USEJ 6 (1) (2017)

Unnes Science Education Journal

http://journal.unnes.ac.id/sju/index.php/usej

THE EFFECTIVENESS OF HEURISTIK VEE LEARNING MODEL ASSISTED WITH *PERDU*/EDUCATIVE GAMES (EG) WORKSHEET TOWARDS THE STUDENTS' LEARNING RESULT ON PLANT MOVEMENT MATERIAL

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Article Info

Received December 2016
Accepted January 2017
Published February 2017

Keywords:
HEURISTIK VEE;
Learning result;
Tour Garden of Unnes Education

Abstract

This study aims to determine student learning outcomes in learning to use the Heuristic Vee-assisted learning model with LKS PERDU. Material of Motion on Plants in MTs Muhammadiyah 3 Masaran Sragen was employed for the study. This study uses a quasi-experimental design. The sample used is a class VIII A (experimental group) and VIII C (control group). Sampling technique was the purposive sampling. The results showed> 75% of student learning outcomes exceed the minimum completeness criteria (KKM) is 75. Cognitively, the average grade student mastery learning experiment was 90% while the control group 77%. In psychomotor aspect in the experimental class 79.2% of students qualify as very good, and the rest on both criteria. On the affective aspects in the experimental class 75% of students qualify as very good, and the rest on both criteria. In general, teachers and students also respond very well to be applied learning. Conclusions from this research is learning by learning model Heuristic Vee student learning outcomes, student psychomotor, and affective student in plant material Motion class VIII MTs Muhammadiyah 3 Masaran Sragen.

p-ISSN 2252-6617
e-ISSN 2502-6232

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INTRODUCTION

Learning can be defined as a process conducted by a teacher for the student to learn, so that student gets knowledge, skill, and behavior (Dimyati and Mudjiono 2006). One of the problems in education nowadays is the weak learning process. Learning process in class only focuses on the students' ability in memorizing the information without connecting them with daily life activities. (Sanjaya 2013). The currently used biology learning model demands the students to memorize information without understanding the application of its basic theory to the applied direction.

Based on the observation of Natural Science learning activities in MTs Muhammadiyah 3 Masaran Sragen, the teacher had tried to explain the material in conventional method using field as the out of school learning media. However, with conventional learning, students were demanded to memorize the material, so that it was ineffective to improve students' understanding. Besides, teacher did not use discussion and another innovative media so that students were less active and less interested in the learning media.

The discussion with biology teacher about plant movement material showed that this material had some concepts which were delivered through conventional learning. It was considered as a difficult material because it required memorization skill. Conventional learning model was ineffective proven by the average score of students' learning result on plant movement material was below passing grade. The average of daily test score was below 75 as passing grade.

Plant movement material was a material with wide concepts which were poured into descriptive notes. As a result, the understanding of the concepts was acquired through memorization, so that it became a short-term knowledge.

Model of teaching is an innovative method of teaching. There is need to direct efforts towards transformation of teaching methods right up to development of science and technology, curriculum and material research along with teacher orientation (Singh, 2011). An innovative learning model which requires the students to build their knowledge is needed. The transmission model of education is being challenged, since the learner is learning on autonomously, with the teacher only facilitating this process by providing the necessary tools (Cañas et al., 2012). The learning model is called Heuristik Vee. Heuristik Vee is a learning technique which connects some concepts in diagram (Handayani et al. 2014).Heuristik Vee is a learning model which helps the students and teachers to understand the structure of knowledge and how the knowledge is constructed. So, the use of concept map in Heuristik Vee model will improve the understanding of the concepts (Karakuyu 2010).

