoly on the Force Learning Material for Elementary School Students

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Abstract

Natural science learning in elementary schools is considered difficult by students due to its complexity. Teachers have not been fully able to present the natural science lesson in accordance to the characteristics of elementary school students who are still love to play. Those making the learning process and outcomes have not been maximized and require learning media to overcome the problem. This study aimed to: (1) understanding the way to develop science monopoly in Force learning material; and (2) understanding the quality and feasibility of science monopoly. This study was research and development by ADDIE model in five stages, which are; analysis, design, development, implementation, and evaluation. The test of the product was conducted to the 4th grade students of Muhammadiyah Bausasran 1 Elementary School, Yogyakarta. Instruments have been stated as valid by the expert judgement. The instruments were questionnaire of the feasibility of material, media, and learning expert; questionnaire of students response; and teacher response. Data analysis techniques were qualitative and quantitative data analysis. The assessment score of the media expert validation was 86.5 (very good), subject material expert was 87.5 (very good), learning expert was 85 (very good), teacher response was 100 (very good), and students response was 92.5 (very good). Thus, the learning media of science monopoly on force learning materials for elementary students was already feasible to use as a media of natural science learning.

Keywords: science monopoly, natural science, elementary school, force learning material.

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Introduction

Education is a conscious effort conducted by family, community, and government, through counseling/guiding, teaching and/or training activities, which take place in school and out of school throughout life, to prepare learners in order to play a role in various environments in the future (Mudyahardjo, 2014). The implementation of educational goals is responsibility for educators, parents, prospective educators, and citizens of Indonesia. Capacity development and the forming of positive character is done to educate the nation's generation in improving the nation to the advanced the nation and has great appeal.

The advanced development of science and technology demands a more modern of education. However, there are a lot of teachers who have not mastered and did not follow the

development of science and technology. Then, the advanced development of science and technology era demands a teacher to be more creative and innovative in the development of learning media, in order make learners more enthusiastic and active in learning. Teachers must also be able to follow the renewal and development of science and technology. Isjoni, Ismail, Nordin, Firdaus, Mahmud, & Bari (2008) argue that learning technology holds on the philosophy of developing the optimal potential of learning (learners) effectively, efficiently, and harmony with the development and conditions in community. One of the benefits of technology development in education is the use of varied learning resources in the learning process (Anjarsari & Irianto, 2015). The learning process is not only book-based or a learning resource. Learning resources that are

generally used in the learning process is a media or a tool to facilitate teachers in delivering learning materials. In addition, the use of media in the learning process may facilitate the students in understanding the material delivered by teachers, and the use of learning media may improve the students' learning outcomes (Enny, Setya Raharja, & Mustadi, 2014).

Media has a role in improving motivation, and making the learning process becomes more interactive. Finally, a media is able to improve the students' quality of learning (Nurrohmah, 2015). In fact, the schools' condition in Indonesia show that the use of media especially in science subjects is still very limited. Meanwhile, the science learning requires direct contact between students and learning materials, in order, the students may better understand to the concept by observation, practice, or experiment.

According to Sulistyorini (2007), Science education is a learning that has dimension of process outcomes and the development of scientific attitudes. In science learning, teachers must present the material in easy way to understand by students. Appropriate approach is also a factor that supports the achievement of competence in science learning. So in the learning, teachers are expected to choose the approach in accordance with the characteristics of students and materials (Maryani & Fatmawati, 2015). Contrary to the theory, most of students still have a thinking that natural science is a boring subject due to its high complexity (Atmara, 2016). Many factors that affecting science subject are considered as difficult lessons; material characteristic is abstract, logical, systematic, and full of confusing symbols and formulas.

Based on preliminary study conducted on August 19th, 2016 at SD Muhammadiyah Bausasran 1 Yogyakarta, found that during the learning process, the class condition was crowded and some students still playing or do activities outside the context of learning. In addition, there are number of students who are less excited and bored. Students are pay less attention to the explanation of the teacher during the learning process.

Various ways of teaching have implemented such using variety of approaches, and reward students who follow the lessons well. Sometimes, teachers also use instructional media in the learning process. This is viewed when the teacher using a learning media,

students become more active and passionate in the question and answer activity. Then, the use of instructional media needs to use by the teacher.

