



The Development of Plantapicard Education Game Learning Media for Tenth Grade Students of Senior High School

Miskiyati Saroya Mahfiroh^{1✉}, Eling Purwantoyo¹, Ely Rudyatmi¹

¹Biology Department, Faculty of Mathematics and Sciences, Universitas Negeri Semarang, Indonesia

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Abstract

This research was conducted in SMA Negeri 1 Randudongkal. This research uses research and development design (R& D). The product trial was conducted in class X MIPA 2 and X MIPA 3 by Sampling Purposive method and experimental design, Nonequivalent Control Group Design. The results of the assessment of educational plantapicard game expert obtained very valid with the value 92.5% for material and 95% for media. According to experts, learning media developed plantapicard education game has the advantage i.e. the size of a small book so practical use when learning, interesting book, creative design, and language that is easy and communicative so as to create student interest in understanding learning. From the results of the teacher and student's responses questionnaires to the product, the test gets positive feedback with very good criteria. Mastery learning is obtained from the analysis with value of 86.11% for X MIPA 2 and 50% for X MIPA 3. Students activity in the learning process using Plantapicard Education Game increases at each meeting. Most students meet the active and highly active criteria. This study shows that Plantapicard Education Game in Plantae is valid, practical and effective use as a learning medium.

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✉ Correspondence Address:

D6 Building 1st Floor Jl Raya Sekaran, Gunungpati, Semarang
E-mail: msaroya008@gmail.com

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INTRODUCTION

Learning activities in schools are very influential on students' achievement. Effective learning is influenced by several factors, one of the factors is the teaching-learning media used by the teacher. An interesting learning media can attract students's interest to study so students are easier to understand the material that is taught in the learning process (Falahudin, 2014).

Observations show that learning processes are often held in the classroom using the lecturing method, textbooks as teaching materials, and power point slide as the media. Teachers want to use interesting learning media in learning activities yet not available. The consequence of this problem is the weak understanding of the students on the material. This is the reason why researchers develop interactive and innovative learning media to facilitate students in studying the material.

The selection of appropriate media in learning process needs to be considered by the teacher. The appropriate use of media will increase students' interest and motivation toward learning. So, it will improve student's learning outcomes (Arsyad 2011). Media that is considered most capable to improve learning result which is often used is visual media (Apriliani, 2013). Visual-based media (image or imagery) plays a very important role in the process of learning. Visual media can ease understanding and strengthen memories. Visual media can also cultivate students's interest and provide a link between the content of the subject matter and real world. In order to be effective, visual media should be placed in a meaningful context and students should interact with the visual media (image) to ensure the process of information (Arsyad, 2011).

The observed package books which are used in schools tend to be textual and less desirable students. Furthermore, it is important to develop the interesting media which suits the characteristics of students. There are many kinds of media that can be used in the learning activity. One of them is the educational tool media (education games).

Education games are anything that can be used as a means or equipment to play which contains educational value and can develop all students's abilities. Education games are games that contain lesson materials, so students can more understanding the lessons with high learning motivation through games activities while learning (Adiarni: 2009).

Learning with a fun atmosphere without psychological disturbance will optimize the work of the brain in solving various learning problems and provide opportunities for students to be more successful. Students in a happy, calm and relaxed situation can more actively use the brain to process information and remember learning materials for a long time, but when students are tense, stressed or fearful their minds will be empty and difficult to memorize the previous learned material (Darmansyah 2007).

Based on the observation, one of the Biology materials that are considered difficult is Plantae material. The material of Plantae is taught in second semester of grade X. The themes of the materials are Plants, morphological features, metagenesys, and its role in the survival of life on earth. Based on the classification of the five-kingdom system, kingdom Plantae is classified into three divisions namely, moss (Bryophyte), ferns (Pteridophyta) and seed plant (Spermatophyte). The scope of Plantae includes the characteristics, classification of life cycle and the role of Plantae for human life (Kemendikbud, 2016)

Education games that are used as learning media in this research is in the form of visual- media based game. Plantapicard educative game media is a pictorial word card contains Plantae material used as a learning media. The result of Arsiyati (2011) research is known that picture card media can help improve the implementation and achievement of learning achievement, and the score of student achievement.

