Available online at http://journal.um.ac.id/index.php/jps/
ISSN: 2338-9117 (printed)/2442-3904 (electronic)

Jurnal Pendidikan Sains
Volume 7, Number 3, September 2019, pp. 111–115

Improving Creative Thinking Skills of Students Through Learning Based on Simple Hydroponic Projects

Nur Umami Rosidah[1)*], Herawati Susilo[2)], Susriyati Mahanal[2)]
[1)]SMAN 2 Karangan
[2)]Biology Education-Universitas Negeri Malang
Jl. Palem Raja 01 Karangan, Trenggalek-66361, Jawa Timur, Indonesia. E-mail: nurumami1@gmail.com*

Abstract: Project Based Learning (PjBL) teaches many important strategies to train various life skills to face the challenges of 21st century life, one of which is creative thinking. This quasi experiment research aims to determine the effect of project-based learning on the material of growth and development in high school students by using simple hydroponic cultivation techniques on students' creative thinking skills. The research instrument was in the form of pre test and post test questions given to the experimental class and the control class. Data analysis with independent t-test shows the results of *p* value < α (α = 0.05), which proves that the research hypothesis is accepted, so it can be concluded that simple hydroponic project-based learning can improve students' creative thinking skills.

Key Words: PjBL, creative thinking skills, hydroponic

Abstrak: *Project Based Learning* (PjBL) merupakan metode pembelajaran yang mengajarkan banyak strategi penting untuk melatihkan berbagai kecakapan hidup untuk menghadapi tantangan hidup abad 21, salah satunya yaitu *creative thinking*. Penelitian *quasi experiment* ini dilaksanakan dengan tujuan untuk mengatahui pengaruh pembelajaran berbasis proyek pada materi pertumbuhan dan perkembangan pada siswa SMA dengan menggunakan teknik bertanam hidroponik sederhana terhadap keterampilan berpikir kreatif siswa. Instrumen penelitian berupa soal *pre test* dan *post test* yang diberikan kepada kelas eksperimen dan kelas kontrol. Analisis data dengan *independent t-test* menunjukkan hasil *p value* < α (α = 0,05), yang membuktikan hipotesis penelitian diterima, sehingga disimpulkan bahwa pembelajaran berbasis proyek hidroponik sederhana dapat meningkatkan keterampilan berpikir kreatif siswa.

Kata kunci: PjBL, keterampilan berpikir kreatif, hidroponik

INTRODUCTION

Facing the challenges of life in the 21st century, it is important to equip students with the essential life skills (Prajapati & Sharma, 2017). By acquiring life skills from the educational process, students are expected to be able adjust to the demands and challenges (WHO, 1994), and have wider opportunities in the professional circumstance and have a better life (Kagan, 2004). One form of essential life skills is creative thinking skills (WHO, 1994).

The ability to think creatively is essential in the learning process to achieve learning success (Cachia, Ferrari, Ala-mutka, & Punie, 2010). Creative thinking encourages students to find ideas in solving problems (Okpara, 2007). The learning process can accommodate students to think critically (Sharp, 2004), so the process of creative thinking becomes a habit (Lau, 2011). Students with creative thinking skills have more opportunities to improve learning outcomes in school (Caroselli, 2009). Schools, as educational institutions, should prioritize the development of creative thinking skills to form individuals who are responsive to the changes and challenges of life in the 21st century.

The application of appropriate learning methods encourages students to develop creative thinking, understand the knowledge acquired and produce satisfying learning outcomes. Project Based Learning (PjBL) is a learning method that provides opportunities for students to develop creative thinking (Hidayah, Yulianto, & Marwoto, 2015). Project Based Learning (PjBL) provides opportunities for students to develop 21st century skills and encourages students in inde-

Article received 24/2/2019; Approved 25/8/2019

pendent learning through inquiry activities. In addition, Project Based Learning (PjBL) encourages students to work together in researching and producing the final product as a result of understanding the knowledge they get (Bell, 2010), and also a realistic product (Thomas, 2000). Students can choose activities and work done during project activities, students can also be communicative, creative and develop practical thinking because they are actively involved in the investigation /discovery and decision making (Mcgrath, 2000). In addition, the PJBL also helps improve problem-solving abilities (Mihardi, Harahap, & Sani, 2013).