The use of learning media is one solution to create a more active atmosphere and improve the learning outcomes. Learning media should be accordance with the characteristics of students and learning styles which able to support students in achieving competence. Science monopoly is one solution in the development of learning media because the science monopoly is a game-based media. The science monopoly was developed into a game containing knowledge; in other words, science monopoly is a medium of learning in educational games. According to the statement Affifurahman (2015), the game is widely used as an alternative learning medium to grow students' motivation, improve students' understanding, and improve the students' attitude in everyday life. By the science monopoly media, students may play the game while learning. Science monopoly may create a fun learning. The study aimed to: (1) understand about how to develop science monopoly learning media in forces materials; and (2) understand the quality and feasibility of developed science monopoly learning media.

Method

This study was research and development by ADDIE model which are; analysis, design, development, implementation, and evaluation.

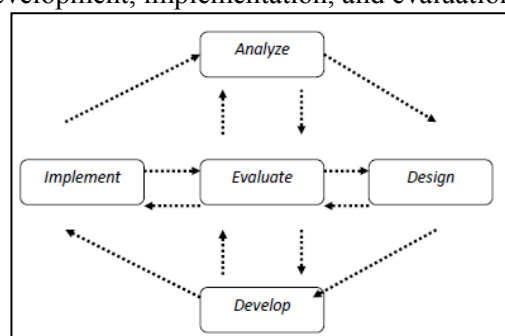


Figure 1. Frame of ADDIE Model (Tegeh & Kirna, 2013)

The procedure for developing science monopoly learning media on force materials for elementary students will design according to the development model and developing through the steps;

Analysis

In this stage, the researcher did observations and interviews to determine the actual condition. Analysis conducted by the researcher was condition analysis, learning component analysis, and needs assessment.

Design

In this stage, the researcher made the product design; design of the media base and the supporting components of the media. In addition, in this stage the researcher also determine the materials, shapes, images, and colors.

Development

In this stage, it made or developed the products accordance with the design. The steps in developing the product of science monopoly learning media on the forces material for elementary students are:

Development of Science Monopoly Base

The process of developing learning media was conducted by referring to the steps at the planning stage. Science monopoly base was made through design first. The design of the science monopoly base made with the size of 45 cm x 45 cm x 2,5 cm with the design of the front cover is a box of monopoly board. The cover has varied colors. There was an image or animation on the center of the cover of the science monopoly.

Development of Question Card

The process of making question card was done by making the design first. The design was the front view and rear view of question card. The front view contained an image and the title "question card", meanwhile the rear view contained a question with the forces material.

Development of Mysterious Cards

The mysterious card design was front and rear view. The mysterious card is a surprise card with two types of card contents: traps or penalties and rewards or gifts. The front view contained an image and the title of "mysterious card", meanwhile the rear view was the contents of the card; written text with beautiful small images.

Development of Card Ownership

The ownership card design was front and rear view. The front view contained image and

the title of the "ownership card", meanwhile the rear view contained writing the details of the cost or price of the floor plan or part to be purchased or rented.

Usage Instructions Guide

Usage instruction Guide are designed or designed just like a typical usage manual. Display guides are made with multiple images and varied of colors. The usage instructions guide serves as a guide for using science monopoly learning media.

After the finished product is developed, the next stage is to test the validity by media experts, learning experts, and material experts. Test validity is conduct to obtain valid material learning.

Implementation

Implementation stage was conducted after the developed media has stated as valid by the experts. Learning media of science monopoly was tested on 20 students of 4th grade of Muhammadiyah Bausasran 1 Yogyakarta.

Evaluation

Evaluation stage conducted after the stage of development and implementation. The evaluation stage was formative evaluation (internal) which was used as feedback to make improvements. Formative evaluation in the research was validation from media experts, materials, learning, and response from teachers and students. In this research only used formative evaluation because research aims to determine the quality and feasibility of developed learning media.

Experimental designs are expert validation and field trials. In the expert validation, the researcher gave assessment instrument to know the quality of developed learning media of science monopoly. The instrument has validated by the instrument validator and has stated as valid. Validation was conducted by three experts who are, media experts, material experts, and learning experts. Meanwhile in the field trial stage, the researcher gave response questionnaire to the students and teachers to know the feasibility of developed learning media of science monopoly.

Subjects of the study were 20 students of fourth grade of Muhammadiyah Bausasran 1 Yogyakarta. The type of data in this study was primary data and secondary data. Primary data obtained from the assessment of experts,

teachers, learners, and observation data that conducted during the learning process. Meanwhile, secondary data collected from teacher interview result. The instrument in the research was a structured questionnaire. After the collected data, the researcher conducted data analysis. Data analysis techniques were qualitative and quantitative data analysis. Quantitative data analysis used for the assessment data of experts, teachers, and learners in the form of numbers. The qualitative data analysis used for data from comments and suggestions provided by experts, teachers, and learners.