According to Cardoso et al. (2009) the learning of the classification of living things using picture cards makes learning more interactive and effective to the learning outcomes. Sudjana (2008) defines student learning outcomes as a behavioral changes as the learning outcomes in a broader sense including cognitive, affective, and psychomotor fields. Plantapicard Education Games media contains various information related to plant's classification and description which can gives a real picture to the students about the reasons for the classification of certain plants based on observable characteristics. Plantapicard Education Games media is a medium of learning in the form of visual media that can make learning more interesting and effective.

According to Van Den Akker and Nieveen (in Khabbah, 2006: 43) a material is said to be of good quality, if it meets the quality aspects of: (1) Validity (validity), (2) Practicality and (3) Effectiveness). According to Kamus Besar Bahasa Indonesia (2008), valid is in the proper manner, valid and valid. Practical is easy and happy to wear it. Effective is there are consequences or can bring results.

Based on the description above, the researcher then conducted a research on the development of plantapicard education game on Plantae material. The research of development of plantapicard education game was held in SMA N 1 Randudongkal. The goal to be achieved in this study is to know the validity, practicality and effectiveness plantapicard education game material Plantae as a learning media.

RESEARCH METHOD

The development research of Plantapicard education games was done in D6 building, Department of Biology and SMAN 1 Randudongkal. The time of the study was conducted in January-June 2017. The subject of this research is the students of grade X MIPA SMA Negeri 1 Randudongkal. Research method in this research is Research and Development (R&D) method. According to Sugiyono (2014), stages in the research and development process include potential and problem analysis, data collection, product design, design validation, design revision, product testing, product revision, usage testing, product revision, and produce the final product as learning media.

The collected data includes the list of students' score, high school biology syllabus, teaching materials, materials for the media content, and images for the manufacture of other media. Product design stage is the stage of making plantapicard education game products. The design of learning media products plantapicard consists of 3 items; they are the word card pictorial, plantapicard board, and the facilitator book. The product of plantapicard is validated in terms of material and design by experts to know the appropriateness of the media. Product trials were conducted on 36 students of class X of MIPA in SMA N 1 Randudongkal. Usage testing was done in class X MIPA 2 (experiment) and X MIPA 3 (control). The sample was taken by using purposive sampling technique. The experimental design which was used in this study was Non-equivalent Control Group Design. The indicators of success in this study are (a) Media is declared valid if the results of the assessment by experts is 70%, (b) Media is stated practical if $\geq 75\%$ the results of both student and teacher' responses reach the minimum criteria which was good criterion, and (c) Media is declared effective if $\geq 75\%$ of students in the class that use the media is complete (KKM 75) and student's activity in the class at least achieve the active criteria and student and teacher responses reach at least the good criteria.

RESULT AND DISCUSSION

The result of the study is explained as follows:

The Analysis of Potential and Problem

The result of observation and interview indicates that in the SMA N 1 Randudongkal have available tools and facilities for supporting the learning activities such as counselling room, medical room, science laboratory, language laboratory, computer laboratory and library. The human resources are good; there are TU staffs and about 66 teachers (88% civil employee, 12% temporal teacher) with more than 5 years experiences, the number of students are 1162 and many achievements has achieved from district level to province level. Natural resources in SMAN 1 Randudongkal included orchards, toga gardens, ornamental gardens, and rice fields.

The problems on SMA Negeri 1 Randudongkal are lack of school's facilitation operation, low students' learning result, and lack of learning media. The available media only power point slide so the learning process only uses lecturing, discussion and presentation method. In addition, one of the subjects that get low learning outcome is Biology. The average of biology score only 54. Plantapicard Education Game has been developed to overcome those problems by substituting one of Biology materials which is Plantae. Suparmi et al (2013) in her study states that the use education game as media on animalia materials can improve the students' interest because the materials are served interesting and fun, so students are able to understand and memorize the materials. The use of education game on Plantae material is expected can improve the students' interest so the learning activities and outcomes also improving.

Data Collecting

The collected data in the process media development is media which available in SMA Negeri 1 Randudongkal. The media included powerpoint slide, video, flash, torso, pictures and learning method which has applied in the school such as lecturing, discussion, and presentation. The needed components in developing media for Plantae materials are media, pictures, and other components for making media and also proper application for media design.

