

Developing Biology-based Monopoly Game as Media to Enhance Students' Learning Outcome and Social Ability

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Abstract— The purpose of this study is to describe the development of biology-based monopoly game as media to support students' learning outcome and social ability. Using the Four D-Model, we created and developed a set of biology-based monopoly game and tested it to junior high school students ($n = 24$). This study consists of two phases namely the development and implementation phases by using a one-shot case study design. Research parameters were the feasibility of the developed game as the media, the students' learning outcome, and the social ability. Data were analyzed descriptively according to the characteristics of the existing data. The findings showed that media can support students' learning activity based on the correct understanding of the students' learning outcomes; the excellent enthusiastic, high competition and cooperation, and good discipline aspects. Based on this study, the feasibility is considered very feasible. Results indicated that biology-based monopoly game is effective to support junior high school students' learning outcome and social ability.

Keywords—monopoly game; media; learning outcome; social ability

I. INTRODUCTION

The best learning media will enable students to respond, to generate interest and to learn motivation [1]. Effective learning games in the learning process consider couples of prerequisites that can bring real-world values, knowledge, and joy, of which do not make students look stupid or superficial, rather, make them work together, challenge, and feedback [2]. The results of observations and interviews conducted by researchers show that students are less motivated in learning biology due to many unfamiliar scientific terms students must understand. Teachers also have not used game as media and not yet implemented appropriate teaching techniques. As a result, the completeness of student learning outcomes has not been achieved and the students' social skills have not developed optimally.

Rokhmani's research concludes that the effective monopoly game is used as media to support the teaching and learning process in Chemical Formula and Reaction Equation matters. The effectiveness in terms of media quality, media concept,

student's interest response, fluency of the game and learning process, and media ability to improve student's learning outcomes [3]. Trisana's research also concluded that students in the class using monopoly game achieve better learning outcomes than students in the class who do not use the monopoly game media in learning [4]. However, research on the development of monopoly game in the material structure and function of plants has never been done by other researchers.

The purpose of this research is to develop instructional media adopted from a monopoly game to support the completeness of student's learning outcomes and the development of students' social attitudes. This research uses only two phases of which from four D-Model and its application phase using one-shot case study method. The result of this research of developing monopoly game as media can improve student's learning result as much as 75,4% and student's social attitude includes the excellent enthusiasm aspects; very good in competition and cooperation aspects; while, quite good in discipline aspect. This shows that the advantages of the game as a medium are (1) something fun and exciting because there is an element of competition, (2) having the ability to engage students in an active learning process, (3) providing direct feedback (Sadiman et al., 2006). Learning games can get rid of the "seriousness" that hinders to create an atmosphere of joy and excitement in learning and creative intelligence can be achieved [5].

II. METHOD

This research is a research type applying various learning models assisted with learning media in a form of monopoly game on the material structure and function of plants. Concepts related to the material include the morphological structure of the roots, stems, leaves, flowers and seeds and their functions. This study consists of 2 stages; the development of learning media tools and the application of monopoly game as a learning media to support the completeness of learning outcomes and the ability of students' social attitudes. The development of learning tools using 4-D model consists of 4 stages; (1) Defining, of which includes the analysis of

curriculum analysis, student analysis, concept analysis, task analysis, and formulation of learning objectives; (2) Designing, of which covers the preparation of monopoly game and the preparation of research instruments; (3) Developing, of which includes media validation by experts in media development, biology lecturers and teachers. The validation results are used to revise the media to meet the criteria. Then it is performed the application of monopoly game about the material structure and function of plants four times in the classroom learning activities as described in table 1.

TABLE I. LEARNING ACTIVITY WITH BIOLOGY MONOPOLY GAME MEDIA

Meeting	Time (minute)	Learning Activity
I	80	Submitting materials or concepts of structure and function of roots, stems, leaves, flowers, fruits, and seeds. The material presented is limited to morphological structure only
II	40	Socializing or introducing the rules of monopoly play and its components by modeling the rules how to play
III	80	Playing activities done by the students and judged by the observer
IV	40	Providing an evaluation test (post-test) to measure the level of students' understanding of the subject matter that has been learned after playing the monopoly.

A monopoly game was played by students in a group of eight divided into four small groups consisting 2 students. During the game and learning activities using the media, observations of students' activities were done by observers from the beginning to the end of the game covering aspects of enthusiasm, competition, cooperation and order during monopoly play; (4) Disseminating. However, this study only works up to the third phase namely development. The research design used was One-Group Pretest-Posttest Design developed by Campbell and Stanley [6].