Growth and Development Topics (Basic Competencies 3.1 and 4.1) (Permendikbud, 2016) invites students to learn various factors that influence growth and development. This topic opens opportunities for students to explore broadly about farming techniques and experiment with the factors that influence the growth and development of plants in their projects. By only learning theories and concepts, students do not have the opportunity to develop the critical thinking skills, problem solving, and creativity needed to meet the challenges of the 21st century. Therefore learning activities are needed that can develop these skills.

Students can use several farming techniques to make observations and experiment about Plant Growth and Development, one of which is a hydroponic technique. This hydroponic technique is a planting technique that utilizes water as a plant nutrient medium without using a solid medium (soil) (Karsono, Sudarmadjo, & Sutiyoso, 2002), making it easier to vary the conditions of various factors that can affect plant growth (Nurlaeny, 2014). In this way students can more freely conduct experiments to build concepts about plant growth and development and the factors that influence it. Through a series of hydroponic farming project activities and in arranging hydroponic growing media, it developes creative thinking skills.

This study aims to develop students' creative thinking skills through learning based on simple hydroponic projects. The hypothesis proposed in this study is: "there are differences in students' creative thinking skills after being taught with simple hydroponic project-based learning with control classes."

METHOD

This research was a quasi-experimental study with Pretest Posttest Control Group Design. The study was conducted at SMAN 2 Karangan Trenggalek in two classes, class XII IPA 1 as a control class and one class XII IPA 3 as an experimental class. This experimental research involved two types of variables, namely the application of learning Material Development and Development based on PjBL as the independent variable, and the improvement of creative thinking skills as the dependent variable. Data collection instruments in the form of pre-test and post-test creative thinking skills that have been validated, as well as observation sheet of the implementation of learning. The research data of the pretest posttest students' creative thinking skills were tested for normality using the Kolmogorov-Smirnov Test and homogeneity using the Levene's Test, then the pretest and posttest difference in data from the two groups were analyzed using an independent t-test at a significance level of 5%.

RESULTS

The pretest and posttest results of creative thinking skills were calculated to find out the average difference between the experimental class and the control class. The experimental class had an average pretest creative thinking skills of 38.64 and a posttest of 82.92 and the control class had a pretest average of 34.58 and posttests of 54.42. The data shows that there is an increase in the value of creative thinking both in the experimental class and the control class, but the higher increase in the experimental class. It can be seen from the difference in the pretest and posttest values (gain values) in each class. The average gain score in the experimental class and the control class shows that the experimental class is higher than the control class that is equal to 44.28 compared to 19.85 (Figure 1).

Data were then tested for normality using the Kolmogorov-Smirnov Test and homogeneity using the Levene's Test. The results of the normality test show that the data is nomal (p value 0,200 > α (α = 0.05)), and the homogeneity test results show homogeneous data (p value 0.849 > α (α = 0.05)). The results of testing the hypothesis of creative thinking skills using the independent t-test at a significance level of 5% indicate that the p value < α (α = 0.05), thus it can be concluded that the research hypothesis is accepted (Table 1). The results of this analysis prove that simple hydroponic project-based learning significantly improves students' creative thinking skills.