Obtained score's calculated by formula provided by Arikunto (2011):

$$P = \frac{\sum \text{Score}}{\sum \text{Maximum Score}} \times 100 \%$$

After obtained score of assessment, then conducted interpretation the results of the assessment in four criteria:

0% - 25%	: not good
26% - 50%	: less good
51% - 75%	: good
76% - 100%	: very good

The learning media of science monopoly on forces material for elementary school students was feasible due to the final result of data analysis has good category with score 51% - 75%.

Result and Discussion

Data of trial test in developing learning media of science monopoly was outlined based on the development procedure by ADDIE model, and described of: analysis, design, development, implementation, and evaluation. In the analysis stage, the researcher did observations to collect data and information about problem of the actual condition; Analysis conducted by the researcher was condition analysis, learning component analysis, and needs analysis. The collection information was focused on the needs of students and teachers toward the development of media. Based on the observation result on SD Muhammadiyah Bausasran 1, it obtained problems that have described in the previous introduction. The following is the result of observation, and observation relating to the problems occurred in SD Muhammadiyah Bausasran 1 Yogyakarta, which are: (1) there are a number of teachers who have not mastered and have not followed

the development of Science and Technology; (2) the science learn-ing process tends to be less in practice due to the limitations of natural science learning equipment availability and the media; (3) when the learning process begins, students still do their activities, and students have not focus or concentration to follow the learning, and mostly students do not pay attention to material' explanations; (4) the motivation possessed by the students is still low; (5) learning media in schools is very limited, and some media can only be used on certain materials.

During the learning process especially in science learning, students have difficulties because science learning is considered to have complex characteristics. Based on the results of interviews with teachers, it may take a conclusion that the science learning process tends to less in practice due to the limitations of the science laboratory and its equipment. In addition, when teachers give rewards to students, it made the student in following the learning process become very enthusiastic and good. Students love method that involves them directly. By this situation, the suitable media for learning process are the media which involves students directly in the learning, learning materials are from around the students, and able to attract the students' attention by including rewards. In line with the research results by Wulandari & Hidayat (2014) stated that the effect of reward and punishment on learning motivation is greatly improved. Therefore, the development of learning media of science monopoly using or including elements of reward in the media aims to attract the students' attention and improve the motivation to learn. Based on this limitation, the researcher needs to develop science monopoly learning media on the forces material for elementary students.

The development of learning media of science monopoly is conducted because the science monopoly specification matches to the characteristics of media needed in the learning process. In line with Arsyad (2014) states that the use of learning media may grow the students' motivation and interest, learning media may also help students to improve the understanding, present data with interesting and reliable, facilitate interpretation of data, and full of containing information. By the learning media of science monopoly may provide knowledge, motivation, and provide a pleasant learning experience because the learning media

of science monopoly is a media of education game-based. According to Rohwati (2012), educational games is a very fun activity, and may become an educational way or educational tool. Then, educational games are useful to improve the language skills, thinking, and relationship with the environment. In addition, the use of learning media of science monopoly is expected to assist the students to understand the learning materials, especially on forces materials and may help teachers to deliver material in the learning process, and then teaching and learning activities may run effectively, and efficiently; and impact to create an active learning. The statement is supported by research result of Vikagustanti, Sudarmin, & Pamelasari (2014) states that the use of learning media of science monopoly positively affects the ability to think and improve students' achievement.

The next stage is design. In this stage, the researcher designed the product design, and determines the shape, the materials, and the planning related to the assessment. The Figure 2 is a figure of the planning sketch conducted by researcher (storyboard).

<p>Papan Alas Monopoli Sains</p>	<p>Keterangan:</p> <ul style="list-style-type: none"> ■ = Question Card ■ = Kartu Misterius ■ = Petakan <p>Pada setiap petakan terdapat gambar sesuai dengan materi yaitu gaya.</p>
<p>Question card</p>	<p>Keterangan:</p> <p>Terdapat dua sisi yaitu depan dan belakang. Judul terletak pada bagian depan dan sedangkan pada bagian belakang terdapat teks (soal) dengan background sama tapi pada bagian belakang background diseting transparan.</p>

Figure 2. Design Planning (Story Board) Monopoly Board and Question Card

Based on the Figure 2, in the first column is the design of the developed science monopoly board consisting of the squares in green color and dividing into 2 slots; slot for question cards and mysterious cards. Moreover, on the science monopoly board, there is a name of developed media. In the second column is the design of the

question card; display of question card consists of two parts, the front and rear view. Meanwhile, on the small squares of rear view is a part to put writing, and the image is made into transparent.