III. RESULTS AND DISCUSSION

The results of this study are divided into two namely the results in the development stage of media and results in the application phase of the media. The results were analyzed qualitatively and quantitatively. Data shown as the results of media feasibility assessment are presented in Table 2. Before being tested to students, this media has undergone several times in the revision phase. The draft I is the initial draft of the revised media based on the suggestions from lecturers I and II so that the draft II is produced. Then draft II gets revised again into draft III that is ready to be tested to the students. The revision was made to develop a monopoly game media in order to obtain a viable and effective media used in supporting learning activities. The types of revisions include the implementation of media trials, rules of play, visual aspects, questionnaires format, language use or sentence, and the materials used.

TABLE II. RESULTS AND TYPES OF MEDIA REVISION OF MONOPOLY GAMES ON MATERIAL STRUCTURE AND FUNCTION OF PLANT

No	Type of Revision	Results of Revision		
		Draft I	Draft II	Draft III
1.	The trial of media implementation	The trial was held twice (120 minutes) with details: Meeting I (80 minutes) was used for material delivery and playing a biology monopoly. Meeting II (40 minutes) is used for the evaluation test (post-test).	The trial plus two meetings, results in four meetings (240 minutes). The change occurred in the second meeting (40 minutes) used for introducing how to play. Then the third meeting (80 minutes) is used for learning processes with biology monopoly game.. The last meeting (40 minutes) is used for the evaluation test (post-test).	The number of meetings in the the trial was not changed. However, before the test phase was actually implemented in the classroom, the researcher conducted a limited trial to find out whether the number of questions contained in the media was enough to be learned by playing biology monopoly media for 80 minutes.
2.	Rules how to play.	Players can get out of jail if they get the same number of the dice when throwing for the third time.	The rules are replaced by answering questions from the bank with three occasions. If the wrong answer on the occasions I and II pay a fine of 20. If on the third occasion still answered wrongly, the player paid a fine of 200.	The regulatory changes are focused on the amount of the penalties. On occasions I and II, the amount of the penalty is replaced by 10. Opportunity III the amount of the penalty is replaced by 25.
		The turn of play of each group is determined directly by the bank officer.	Changes in the way of turn to play are determined by the position of each group in a clockwise direction.	The determination of how to play each group is changed again by taking the lottery numbers that have been provided by bank officers.
		The method of giving the question is done by taking the lottery number.	The way of giving the question is replaced by reading the question directly according to the serial number of the questions in each question list.	The method of giving the question is replaced by a direct appointment whether it is a matter of theory or a matter of images contained in each question list.
		The way of determining the winner is only based on the amount of wealth most obtained by each group.	The method of determining the winner is changed based on the amount of his wealth and the number of correct answers by each group	The way of determining the winner is completed. If two groups have the same number of correct answers, the winner is determined by a priority list of questions made by the researcher.

TABLE II, cont.

3.	The visual aspect	The game board is printed on the cardboard and is black and white.	Game boards are stamped on photo paper and pasted on cardboard.	The media is packed with making wooden boxes and game boards pinned on top of the box.
		The general fund and opportunity cards are printed on HVS paper and are black and white.	General fund cards and opportunities printed on photo paper and added supporting illustrations in the form of line frames	Change the shape of the more interesting illustrations and color changes.
		Monopoly money uses money as is commonly used in monopoly games.	Replacing monopoly money with monopoly money designed by researchers. But the value of its currency is greater.	Changed the currency value to smaller.
		Colors on each sub concept (Roots: gray, Trunk: orange, Leaf: light blue, Flower: blue, Fruit: yellow, and Seed: Pink).	Change the color on some sub-concepts of Roots become magenta, Flower becomes red, and Fruit becomes green. The colors are matched with the proprietary box on the board and on the proprietary card	Change the layout of the image and add the supporting illustrations. Add the word Biology Monopoly in the middle of the board game.
		Create a monopoly board design with size 50 cm x 50 cm	The size of the monopoly game board is changed to 40 cm x 40 cm	At the edges added as much as 5 cm so that the size returns like draft I.
		Images in questionnaire do not match the proposed or the concept.	The image in the center of the game board is removed and replacing the image that is inconsistent with the concept.	Add an arrow mark to the image according to the question
4.	Question naire grouping format	The Question List is grouped into matter Theory and Fig. Each group has a sub-concept of matter (Root-Seed). While the answer is printed, the paper contained in the question.	The grouping is converted into a list of questions Theory 1, Theory 2, Figure 1, and Figure 2. The answer is no longer printed on the back of the paper with the question but on the other.	Create a new questionnaire group that is a Reserve or Pot checklist. Then add the number of questions to the Questionnaire of General Funds and Opportunities list. And fixing the wrong typing and print.

