

The influence problem-based-learning model assisted by games (Ludo) towards concept understanding of plant tissues

V Rizkita¹ and Djukri¹

¹Biology Education, Universitas Negeri Yogyakarta, Sleman, Yogyakarta, Indonesia

Corresponding author: rvikqi@gmail.com

Abstract. This study aims to investigate the increase in Problem-Based-Learning using games to improve students' concept understanding of plant tissues. The game used in this study was Ludo completed with question cards. This research is a quasi experimental type with a pretest posttest control group design. This research conducted in SMA N 3 Bantul involving 2 sample groups, experimental and control groups. The samples was chosen using a purposive sampling technique. Data were collected through a written test using 20 multiple-choice questions. The result showed that PBL using Ludo completed with question cards managed to improve students' concept understanding of plant tissues. That was proven by independent sample t-test with a significance level of <0.05 , $0.007 < 0.05$. It implies that the students in the experimental group have a better concept understanding than control group. The average of experimental group pretest score was 60.88, while the posttest was 86.02 and the average of control group pretest score was 73.59 and posttest score was 80.

Keywords: *PBL, games, conceptual understanding*

1. Introduction

Education, as a process, guides students towards the maturity level through formal and non-formal education, including education in the family and community environment. Therefore, this sustainable and interrelated educational process will instill on students' mindsets and facilitate them to have a deeper understanding. This affects students' attitudes and mindsets. It does not merely improve their knowledge but also their behavior and moral.

The education process is expected to improve the quality of education and the quality of students in any aspect. Thus, innovation in education models and methods is crucial in developing appropriate educational quality in accordance with student characteristics. However, the education process has not managed to meet the standard competence written on the curriculum thus far. Several schools have not managed to meet the expected targets.

States that teachers as a facilitator present limited information regarding this problem. The group is burden with tasks to identify different aspects of the problem by proposing questions to the facilitator to get relevant information [2].

Based on the result of an unstructured interview with the biology teacher at SMAN 3 Bantul on July 30, 2019, it found that for materials concerning the structure and function of plant tissues, the teacher applied lecturing and experimental methods in the laboratory. Indeed, the teacher used the Problem-based Learning method for other materials. However, the teacher has never combined this method with games.



Cooperative learning models using academic games in which the students learn in small heterogenic groups with positive interdependence. “Problem-based learning (PBL) deserve a more prominent place in undergraduate elementary science education for pre-service teachers because the process empowers students and educators to assume responsibility for directing learning, defining and analysing problems and constructing solutions” [6]. Problem-Based-Learning is a learning strategy that incorporates specific instructional pre planned activities, focused on a relevant learner problem. It also allows for the flexibility of the situation and the learners in classroom. This course model has its foundation in the theories of humanistic, learners-centred, and problem centred design approaches [7].

Understanding is a level of learning outcomes which is higher than knowledge. [4] state “A *concept is an abstraction of events, objects, or phenomena that seem to have certain properties or attributes in common*”. Meanwhile, Bloom states that understanding covers the ability to capture the meaning of something being learned [11]. In simple, understanding can be referred to as the ability to understand.

2. Research method

This research was conducted in SMA N 3 Bantul, located on Jl. Pramuka, Gaten, Trirenggo, Bantul, Yogyakarta 55714. The school has the highest accreditation level, level A. This research was conducted in September 2019 or the odd semester of 2019/2020 academic year. It is a quasi-experimental study use pretest posttest control group design involving two groups, control and experiment selected purposive sampling. The pre-test was conducted to find the students’ initial level of understanding in both groups. The control group used conventional learning methods, namely lecturing and discussion, while the experimental group used the PBL model inserted with Ludo completed with question cards.