Along with the discussion of learning media, namely worksheet, it was known that the worksheet contained of summary of the material completed with some questions, so that students were not able to connect the material with their daily life. Education Games (EG) worksheet is carried out differently than other worksheets. The strength of this worksheet is that it contains of riddles which should be solved in the learning process so that it helps the students to think. It does not bore the students, and is completed with a clear practical work direction. Pretending that science education leads to a rich, substantive, not literal, learning of concepts, laws and scientific theories, able to enhance students to solve various scientific problems, the human mind trans dimensionality should be taken into account, therefore the planning of teaching must use different media, different strategies and different ways of expression (Valadares, 2013).

A research on the use of Heuristik Vee learning model to measure concept understanding and students' learning result has been conducted so that it is known how well the students comprehend the point of learning. This research is expected to give an effective contribution to be used as one of the learning model to improve students' learning result.

METHOD

This research was conducted on the academic year 2015/2016. The design of this research was quasi experimental design in the form of nonequivalent control group design.The samples of this research were two classes, namely experiment and control classes (learning with discussion method). The samples were withdrawn through purposive samplingtechnique(Sugiyono 2010).The data were collected through

observation and test method. Observation method was conducted to assess students' psychomotor and affective aspects during learning process. Test method was conducted to measure students' cognitive aspect on plant movement material in the form of multiple choices questions. The questions had been tested to analyze its validity, reliability, difficulty level, and distinguishing capacity. The test was given at the beginning as pretest and at the end of the meeting as posttest. The treatment given in experiment class was in the accordance with the syntax of Heuristik Vee model. The treatment in control class was given using discussion method.

EG worksheet was used during learning process, and inside or outside class discussion. The observation form was used to measure students' learning result in psychomotor and affective aspects.

The data were in the form of cognitive test result, observation result of psychomotor and affective aspects. The data were analyzed using descriptive quantitative method. Cognitive assessment was conducted using two instruments, namely EG worksheet (for experiment class) or worksheet (for control class), and multiple choices questions in pretest and post test. Psychomotor aspect was the result of observation and self-assessment, while affective aspect was the result of observation.

RESULT AND DISCUSSION

Students' Learning Result

Statistical analysis for cognitive score in experiment and control class had normal distribution, so that t-test could be conducted. The result of t-test showed that there was no significant difference in the result of cognitive competence aspect between experiment and control class.It was because of this aspect contained a pure score from students' learning effort such as final evaluation score. The effectiveness of Heuristik Vee learning model assisted with EG worksheet on plant movement material is proven by the cognitive learning result which meets the indicators as follows.

a. The average of students' learning output in experiment class achieves the classical passing grade ≥ 80% with the passing grade of ≥ 75. The score is 90, and it is higher than the average score of control class whose passing grade is 77.
b. Hypothesis test with the test of post test and pretest difference between experiment and control class were done using software PASW Statistics 16. The *sig* value of students' learning output in both classes was0.994> 0.05. It can be said that there is a significant difference in the students' learning result between the experiment and control class.

The students' cognitive learning result on plant movement material using Heuristik Vee model assisted with EG worksheet was acquired from pretest and post test.Post test score was used to determine the classical passing grade, while pretest score was used to measure the students' initial skill level before the learning activity. The difference in students' learning result between experiment and control class was analyzed through the test of average score of both classes (t-test) in which prerequisitetest was conducted first to know the normality and homogeneity.

Table 1. The Percentage of Students' Learning Result

Class	Total Student	Highest Score	Lowest Score	Posttest Average Score	Worksheet Average Score	Average of Learning Output
Eksperiment	40	100	65	88.12	87.39	90
Control	40	100	60	78.5	92.35	77

The learning result in cognitive competence is shown by the significant difference in the average of learning result between experiment and control class. The final scores of experiment and control class are 88.12 and 78.5. Hypothesis test was done through the test of the similarity

between two average scores. This test was used to find whether there was a difference in students' learning result between experiment and control class or not.

The statistics analysis showed that cognitive learning result achieved from the difference of post test and pretest score from both classes had normal distribution, so that t-test could be conducted. The result of t-test showed that there was a significant difference between the results of experiment and control class's cognitive competence in which the average of post test and pretest in experiment class was higher than the average score of post test and pretest in control class. It shows thatHeuristik Vee model assisted with EG worksheet gives a positive contribution for experiment class. EG worksheet is completed with pictures and riddles, so that it gives a fun and more contextual learning experience.