Product Design

In the making Plantapicard Education Game' design, the author used Corel Draw X7 Graphic Suite. The Plantapicard Education Game design consists of three parts, (1) text-picture card which is made of duplex paper with the 0,55mm thickness and 10 x 8 cm size consists of 2 colors. The red card is used as question card and the white card as sanctions card; (2) education game board which is made of flexi 340gr with size 1.5 x 1.5 m in form of MMT (Metro Media Technologies) banner is used as education game area; (3) facilitator book is a book made from A6 art paper with size 10.5 x 12.4 cm and used as teacher's hand-out which contains answer key and explanation of the questions.

Design Validation I

Design validation of Plantapicard Education Game is done twice. According to the expert judgment on the first validation, the Plantapicard Education Game has not been stated valid. The analysis result of validity as states on Table 1.

Table 1. Validity Analysis of Plantapicard Education Game by Expert (1st Validation)

No	Expert	Percentage Ratings	Validity Criteria
1.	Media	79,0 %	Quite Valid
2.	Materials	52,5%	Less Valid
Average		65,75%	Quite Valid

Product Revision

Design revisions on Plantapicard Education Game in terms of appearance are (1) column design taxonomy level on facilitator book in the beginning, is too small then revised with enlarging the letter size; (2) the pictures on the facilitator book is revised from 4 x 2 cm into 5 x 2 cm to make the pictures clearer; (3) the color of plantapicard is revised from dark blue to light grey and yellow to make the color design more contrast.

The design revisions in term materials are the materials concept. Before revisions the concept is taken from the schools-textbook after the revisions the materials concept of pteridophyte base on the spore and pollination is corrected base on the literature studies from Biology books and journal.

Design Validation II

According to the judgment expert on the second validation, Plantapicard Education Game has been stated valid as learning media. The analysis of validity states on Table 2.

Table 2. Validity Analysis of Plantapicard Education Game by Expert (2nd Validation)

No	Expert	Percentage Ratings	Validity Criteria
1.	Media	95 %	Very Valid
2.	Material	92,5%	Very Valid
Mean		93,75%	Very Valid

Expert of material argues that Plantae material which is provided has been appropriate. According to expert of media, the appearance of the media is simple but interesting, understandable, communicative, creative and interactive. So the processes of the learning become more relax and fun and the materials can be more understanding. Wayan (2013) stated that in the education game, students are engaged to interact with the other students through educational games where this process become fun for students, so the memorization of the materials will be stay longer. Plantapicard Education Game media is very appropriate to be developed because it packs the Plantae materials in a fun and relax learning.

Product Trial

Based on the results of teacher's response analysis on product trial, it is known that teacher gives a good responds on plantapicard education game as a learning media on Plantae material due to the design. The design is interesting, materials are systematically ordered, clear usage direction, pictures for helping students understand the material. The Plantapicard Education Game media makes students excited so students interested to study.

In the students's response analysis on product trial, there are 89.2% students give positive respond toward the application of Plantapicard Education Game in the learning process. All of the students tell that the application help students in understanding the Plantae materials. Furthermore, students are motivated and interested to do independent learning. 97% students tell that Plantapicard Education Game is easy to carry on. The media is easy to use and fit in the situation, condition of

students, teacher and school and also the time allocation. It makes this media is practical. So the students give positive responds. More than 80% students argue that Plantapicard Education Game has helped them to study because it provides the example the species of plants around the students. As a result, students have more knowledge about plants, in terms of classification, description, and benefit for life. The result of student'S response is presented on Table 3.

Table 3. Student's Response on the Application of Plantapicard Education Game Media

No	Student's Response	Answer	
		Yes	No
1.	Plantapicard helps students to understand the Plantae materials	100%	0%
2.	Plantapicard motivates students for independent learning	78%	22%
3.	Plantapicard is provided in interesting design that increase the student's interest on Plantae materials	95%	5%
4.	Pictures, classification, description, plants' benefit are served clearly, interesting and coherence	92%	8%
5.	Plantapicard is easy to carry on	97%	3%
6.	Plantapicard is completed with interesting and understandable worksheet as supplement on Plantae materials	78%	22%
7.	Plantapicard is useful in the classroom learning or daily life	77.8%	22.2%
8.	Plantapicard helps students study in the classroom or outside class	86.1%	13.9%
9.	Plantapicard can be used as students' learning source	89%	11%
10.	There is no writing mistake in Plantapicard	100%	0%
Average		89,2%	10.8%
Criteria		Very Good	