TABLE II, cont.

5.	Use of language or sentence	Sentences or languages on the Fund and Opportunity cards are much negative.	Replaced by a positive phrase or language	Repair mistyped sentences and print
		Some questions have multiple meanings, thus confusing the student when answering and the answer is also incorrect.	the question is replaced or the sentence is fixed so that it has no double meaning so that the student's answer is only focused on one answer only.	Wrong replacement of sentence and print.
6.	Material used	The material consists of anatomical structure and morphology of plant functions	The material only focuses on the morphological structure and function of the plant body	For the material, function is taken only functions associated with morphological structure only

Monopoly game media can be tested on students after experiencing revisions and judgments of Biology lectures, media experts, and biology teachers. The result of the feasibility assessment of the monopoly game media is presented in Table 3.

TABLE III. ASSESSMENT OF MEDIA FEASIBILITY OF BIOLOGY MONOPOLY GAME ON MATERIAL STRUCTURE AND FUNCTION OF PLANT

No	Indicator	Expert Media	Biology Lecturer	Biology Teacher
A.	Media Format	90%	95%	95%
B.	Visual	100%	95%	100%
C.	Media Clarity in Presentation of Concepts	95.83%	93.75%	100%
<i>Average Percentage Media Feasibility Value</i>		<i>95.28%</i>	<i>94.58%</i>	<i>98.33%</i>

The indicators of the feasible assessment or valid monopoly game media are grouped into three aspects of assessment namely media formats, visual aspects, and media clarity aspects. Based on Table 3 and referring to the percentage of media assessment criteria, the assessment of the three reviewers generally shows that the monopoly game media on the material of Plant Structure and Function is very suitable to be used to support the learning process.

The validation or feasibility process of monopoly game media is done by Dra. Rinie Pratiwi P., M.Si. as a media expert, Dra. Yuni Suryawati as a Biology teacher, Dra. Leonita Santoso, M.Si., and Dra. Sifak Indana, M.Pd., as lecturers of

Biology I and II. Based on Table 3, the reviewers stated that the monopoly game media earned a very reasonable rating category. The categories of assessment are grouped into three aspects: (1) media formats, including media suitability with learning indicators, systematic presentation of questions, conformity of evaluation tests with sub-indicators, clarity of rules on how to play, and the format of the presentation of media components; (2) the visual includes the quality of the image or illustration, the color quality of the image or illustration, the clarity and shape of the letters on the media, the design and the size of the media, the clarity and understanding of the use of the language or sentence in the media; (3) media clarity in presenting the concept of the structure and function of roots, stems, leaves, flowers, fruits, and seeds.

This media's assessment is based on the overall visual aspect by all three reviewers by 100%. That is, the biology monopoly media is very suitable to be used to convey material Structure and Function of Plants. This means that information that is usually delivered verbally can be displayed visually in biology monopoly media so that the learning process is more interesting and the purpose of learning can be achieved.

The clarity of biology monopoly game media in presenting the concept of the morphological structure of roots, stems, leaves, flowers, fruits, and seeds and their functions are highly appraised. This means that the media presents the concept clearly and systematically through easy play activities. This media can combine images and words to visualize the concepts of concise and clear facts and ideas.

In this research, the standard of the measures of learning outcomes used in each learning indicator is more than 60%. Table 4 shows the data of students' learning outcomes after the learning process using biology-based monopoly game to master the structure and function of plants.

TABLE IV. COMPLETION OF STUDENT LEARNING OUTCOME IN EACH SUB INDICATOR

No	Sub Indicator	Percentage (%)	Completeness
1.	Students can define the sections of the root with the image	100	Completed
2.	Students can explain the function of the root hood	83.3	Completed
3.	Students can explain the five functions of the stem	91.7	Completed
4.	Students can distinguish 3 characteristics of the morphological structure of herbaceous rods and woody stems	91.7	Completed
5.	Students can name two examples of herbaceous stems	100	Completed
6.	Students can name two samples of woody stems	100	Completed
7.	Students can specify parts of leaves with drawings	95.8	Completed
8.	Students can explain the main function of the leaves	100	Completed
9.	Students can distinguish leaf samples that include leaves complete with incomplete leaves	54.2	Incompleted
10.	Students can determine the morphological structure of flowers with images	95.8	Completed

TABLE IV, cont.