EG worksheet is a worksheet designed with riddles in order to find a concept of plant movement material. This worksheet is aimed to support the learning process by stimulating the students to improve their thinking skill in solving a problem of finding a concept on plant movement material through group discussion.

The design of contextual pictures helps the students to connect some plant movements to find a concept, motivate the students to solve a problem in group, and understand the mechanism and simulation of plant movement.

Students are given a chance to solve a problem and find a concept based on the key in the accordance with their ability. Teacher gives guidance for each group. Students observe, investigate and organize the acquired data, analyze the exploration, explain, are given the chance to develop their own understanding, and connect their understanding into a real situation so that they have a more contextual understanding on plant movement material.

According to the analysis, there was an improvement on the post test and pretest average score. Pretest score was low because the students had not learned the material, so that they answered the questions based on their insight only.After being taught using Heuristik Vee model assisted with EG worksheet in experiment class, the average of post test score was higher than control classes.

Based on the result of t-test, it could be concluded that there was a difference in students' learning result between experiment and control class. The result of experiment class was better than control class, so that the use of EG worksheet on plant movement material in MTs Muhammadiyah 3 Masaran Sragen was effective.

Learning process with Heuristik Vee taught the students to do an observation and experiment in group. Each group consisted of four or five students which enabled them to help each other through a collaboration to find a concept, and construct the concept. This learning process also involved the students so that the material was easier to be understood. It went along with a study by Senjayawati (2014) who said that in Heuristik Vee learning, students were more active in the learning process, and teacher was more opened in understanding students' idea.

It was because Heuristik Vee model was student-centered with discussion in which each member was given some questions to be solved in group. Group discussion motivated the students to learn. They were serious in understanding the whole topic so that they were able to answer the questions correctly. Student-centered learning with high motivation to learn would help the students to memorize the previous material and create a long-term knowledge so that the result of final evaluation would be optimal. Student-centered learning and high motivation to learn were expected to improve students' learning result. Based on the explanation, it can be said that the stages in Heuristik Vee is systematic and can be applied for learning. Heuristik Vee stages from the beginning until the end helps the students to achieve learning purposes. It is because from the beginning students have been guided to achieve learning purposes systematically.

Learning activity was also assisted with EG worksheet. It was interested for the students. A fun learning would help the students to understand the material. It went along with the opinion from Ismail as cited by Rahayu (2011) that educative game was a fun activity. Educational tool can improve language and thinking skill, the ability to adapt with the environment, develop personality, strengthen teacher and students' relationship, and support students' activity. Students were faced with some riddles in the worksheet. They were given the chance to think, combine letters into words, and find the hidden words based on their ability. After

that they discussed, investigated and organized the words, explained, and were given the chance to develop their own understanding about the concept and apply it in a real situation.

The learning result of experiment class which was higher than control class was caused by some factors. One of them was a fun learning environment using a contextual worksheet contained pictures. During the learning process, students were enthusiastic to learn and discuss. It could be seen from the way they solved a problem, found and understood a concept by finding resource in some literature. Students shared information between one another so that they completed all the information needed to build a concept. Students' enthusiasm appeared because learning with worksheet gave some advantages like helping the students to find a more contextual concept with the help of real pictures. Besides, it also helped the students to work together, be responsible, and drew students' attention. Damayanti et al (2012) stated that worksheet optimized and improved students' cognitive. Based on the explanation, it can be concluded that learning with Heuristik Vee model assisted with EG worksheet is able to improve students' learning result on plant movement material.