Product Revision

According to students' suggestion on product testing, the revision of the Plantapicard Education Game is adding the *citrus sp*, *Amaranthus sp*, *Solanum lycopersicum*, *Capsicum frutescens* and *Jasminum sambac* species. Those species can be found in the toga garden, orchards and ornamental gardens. It makes students easy to observe the plants. The play time duration is revised from 90 minute into 105 minute. The teacher should manage the play time with the learning time allotment so the game does not disturb the other subjects.

Usage Testing

Based on the t-test analysis of pre-test the t_{value} is smaller than t_{table} which is ($0,246 < 1,667$), so H_0 is accepted. It means the cognitive condition of both classes before the application of Plantapicard Education Game was same. X MIPA2 class was given treatment using Plantapicard Education Game while X MIPA3 was not given media treatment. The t-test analysis of post-test score shows that t_{value} is bigger than t_{table} , ($2,430 > 1,667$) so H_0 is rejected. This means the cognitive understanding of both classes after treatment is different. Results of analysis of student learning outcomes such as are presented in Table 4

Table 4. Students'ss Learning Outcomes on Usage Testing

Class	Pre-test Mean	T-test of pre-test	Post-test Mean	T-test of post-test
X MIPA 2 (E)	49,16	0,246	80,14	2,430
X MIPA 3 (K)	48,75		74,30	

From the analysis of students' result, it is known that there is a significant difference between X MIPA 2 which is using media plantapicard education game and X MIPA 3 which did not use the media (Table 4). The significant difference means the use of plantapicard education game *Plantae* material affects student's cognitive learning outcomes. This is in line with Jussanti's research (2011) that is students' test result after the learning process using picture media is showing improvement. High cognitive learning outcome is occurred due to the learning scenario which enables the students to be active in the discussion and question-answer activities. In addition, the happy condition of the students is helping to understand *Plantae* material better.

Students learning result consists of score of exercise, discussion, and evaluation (pre-test - post-test). Those score are collected become final score with scoring weight 2 for exercise, 1 for discussion and 3 for (pre-test - post-test). Based on the result of student's final value analysis, it is known that learning with Plantapicard Education Game applied in class X MIPA 2 gives positive impact with students' classical completeness 86.11%, compared to class X MIPA 3 which did not apply the plantapicard media with students' classical completeness 50%. The results of the analysis are presented in Table 5.

Table 5. Student's Learning Results

No.	Students's Score	X MIPA 2	X MIPA 3
1.	Mean of Final Score	75,14	73,27
2.	Highest Final Score	83,33	74,30
3.	Lowest Final Score	57,22	48,75
4.	Incomplete Students	13,89%	50%
5.	Complete Students	86,11%	50%

High classical completeness shows the effectiveness of Plantapicard Education Game Plantapicard Education Game. In the X MIPA 2 (experiment), the highest score was 83.33, lowest was 57.22 and class' mean was 75.14. 13.89% of the students have not completed the learning. This is because the low interest of the students to the material and students are less active in the learning process. As a result their motivation is low. Students are lazy and did not work hard. They ignore the exercise, so their learning experience is low and less understanding to the material. As a consequence, their outcome is low or even does not reach the minimum completeness criteria.

Based on the results of student activity analysis found that low student activity at the first meeting (before media application) increased in the second meeting (after media application). in class X MIPA 2 (experiment) students who are very active and active increased by 5.55% and 22.33% respectively in the second meeting. Meanwhile, students who are quite active and less active decreased by 25.11% and 2.78%. In the X MIPA 3 (control), the highly active students did not increase, while active students increased by 8.33% at the second meeting. Meanwhile, students who are quite active decreased by 8.43 % and students who are less active do not decrease or increase (state). The result is presented on Table 6.