<p>KARTU MISTERIUS</p>	<p>Keterangan:</p> <p>Terdapat dua sisi yaitu depan dan belakang. Judul terletak pada bagian depan dan sedangkan pada bagian belakang terdapat teks dengan background sama tapi pada bagian belakang background diseting transparan.</p>
<p>KARTU KEPEMILIKAN</p>	<p>Keterangan:</p> <p>■ = Warna menyesuaikan petakan</p> <p>Tulisan pada kolom biru yaitu judul sesuai dengan petakan. Dibawah judul terdapat petunjuk harga sewa, bangun, dan perbaikan.</p>
<p>CATATAN PETUNJUK PENGGUNAAN</p>	<p>Keterangan:</p> <p>■ = bagian yang dipang dengan jilid spiral</p> <p>Kotakan paling luar merupakan bingkai dari catatan petunjuk. Sedangkan petakan dalam merupakan bagian yang akan digunakan untuk teks.</p>

Figure 3. Design Planning (Storyboard) of Mysterious card, ownership card, and usage instructions guide

Based on the Figure 3, the first is a mysterious card design. The small squares on the rear view is a part to put writing, and the image is made into transparent. The second column is ownership card design. The blue map is a part that will be adjusted to the column color of the map on the media base. In addition, the squares containing written of the slot name, and on the outside of the white colored containing a written relating to the price of rent, sale, or repair. The last column is the design of the usage instructions guide. Usage instructions guide are built or designed similar to books. Red squares is the part where to put spiral coils, and the middle squares is part where to put a writing.

The next stage is the stage of development. In the stage of development, the researcher made the manufacture or development of products in accordance with the plans in the previous stage. The developed product was a learning media of science

monopoly on the forces material for elementary school students. After the product had finished, the researcher conducted the product test to the experts who were media experts, material experts, and learning experts. In this stage, the assessed products made improvements in accordance with comments and suggestions provided by media experts, materials experts, and experts learning.

The next stage is the implementation. The stage is conducted after the product of learning media of science monopoly stated as valid and feasible by the experts. In the implementation stage, the researchers conducted product trials to 20 students of four grade Muhammadiyah Bausasran 1 Yogyakarta. The last stage is the evaluation stage.

The evaluation stage has actually conducted in the stage of development and implementation. Evaluation of science monopoly learning media was conducted on the validation process and filling the instrument sheets of a questionnaire to media experts, material experts, learning experts, teacher response questionnaire, and students response questionnaire. Questionnaire was used as a guide in the assessment score, and it had consulted to the instrument validator, due to the questionnaire in the learning media of monopoly science was valid. The evaluation in this study was a type of formative evaluation. The data of research result was qualitative and quantitative from the whole of research process. Qualitative data was obtained from critics and suggestions by media expert, material expert, learning expert, and responses of teachers and students. The following was a qualitative data obtained from experts and responses of teachers and students.

Media Expert

Critics and suggestions were given by the media expert, which were; need to improve the board of monopoly science in order the board are balance when placed on the plane. In addition, the usage instructions guide was provided with key answers of question card and Olympic question. Aiming to make a better media, the media expert suggested adding a separate guidance note for the Olympic rules in a sheet; question card is build with greater difficulty different from questions on the question card; and the adding of image on media base and its description on the usage instructions.

Materials Expert

Critics and suggestions were given by the material experts, which were; need to fix one of the words contained on the mysterious card. Expert material described, the word was less appropriate or not maximum for use in learning media of monopoly science. In addition, the material expert also provided suggestions for correct writing errors of the material.

Learning Expert

Critics and suggestions were given by the learning expert, which were; the board color needs to adjust to the students' characteristics and should use a bright color. Learning experts explained, the use of light gray color seemed less to attractive and less alive, would be better if used the light green or light blue. In addition, the learning expert also provided suggestions for adding Material Cards to the learning media of science monopoly, due to the note of the learning expert; If not added with Material Card, then the learning media of science monopoly is the same to the lecture method in learning process.

Teacher Response

Comments or suggestions were given by the teacher which is; learning media of monopoly science was very good and very interesting. By using the learning media of science monopoly, students seemed enthusiastic to follow the learning, and then, the students also become not bored in following the learning process.