Kusnarti (2009) stated that "Effectivity is not only seen from productivity, but also from one's perception". Effectivity in learning can also be seen from students' achievement through their learning result, and their responses on the learning process. Students' responses are the feedback for the learning process, acquired from a questionnaire given at the end of learning. The learning process got an excellent response. Students were interested in the learning using Heuristik Vee model assisted with EG worksheet on plant movement material.

The result of students' responses was very good. 32.5% students chose strongly agree, 60% students chose agree, and 7.5% students chose not agree that the learning process became more interesting and challenging. 57.5% students chose strongly agree, 40% students chose to agree, and 2.5% chose not to agree that plant movement material was easier to be understood using Heuristik Vee model assisted with EG worksheet.60% students chose strongly agree, and 40% students chose to agree that Heuristik Vee motivated them to learn. 45% students chose strongly agree, 45% students chose to agree, and 10% chose not to agree that the worksheet triggered them to think critically in solving a problem. 47.5% students chose strongly agree, 42.5% students chose agree, and 10% chose not agree that they felt comfortable with the case study during discussion. 47.5% students chose strongly agree, 50% students chose agree, and 2.5% students chose not agree that the learning model helped them to strengthen their memory about the material. 30% students chose strongly agree, 57.5% students chose agree, and 12.5% students chose not agree that they were triggered to think critically about solving a problem.32.5% students chose strongly agree, 62.5% students chose agree, and 5% students chose not agree that they were able to solve a problem easily. 22.5% students chose strongly agree, 65% students chose agree, and 12.5% students chose not agree that they were more courageous to deliver their idea during the learning process. 62.5% students chose strongly agree, 35% students chose agree, and 2.5% students chose not agree that this model should be applied for other subjects. It goes along with the purpose of Heuristik Vee model; that is learning process becomes more interesting, and students' interest in learning is improving which affects the learning result to improve.

Students' responses in terms of the improvement of learning interest acquired 90% responses. It meets the purpose of Heuristik Vee learning that students are able to develop their interest and motivation in learning. The lowest aspect was the delivery of idea during learning process which acquired 77.5% responses. It happened because students listened to the teacher more frequently.

Students' responses showed that they had good responses and interests in the learning process using EGworksheet on plant movement material in MTs Muhammadiyah 3 Masaran Sragen. Besides, students were enjoying the use of the worksheet during learning process because it helped them understand the way to design an experiment and observation with simple and understandable steps. (Wulandari 2012).

The result of teachers' interview showed that they were interested to conduct a learning process using EG worksheet. They strongly agreed that plant movement material presented in the worksheet had already covered all indicators and based on Competence Standard and Basic

Competence.The weakness of this learning was that it needed more time to produce a similar worksheet for other material. The obstacle during the learning process was in conditioning the students to conduct an observation and experiment because students had different characteristic.

The overall result of questionnaire showed that teachers were interested to apply the EG worksheet for learning because it improved students' learning result. The learning process improved the understanding and mastery on plant movement material, so that it improved the students' learning result.A research by Karsli and Sahin (2009) pointed that worksheet helped a teacher to facilitate the students to read, think, and develop process and collaboration skill. Learning with EG worksheet was effective to be implemented on plant movement material in MTs Muhammadiyah 3 Masaran Sragen because the students enjoyed the process.

Classical Passing Grade

Classical passing grade is used to compare post test score with the passing grade in the score of 75. Students pass the learning if their scores are ≥75. Based on the calculation usingMicrosoft Office Excel 2007, there were 38 students in experiment class who passed the test. In control class, there were 29 students who passed the test.

It could be concluded that the total students in experiment class who passed the test was higher than control class. It means that Heuristik Vee learning model assisted with EG worksheet is effective to be applied on plant movement material in MTs Muhammadiyah 3 Masaran Sragen. The recapitulation of students' passing qualification of learning is presented in Table 2.

Table 2. Passing Qualification of Learning

Class	Passing	Total
Control	Passed	29
	Not Passed	11
Experiment	Passed	38
	Not Passed	2

Passing qualification was used to compare post test scores with passing grade in the score of 75.The classical passing grade was ≥ 80%.Classical passing grade of experiment class was also compared to classical passing grade of control class.