The statistical hypothesis test was performed to analyze the data samples. The experimental testing used normality, homogeneity, and hypothesis tests with independent samples t-test. The independent sample t-test was typically for testing the average difference of two independent or related samples. The output analysis would be based on a significant level of 5% in which if it is less than 0.05, it does not have a significant relationship but if it is higher than ≤ 0.05 , it has a significant relationship [9]. The construct validity involved experts in the related field to judge the instruments that have been designed, whether the instrument could be used without revision, with minor revision, or with major revision.

3. Results and Discussion

3.1. Results

3.1.1 Implementation of PBL model using games. This study inserted Ludo into the PBL model. Ludo is one of the teaching media providing interesting teaching and learning process in the classroom. It facilitated the students in learning the materials. There were 5 stages in the PBL model, namely exploring the issues, organizing students to learn, guiding group activities using Ludo, developing and presenting the works, and analyzing and evaluating the problem-solving process. The insertion of Ludo was in the third stage as this stage was suitable to help the students in comprehending the concepts.

First, the students were asked to answer the questions in the pre-test section. It was done to find out their initial abilities. Then, it was continued by watching videos and answering the teacher’s questions related to the video to stimulate them in learning. Second, the students were grouped into eight and they were required to read and understand the rules in Ludo and question cards related to the structure and function of plant tissues. Third, the students played the game and if they have received a command to complete a question, the game was stopped immediately and they had to start working with their groups to discuss the question and find the solution. Fourth, the students worked in groups to write a report and then appointed one of the group members to present the results of the discussion.

Finally, the teacher would clarify the problem and its solution. Then, there was a post-test to find out their improvement in understanding the concept of materials.

The use of the PBL model fitted with Ludo and question cards were applied in class XI MIPA 2. Meanwhile, another class, XI MIPA 1 was without Ludo or only lecturing and discussion facilitated with LKPD (students' worksheet) to solve a problem in groups and then presenting the result in the classroom.

3.1.2 Statistic analysis. In this study, the data were being gathered using 20 multiple choice questions regarding the structure and function of plant tissues. Analysis of data obtained, have the value significant difference in the students' ability in understanding the concept of structure and function of plant tissues between control and experimental groups. The collected data from pre-test and post-test both in control and experimental groups can be seen in the following table:

Table 1. Result of one sample ks test.

		Unstandardized Residual
N		32
Normal Parameters ^{a,b}	Mean	0E-7
	Std. Deviation	16.63461519
Most Extreme Differences	Absolute	.196
	Positive	.142
	Negative	-.196
Kolmogorov-Smirnov Z		1.107
Asymp. Sig. (2-tailed)		.172

^a Test distribution is Normal.

^b.Calculated from data.

Based on table 1. The result of the normality test using the One-Sample Kolmogorov-Smirnov Test showed a value of 0.172 indicates that the data obtained was normally. If the result of the analysis showed a significance value > 0.05 , then the data were distributed normal [9].

Table 2. Result of homogeneity test.

Levene Statistic	df1	df2	Sig.
2.881	1	64	.094

Based on table 2. The homogeneity test showed a significance result of 0.094 in which it had the same variant (homogeneous). If the significance result was > 0.05 , the variances were the same (homogeneous) but if the significance result was ≤ 0.05 , then the variances were different (not homogeneous) [9].

Table 3. Result of independent samples t-test of experimental group (XI MIPA 2) with PBL model using Ludo.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2- tailed)	Mean Differ ence	Std. Error Differ ence	95% Confidence Interval of the Difference	
Post Test	Equal variances assumed	1.009	0.319	2.773	64	0.007	6.029	2.175	1.685	10.37
	Equal variances not assumed			2.777	63.99	0.007	6.029	2.171	1.691	10.37

Based on table 3, t-test results showed a significance value of <0.05 with $df = 64$. It could be seen have different pre test and post test scores. Significance value of 0.007. It indicated that there was a significant effect. Based on the criteria on decision making proposed the significance value of ≤ 0.05 , it could be concluded that there was a difference [9].

Table 4. Description of the results of understanding the concept.