The data was supported by the results of interviews to teachers relating learning media of monopoly science. The teacher explained; the learning media of science monopoly was very good; the first time researcher come for observation, teachers imagined the developed product was just a sheet of paper like a monopoly in general. But, in the implementation of product, teachers were very impressed to the learning media of science monopoly wrapped neatly and with an attractive design. Teachers hope that the use of learning media of science monopoly may increase the students' enthusiasm and spirit in the learning process.

Students Response

Students' response obtained through interviews. In the interview, students explained; they do not understand to the games because when the explanation of how to use the learning

media of monopoly science conducted by researchers, students were less attention, as the result, there were some rules or steps that they did not understand in trials of media phase. In the aspect of “learning motivation”, there were 3 students who answered not by the reason they do not like to learn, but they only like to play the game. However, when in round 1-4, it required to take the Materials Card, and then read aloud and heard by their friends. They do not like it or not interested because they were lazy to read, and the three students assumed that all things related to learning is boring.

The quantitative data obtained from the validation results of material experts, media experts, learning experts, and response of teachers and students. The following is quantitative data obtained from experts and response of teacher and students.

Media Expert

The results of the assessment of media experts on the quality aspects of learning media of monopoly science obtained the score of 45 with the assessment of learning media of science monopoly is 86,5 with the following calculations:

$$P = \frac{\sum Score}{\sum Maximum Score} \times 100 \%$$

$$= \frac{45}{52} \times 100\%$$

$$= 86,5$$

By the score, the conversion of qualitative data, then the developed learning media of science monopoly was feasible.

Materials Expert

The results of material expert assessment to the quality aspects of learning media of science monopoly obtained the score of 56 with the assessment of learning media of science monopoly is 87,5 with the following calculations:

$$P = \frac{\sum Score}{\sum MaximalScore} \times 100 \%$$

$$= \frac{56}{64} \times 100\%$$

$$= 87,5$$

By the score, the conversion of qualitative data, then the developed learning media of science monopoly was feasible.

Learning Expert

The results of learning expert assessment to the quality aspects of learning media of science monopoly obtained the score of 34 with the assessment of learning media of science monopoly is 85 with the following calculations:

$$P = \frac{\sum Score}{\sum MaximalScore} \times 100 \%$$

$$= \frac{34}{40} \times 100\%$$

$$= 85$$

By the score, the conversion of qualitative data, then the developed learning media of science monopoly was feasible.

Teacher response

The results of teacher response assessment to the quality aspects of learning media of science monopoly obtained the score of 15 with the assessment of learning media of science monopoly is 100 with the following calculations:

$$P = \frac{\sum Score}{\sum Maximal Score} \times 100 \%$$

$$= \frac{15}{15} \times 100\%$$

$$= 100$$

By the score, the conversion of qualitative data, then the developed learning media of science monopoly was feasible.

Students Response

The results of students response assessment to the quality aspects of learning media of science monopoly obtained the number of “Yes” in the assessment is 185, in contrast, the number of “No” in the assessment is 15. And then, the assessment of learning media of science monopoly; assessment in category “Yes” is 92.5 and in the category “No” is 7.5, with the following calculation:

$$P_{yes} = \frac{\sum Score}{\sum Maximal Score} \times 100 \%$$

$$= \frac{185}{200} \times 100\%$$

$$= 92.5$$

$$\begin{aligned}
 Pno &= \frac{\sum \text{Score}}{\sum \text{Maximal Score}} \times 100 \% \\
 &= \frac{15}{200} \times 100\% \\
 &= 7.5
 \end{aligned}$$

By the score, the conversion of qualitative data, then the developed learning media of science monopoly was feasible. If the assessment is viewed on the basis of the conversion of qualitative data, then the monopoly science learning media developed is criteria worthy.

The obtained data from expert validation and field trials were analyzed in order to obtain conclusions about the assessment of learning media of science monopoly. From the analysis of each assessment, may take conclusion that the use of learning media of science monopoly was very good in the learning process. The result obtained from the validation of media experts, material experts, learning experts, and data of product trial test obtained from response of teacher and students. The data of each assessment were summarized as follows: (1) The result of assessment in the validation stage by media experts related to the quality of learning media of science monopoly obtained score of 45 with score of 86,5 and involved in very feasible category; (2) The results of the assessment in the validation stage by the material experts related to the quality of the learning media of science monopoly obtained score of 56 with score of 87,5 and involved in very feasible category; (3) The results of the assessment in the validation stage by the learning expert related to the quality of the learning media of science monopoly obtained score of 34 with score of 85,0 and involved in very feasible category; (4) The results of the assessment obtained from the questionnaire of teacher responses related to the feasibility of the learning media of science monopoly obtained score of 15 with a score of 100,0 and involved in very feasible category; (5) The results of the assessment obtained from the questionnaire of the students responses related to the feasibility of the media of science monopoly obtained the number of “Yes” 185 with a score of 92,5 and the total of “No” was 15 with a score of 75,0 and involved in very feasible category.