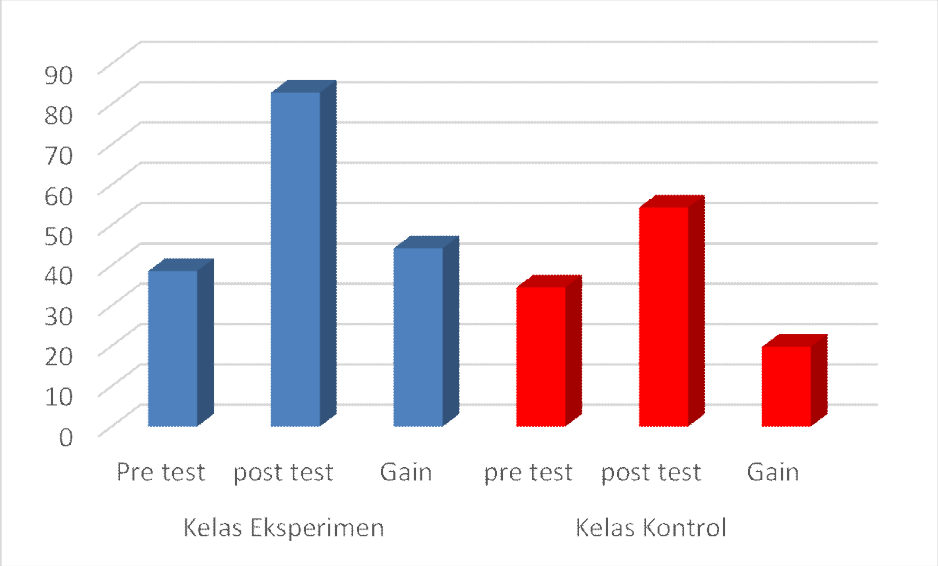

Figure 1. Difference in Average Creative Thinking Skills between Experiment Class and Control Class

Table 1. Hypothesis Test Results of independent t-test of Experimental Class and Control Class

	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	6.351	49	.000	24.43385	3.84701
Equal variances not assumed	6.358	48.994	.000	24.43385	3.84311

DISCUSSION

The results of simple hydroponic project-based learning experiments significantly improve students' creative thinking skills compared to conventional learning. The mean gain score in the experimental class was higher than the control class supported by the independent t-test which showed that there were significant differences between the creative thinking skills of the experimental class and the control class (Figure 1; Table 1). The results of this study indicate that PjBL influences creative thinking skills as reported (Utami & Sumarni, 2016) and that these influences are positive in that they enhance creative thinking skills (Astuti, 2015; Tamba, Motlan, & Turnip, 2017).

In the hydroponic project activities on the material Growth and Development students undertook two projects. In project I, students experimented about the factors that influence the germination process, while in project II students experimented with various factors that affect growth and development with hydroponic techniques. Factors that were experimented on in the project could be light, hydroponic nutrient composition, and acidity level of nutrient fluids. Thus, students gain additional experience in hydroponic farming, namely knowledge of the best conditions that affect plant growth with hydroponic techniques The results of the project carried out by students was in the form of simple hydroponic growing media products on the subject of Growth and Development. In this experiment, students conduct a simple hydroponic system, a wick system using tools/materials that is easily found in the surrounding environment In learning activities by implementing the PjBL, students are required to explore many creative ideas in their projects (fluency), where creative ideas are expected to be unique, interesting and have an element of novelty (originality). Creative ideas must be equipped with details, ways/steps that work logically hence the formulation of ideas becomes easier to apply and clear (elaboration). Students are also expected to be able to solve problems encountered in the project, think of answers from various points of view to solve these problems (flexibility). These four skills are indicators of creative thinking skills (Treffinger, Young, Selby, & Shepardson, 2002). The mean posttest score of the experimental group which was higher than the control group showed the positive effect of the project activities carried out by students on the four indicators of students' creative thinking skills.

PjBL emphasizes the final product (Harmer, 2014; Donnelly & M. Fitzmaurice, 2014) in addition to per-

formance (Donnelly & M. Fitzmaurice, 2014) by giving students the opportunity to work independently in learning activities which will ultimately produce tangible products that illustrate knowledge and student creativity (Thomas, 2000). Through project activities, students produce a product that can reflect what they are learning, how they ask questions, analyze, synthesize, solve problems, produce creative ideas, and how the design becomes a product or system (Doppelt, 2005), activities that can practice the skills of the 21st century. The product is presented and exhibited at the market place at the end of the project activity.

CONCLUSION

Based on the results of this study, it can be concluded that simple hydroponic project-based learning significantly improves students' creative thinking skills. This improvement shows that the activities carried out during learning using the PjBL approach train students' creative thinking abilities better than conventional learning. Products produced by students indicated that students have satisfied creative thinking skills.