Based on the calculation usingMicrosoft Office Excel 2007, 95%, students of experiment class passed the learning process, while 72.5% students of control class passed the learning process. It could be concluded that experiment class had a higher passing qualification than control class so that Heuristik Vee learning model assisted with EG worksheet on plant movement material was effective to be applied in MTs Muhammadiyah 3 Masaran Sragen. The recapitulation of students' classical passing qualification of learning is presented in Table3.

Table 3. Classical Passing Qualification of Learning

Class	Passing Qualification	Total	Percentage (%)
Control	Passed	29	72.5 %
	Not Passed	11	27.5 %
Experiment	Passed	38	95 %
	Not Passed	2	5 %

Students' Psychomotor

Students' psychomotor was measured with observation form which showed the average percentage of 76.4% in experiment class and 70% in control class. The psychomotor of the students in both classes were good, but the average of experiment class was higher than control class. It showed that EG worksheet improved students' psychomotor in learning than using lecture and question and answer methods. Heuristik Vee learning model assisted competition, and involvement in learning (Ammaria 2011).

Students' psychomotor in control class was low because it used teacher-centered learning. The learning model did not guide the students to participate actively. It was shown by the difference of psychomotor percentage of both classes.

The students' psychomotor in experiment class was very good. It was shown that students had conducted an observation and simple practical work so that they became more enthusiastic to develop their curiosity about the material through direct interaction with EG worksheet created a systematic learning, motivated the students, and guided. Heuristik Vee was a learning model that demanded the students to be active in constructing new experience by combining the previous experiences. It was designed to gain understanding about how knowledge was built and used. It helped the

students to get the meaning of learning in which focus questions had been prepared before, so that students were demanded to think (Senjayawati, 2014). With the use of EG worksheet, students enjoyed the learning process more and improved their psychomotor. It went along with the idea from Ismail as cited by Rahayu (2011) that the selection of educative games should try to develop all aspects, whether cognitive, affective, or psychomotor aspect. Psychomotor aspect could be developed through group discussion to answer questions in the worksheet which was designed to help the students to enjoy learning, build responsibility, cooperation, fair environment.

Table 4. The Recapitulation of Students' Psychomoto in Experiment and Control Class

Criteria	Control						Experiment					
	P 1	%	P 2	%	P 3	%	P 1	%	P 2	%	P 3	%
Excellent	16	66.7 %	16	66.7 %	18	75 %	18	75 %	18	75 %	19	79.2
Good	8	33.3 %	8	33.3%	6	25 %	6	25 %	6	25 %	5	20.8 %
Intermediate	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Poor	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Very Poor	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

Students' Affective

Affective aspect in this research included spiritual and socail aspects during learning process. The assessment was aimed to understand students' behavior during learning process in experimental and control class. The assessment was acquired from an observation on students' behavior using observation form. The spiritual aspect assessed was the readiness to participate in learning. The aspects of students' social and characteristics were: (1) Cooperation; (2) Being active to ask; (3) Honesty; and (4) Answering teacher's questions.

The result showed an average percentage of 71.7% in experiment class and 67.5% in control class. It meant that the students' affective of both class was excellent, but the average percentage of experiment class was higher. It showed that EG worksheet improved students' affective in learning than the lecture and question and answer method.

Students' affective in both classes was almost similar because the method was almost similar. Both classes used discussion presentation method. The classical passing grade of both classes was good. It was shown that students had conducted an observation and simple practical work so that they became more enthusiastic to develop their curiosity about the material through direct interaction with environment.

CONCLUSION

It can be concluded that EG worksheet was effective to improve students' cognitive competence on plant movement material. There was a significant difference in the learning result of experiment and control class. Classical passing grade of experiment class was 95%, while the classical passing grade of control class was 72.5%.

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