Figure 4 is the graph about expert validation score of the research in SD Muhammadiyah Bausasran 1 Yogyakarta on

developed learning media of science monopoly for elementary school students. Graph of score assessment of the quality of learning media of science monopoly is presented in Figure 4:

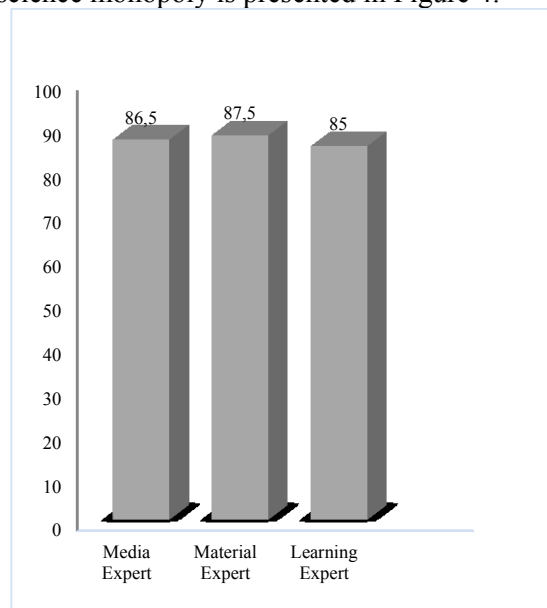


Figure 4. Graph of Score Assessment of the Quality of Learning Media of Science Monopoly

In addition, Figure 5 is a graph of scores of teacher and students response of SD Muhammadiyah Bausasran 1 Yogyakarta on science monopoly learning media for elementary students. Graph of Score Assessment of the Feasibility of Learning Media of Science Monopoly is presented in Figure 5:

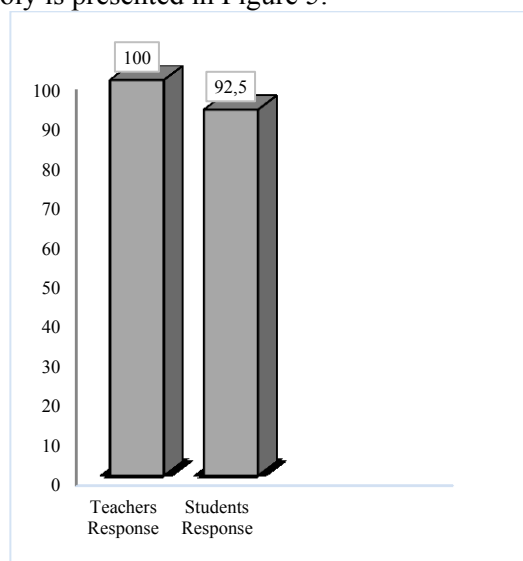


Figure 5. Graph of Score Assessment of the Feasibility of Learning Media of Science Monopoly

The research result proved that the media of science monopoly on the forces material had feasible to help students understanding the learning materials, especially the forces material. In addition, the media also had potential to increase the motivation of learning such as research by Dwiputra (2016) which shows that the use of monopoly media can improve the students' learning motivation. The existence of an interesting learning media can increase the students engagement and have a positive impact on improving the quality of the process and learning outcomes (Maryani, Martaningsih, & Bhakti, 2017). In addition, the enthusiasm of learners in using the monopoly media was very high, and changed the atmosphere of class; from passive class becomes very active.

Conclusion

This research was research and development by ADDIE development model in five stages which are; analysis, design, development, implementation, and evaluation Based on the validation result by experts, it obtained the quality of media with the assessment results in the validation stage of media expert, material expert, and learning expert which involved in very good category. Moreover, the results of the assessment of the feasibility of learning media of monopoly science by teachers and learners obtained score with involving in the very feasible category. Based on the assessment, the learning media of monopoly science had excellent quality and excellent media feasibility. Thus, the developed learning media of monopoly science was very feasible, and had feasible to be used or applied as a medium of learning for teachers and students at four grade elementary school.

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