Project-based learning (PjBL) by applying this hydroponic technique needs to be developed through further innovation, not only discontinuing at the products produced, but can apply the student's project products into effective products thus they can be socialized and applied to the surrounding community, as a form of learning Science Technology Society (STS).

REFERENCES

Astuti, R. (2015). Meningkatkan kreativitas siswa dalam pengolahan limbah menjadi trash fashion melalui PjBL. *Bioedukasi*, *8*(2), 37–41. https://doi.org/10.20961/bioedukasi-uns.v8i2.3872

Bell, S. (2010). Project-Based Learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Cachia, R., Ferrari, A., Ala-mutka, K., & Punie, Y. (2010). *Creative Learning and Innovative Teaching*. Seville: JRC-Institute for Prospective Technological Studies.

Donnelly, R., & M. Fitzmaurice. (2014). Collaborative project-based learning and problem-based learning in higher education: a consideration of tutor ad students roles. *Emerging Issues in the Practice of University Learning and Teaching. AISHE, Dublin*, 87–98. Retrieved from http://www.aishe.org/readings/2005-1/donnelly-fitzmaurice-Collaborative-Project- based-Learning.html

Doppelt, Y. (2005). Assessment of project-based learning in a Mechatronics context. *Journal of Technology Education, 16*(2), 7–24. https://doi.org/10.21061/jte.v16i2.a.1.

Harmer, N. (2014). Project-based learning - Literature review, (August), 34. https://doi.org/10.5897/ERR2014.1777

Hidayah, A., Yulianto, A., & Marwoto, P. (2015). Effect of project based learning approach contextual to creativity of student of madrasah. *Internasional Conference on Mathematics, Science and Education, 2015*(Icmse), 16–20.

Kagan, S. (2004). *Macmillan Life Skills: Language Is a Life Skill*. Retrieved from www.macmillanenglish.com/life-skills.

Karsono, S., Sudarmadjo, & Sutiyoso. (2002). *Hidroponik Skala Rumah Tangga*. Jakarta: Agro Media Pustaka

Lau, J. Y. F. (2011). *An introduction to critical thinking and creativity*. New Jersey: John Wiley & Sons, Inc.

Mcgrath, D. (2000). Getting started with project based learning. *ISTE (International Society for Technology in Education), 30*(3), 1–4.

Mihardi, S., Harahap, M. B., & Sani, R. A. (2013). The effect of project based learning model with KWL worksheet on student creative thinking process in physics problems. *Journal of Education and Practice, 4*(25), 188–200.

Nurlaeny, N. (2014). *Teknologi media tanam dan sistem hidroponik*. Bandung: Unpad Press.

Okpara, F. (2007). The value of creativity and innovation in entrepreneurship. *Journal of Asia Entrepreneurship and Sustainability, III*(2), 1–14.

Permendikbud. (2016). *Kompetensi inti dan kompetensi dasar pelajaran pada kurikulum 2013 pada pendi-dikan dasar dan pendidikan menengah*, (1), 1–7.

Prajapati, R., & Sharma, D. (2017). Significance of life skills education. *Contemporary Issues in Education Research, 10*(1), 1–6. https://doi.org/10.1038/NPHYS4282.

Sharp, C. (2004). Developing young children's creativity: What can we learn from research? *TOPIC, Autumn* (32), 5–12.

Tamba, P., Motlan, & Turnip, B. (2017). The effect of project based learning model for students ' creative thinking skills and problem solving. *IOSR Journal of Research & Method in Education (IOSR-JRME), 7*(5), 67–70. https://doi.org/10.9790/7388-0705026770

Thomas, J. W. (2000). A review of research on project-based learning. *The Autodesk Foundation*, 1–45. https://doi.org/10.1007/s11528-009-0302-x

Treffinger, D. J., Young, G. C., Selby, E. C., & Shepardson, C. (2002). *The national research center on the gitted and talented*. Sarasota Florida: Center for Creative Learning.

Utami, Y., & Sumarni, W. (2016). Kontribusi pembelajaran berbasis proyek terhadap life skill siswa. *Jurnal Inovasi Pendidikan Kimia, 10*(1), 1683–1691.

WHO. (1994). *Life skill education for children and adolescents in schools*. Geneva: WHO.