11.	Students can mention the function of additional parts of flower	100	Completed
12.	Students can distinguish examples of flowers that include flowers complete with incomplete flowers	50	Incompleted
13.	Students can distinguish true fruit groups and pseudo-fruit groups	87.5	Completed
14.	Students can name three true pieces of fruit	87.5	Completed
15.	Students can name three samples of pseudo-fruit	100	Completed
16.	Students can define parts of the seed with the image	91.7	Completed
17.	Students can mention the functions of the embryo	87.5	Completed
18.	Students can mention the function of cotyledons	87.5	Completed
19.	Students can explain the characteristics of the morphological structure of 2 layers of seed coat found in Angiospermae plants	87.5	Completed
20.	Students can explain the characteristics of the morphological structure of the 3 layers of seed coat found in the Gymnospermae plant	83.3	Completed
Average Percentage Completion All Sub Indicators (%)		75.4	

According to the data shown in Table 4, it is known that the average percentage of completeness of all sub-indicators is 75.4%. Of the 20 sub-indicators, there are 18 sub-indicators that successfully completed. That is, the use of this monopoly game media can help students achieve the goals or sub-indicators of learning. The use of media is an important part in supporting the learning process in hopes to facilitate the achievement of predetermined learning objectives [7].

The ability of social attitudes is observed from activities as long as students perform monopolistic play activities in groups. Aspects of observation assessed by two observers in each large group include aspects of competition, enthusiasm, cooperation, and order. The average result recapitulation score of each aspect of observation of student activity during monopoly play in each big group is presented in table 5.

TABLE V. OBSERVATION OF STUDENT ACTIVITY DURING MONOPOLY PLAYING ON MATERIAL STRUCTURE AND FUNCTION OF PLANT

Group	Aspect of Observation			
	Competition	Enthusiasm	Cooperation	Discipline
1	3.75	3.75	3.50	2.75
2	3.50	3.50	3.25	2.50
3	2.75	3.50	2.75	2.25
Average of Each Aspect	3.33	3.58	3.17	2.50
Assessment Category	Very Well	Excellent	Very Well	Quite Good

According to the data shown in Table 5, it shows that the students are very enthusiastic to play a monopoly shown by an average value of 3.58, of which is categorized very good. This

means that almost every group implements observation indicators that are included in the aspect of enthusiasm. Among them, almost all students pay attention to the teacher while introducing the biology monopoly game media component and modeling how to play it. When the game begins, all students in each small group come into the play. In addition, almost all students also play sportsmanship and keep trying to answer the problem even if the answer is wrong.

Students who are divided into groups of three also show cooperation and competitiveness that are categorized as good. Both of these aspects obtained an average score of 3.17 and 3.33. This means that the indicator that each group has competed can be seen from the efforts of the students to win the game. The effort is seen when the students answered correctly at least 3 times and maximum twice for wrong answer. By answering the questions, students also learn how to apply the concept. Aspects of cooperation are also considered good, as evidenced by the observation of each small group, discussing each other, respecting each other's decisions and respecting the opinions of other students or members of the group, and actively participating during play and learn.

Aspects of student's order during the play of biology monopoly are rated by observers with an average value of 2.50. This shows that the play of this monopoly media does not want to create a noisy and chaotic atmosphere. Overall, the four student activities above become a way to get an effective learning game and get added value in the learning process.

IV. CONCLUSION

Based on the analysis of research results and discussion, it can be drawn some conclusions. Firstly, the feasibility assessment of the media based on the aspects of media formatting, visual, and clarity of concept shows that biology monopoly game developed in this research is very feasible to be used to support Biology learning process about Plant Structure and Function. Secondly, the completeness of all sub-indicators after using the monopoly game media on the material Structure and Function of Plant has been achieved with the average value of mastery of 75.4%. Thirdly, students' activity during monopoly play in each social aspect shows excellent in enthusiastic aspect; very good in competition and cooperation aspect; and quite good in discipline aspect.

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