Table 6. Student's Activity during Learning Activities

Criteria	X MIPA 2 (E)		α	X MIPA 3 (C)		α	Average
	I (%)	II (%)		I (%)	II (%)		
Very Active	5.55	11.11	5.55	2.78	2,78	0	18.05
Active	41,67	64	22.33	19,45	27.78	8.33	56.95
Quite active	41,67	16.56	25.11	47,22	38,79	8.43	19.45
Less active	11,11	8,33	2.78	30,55	30,55	0	5.55

The research result of Suprihatin et al. (2014) note that the factor that influences the high activity of students in the learning is the atmosphere of the learning environment. The pleasant atmosphere in a learning environment encourages students to be active in the discussion, practicum, and presentation activities in front of the class. Learning activities using plantapicard education game improve students's activeness in carrying out the learning activities independently.

Teachers respond very well to the learning process using plantapicard education game. Teachers argue that learning using the media is more interesting and fun because the activities in plantapicard which is in the form of learning while playing makes students are more interested in learning. In addition, there is an increase in the pattern of students's critical thinking and student activeness in asking and arguing. In addition to positive responses, there are constraints in learning. These constraints include; students still have difficulty in making relevant questions to the material presented on the white card; and learning using plantapicard is difficult for classroom management if it is only supervised by one teacher because it is too crowded that interfere other class concentrations. These constraints are also found in Suryani et al. (2014), that when students start enthusiastic in learning activities, then the class conditions begin to be difficult to control.

The constrains in this study can be overcome by giving directions to the students in making relevant questions to the material served on white card. Moreover the cognitive knowledge of the students can be improved. When the learning process occurs, the teacher gives and explains the learning rules before the learning process started. The learning rules contain the learning rules and negative (sanctions) and positive (rewards) reinforcement that will be accepted by students so that the learning process in the classroom will be more conducive and more manageable so do not interfere the teaching and learning activities in other classes. Beside that Plantapicard Education Game learning activity is better done in team (team teaching). By teachers' collaboration in the classroom, the process of observation of students becomes more intense. Special notes on behavior, inadequacy, and student difficulties will be well recorded along with it any teaching technique will be well-criticized. To be able to do this well, the two collaborating teachers must have the same goals to be achieved in the learning process.

Based on the results of student's responses analysis is known that 66.67% of students give very good responses and 33.33% of students give good responses so that the total students who gave very good responses and both reached 100% as presented in Table 7.

Table 7. Student's Response to Plantapicard (Large Scale)

No	Response Criteria	Percentage
1.	Very Good	66,67%
2.	Good	33,33%
3.	Quite Good	0%
4.	Less Good	0%
5.	Not Good	0%
6.	Very Good and Good	100%

The results of students' responses show that students evaluate both the learning with media because it gives a positive impact on the process and student learning outcomes. The average increase in student value is balancing by the increase in student learning outcomes after the game learning method has been applied. The average increase in student's grades per meeting is similar to the increase in student's activity at each meeting. Students are more motivated to participate in learning

using Plantapicard Education Game because students are not required to know a lot of material directly. Students take the material step by step so students can more easily understand the material is being studied.

Product Revision

Base on the teacher's suggestion on the usage trial, Plantapicard Education Game is revised by adding the game's rules which gives sanction to the students who make noise which is unrelated to the learning.

Final Production

Based on the description above, Plantapicard Education Game which is arranged after 2 revisions on the materials side, those are improvements on the concept of pollination and pteridophyta and media sides are the improvement on the size of the taxonomy level, the size of the picture, and color on plantapicard board, so the media is valid. Responses of teachers and students on a small scale have met the media practicality indicator that is $\geq 75\%$ good response given to the application of media in learning, so the media is considered suitable and easy to apply in learning. Classroom learning outcomes of X MIPA 2 (experiment) using plantapicard education game has fulfilled classical mastery indicator that is 86.11%.

Classical mastery of class X MIPA 2 is better than class X MIPA 3 which does not apply learning using media plantapicard education game. The use of such media also keeps students active in learning activities. This can be interpreted that the media is effectively applied in learning material Plantae because it can increase student activity and learning outcomes. Thus, it can be interpreted that plantapicard education game including good quality media to be applied in learning because aspect of validity, practicability and effectiveness of media have been successfully achieved.

CONCLUSION

According to research result, the result conclusion is Plantapicard Education Game Plantae material media which has been successfully developed is very valid, practical and effective to be used as the learning media for Biology learning, especially Plantae material for senior high school students.

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