Average description	The value of understanding concepts			
	Experiment PK		Control PK	
	<i>Pretest</i>	<i>Posttest</i>	<i>Pretest</i>	<i>Posttest</i>
Amount of Values	2070	2925	2355	2560
Average Value	60.88	86.02	73.59	80
Number of Samples	34	34	32	32
Maximum Value	80	100	90	95
Minimun Value	35	70	15	65

Based on table 4., the application of Ludo in the PBL model managed to improve students' understanding of the concepts of structure and function of plant tissues. In this model, the students were required to engaged directly in learning, thus they got experiences and it encouraged them to be active learners. The average to class experiment pre-test score was 60.88, while the post-test was 86.02 and the average to class control pre-test score was 73.59 and post-test score was 80.

3.2. Discussion

The insertion of Ludo and question cards into the PBL model makes the PBL model more interesting and facilitates the students to have a better understanding of the concept being learned. Problem-based learning is one of the learning models designed to help students in learning based on a problem and it requires students to learn actively, cooperatively, and collaboratively; to think critically; and to develop abilities and skills to solve problems [3]. "in order to be successful in Problem or Problem-Based-Learning (PBL), students must take responsibility for the learning process by setting goals, monitoring, reflective, and sustaining their motivation from the beginning of the project until end. However, for many students, these processes do not

occur naturally or easily. Therefore, the learning environment and teaching practices in PBL must be designed with intention to support students self-regulated learning (SRL)” [5]. “one of Barrows most recent definitions identified the following key components of PBL; (a) Ill-structured problems are presented as unresolved so that students will generate not only multiple thoughts about the cause of the problem, but multiple thoughts on how to solve it (b) A student-centred approach in which students determine what they need to learn it is up to learners to derive the key issues of the problems they face, define their knowledge gaps, and pursue and acquire the missing knowledge (c) Teachers act as facilitators and tutors, asking students the kinds of meta-cognitive questions they want students to ask themselves. In subsequent sessions, guidance is faded (d) Authenticity forms the basis of problem selection, embodied by alignment to professional or “real world” practice” [10].

The effect of problem-based learning equipped with virtual media on the activities and learning outcomes of high school / MA physics in 2012, showed that there was an increase in student learning outcomes and good learning activities on students using the learning model problem based equipped virtual media. That research using instructional media can help an efficient teaching and learning process [8]. Understanding a concept is a competency that must be possessed by each student to perform accurately, efficiently, and appropriately in learning. The use of games in learning is intended to facilitate the students in improving their ability in understanding a concept as it makes the learning interesting.

Understanding a concept covers knowledge on classifications, categories, and relationships among the three categories which are more complex and well-ordered [1]. This study involved 2 classes set as experimental and control groups. It aimed to investigate whether the insertion of Ludo in the PBL model could increase the students’ ability to understand concepts of structure and function of plant tissue.

The insertion of Ludo with questions card into the PBL model manages to improve the XI grade students’ ability to understand concepts of structure and function of plant tissues. The use of the PBL model fitted with games can be an alternative model in teaching and learning activities for create a fun and interesting atmosphere in the classroom in order to motivate and facilitate students in learning.

4. Conclusion

Problem-based Learning (PBL) is a type of cooperative learning and in this context, it is inserted with games suitable with the learning materials and students’ characteristics. This learning model is beneficial to deliver biology materials in interesting ways. Senior high school students easily get bored, tend to play with their peers, and love challenges to solve problems. Problem-based Learning using Ludo is a form of creativity in learning.

The result showed that PBL using Ludo completed with question cards managed to improve the students’ ability in understanding the concept of structure and function of plant tissues. It was evident with independent t-test with a significance value of <0.05 , $0.007 < 0.05$. The average to class experimental group (using Ludo) pre-test score was 60.88, while the post-test was 86.02 and the average to class control group (without using Ludo) pre-test score was 73.59 and post-test score was 80.

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