

Implementation of the SMK Manufacturing Engineering Drawing Learning Model in Sleman

Hesty Monica Suri and Apri Nuryanto

ABSTRACT

This study aimed to examine the effects of implementing a learning model for manufacturing engineering drawing on students' learning achievement in Vocational High School (VHS) in Sleman, Yogyakarta, Indonesia. This study employed the quantitative descriptive method. The population in this study was all students of class XII of the mechanical engineering program at some VHSs. Using proportionate stratified random sampling, 142 out of 240 students from five VHSs were selected as the research participants. The results of this study show that the five VHSs implemented different learning models, namely project-based learning and discovery learning models. The percentage of Project-based Learning Model implementation in state vocational high schools SMKN 1 Sayegan and SMKN 2 Depok is 79%. Meanwhile, the percentage of discovery learning implementation in SMK Muhammadiyah Prambanan, SMK Nasional Berbah, and SMK Piri Sleman is 72%. Therefore, based on the student learning achievement, project-based learning is better than discovery learning.

Keywords: Discovery learning, engineering drawing, implementation, project-based learning.

Published Online: December 18, 2023

ISSN: 2736-4534

DOI: 10.24018/ejedu.2023.4.6.725

H. M. Suri*

Department of Education, Yogyakarta State University, Indonesia.
(e-mail: hestymonicas@gmail.com)

A. Nuryanto

Yogyakarta State University, Indonesia.
(e-mail: apri_nuryanto@uny.ac.id)

**Corresponding Author*

I. INTRODUCTION

Education in Indonesia is now facing many challenges as it dynamically develops. Education is essential because it determines the future of the young generation. With no proper education, there will be no successors to the noble ideals to achieve the welfare and progress of the nation. Quality education will help change the nation (Nugroho, 2020). Education is required to produce competitive professionals and provide jobs in the field of vocational education. Models of noble characters, skills, and knowledge should be provided by educational institutions. Vocational education should be present in VHSs to give students skills in accordance with industry needs, even before they graduate from school. The Independent curriculum currently implemented in Indonesia demands a learning process that gives opportunities for students to develop their potential.

Therefore, making every learning activity run according to the curriculum is crucial, and teachers are expected to actively support the efforts (Aspi & Syahrani, 2022). This teacher competence is based on what a teacher has, namely, skill and ability. It is said that the skill is related to mastering practical learning so that learning can run optimally. However, many teachers do not have sufficient competencies in teaching, so learning is not optimally conducted. Moreover, learning models are not implemented

optimally, so students are lazy and have low motivation to learn. Learning patterns that make students more interested in learning are those conducted in the classes. Each school has its own learning method, but there is a reference to learning methods that are good to be used for manufacturing engineering drawing subjects in VHSs. Teachers should be able to develop learning models that can increase students' interest and motivation in learning. Teacher competence is an important basis for creating quality and valuable education (Sari *et al.*, 2020). In other words, learning implementation is related to teaching-learning practice. In general, learning implementation is an action or implementation of a plan that is carefully prepared to carry out a learning process (Usman, 2002). According to Imron Hamzah (2019), learning implementation is the interaction among students, educators, and learning resources in a learning environment that includes teachers and students exchanging information. To make the learning process run smoothly, teachers need to first evaluate the learning process.

According to Article 57 paragraph (1) of the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, evaluation is carried out within the framework of controlling the quality of education at the national level as a form of accountability of education providers to concerned parties, including students, institutions, and educational programs. In a broad sense,

evaluation is a process of planning, obtaining, and providing information that is needed to make alternative decisions. In accordance with this definition, each evaluation or assessment activity is a process that is deliberately planned to obtain information or data to be used to make a decision. The purpose of evaluation in learning is to determine the effectiveness and efficiency of the learning system, including the objectives, materials, methods, media, learning resources, environment, or the assessment system itself. The independent curriculum requires teaching-learning activities to provide opportunities for students to develop all their potential. Therefore, designing every activity to be able to answer the demands of the curriculum is needed. Teachers are required to be actively involved in the activity (Muhammad *et al.*, 2021). Therefore, to overcome the problems stated above, developing effective teaching materials with the right models is necessary. The models that can be used are the Discovery Learning (DL) and Project-based Learning (PJBL) models.

According to Riyanto (2010, p. 138), the discovery learning model is “learning to find yourself”. In learning, students are given the opportunity to search for answers, solve problems, and formulate their own answers. In addition, Desyandri *et al.* (2019) state that the discovery learning model includes a process that occurs when materials are not presented in their final forms because students are expected to organize them. The discovery learning model is a learning process in which learning materials are not presented but are expected to be organized in their final forms (Amiyani & Widjajanti, 2019).

Meanwhile, the project-based learning model is based on projects, experiences, and real-life problems (Gijbels *et al.*, 2005, p. 29). Thus, project-based learning leads to a training process based on real problems. The process is carried out by students through certain activities (projects). The project-based Learning method focuses on solving real problems, working in groups, giving, and receiving feedback, discussing, and making final reports. Students are encouraged to be more actively involved in the class and develop critical thinking skills, so they practice conducting investigations and inquiries. Suradi (2021) stated that project-based learning is an instructional method that encourages learners to apply critical thinking, problem-solving skills, and content knowledge to real-world problems and issues.

II. METHODOLOGY

The population of this study was students taking the mechanical engineering program in some VHSs in Sleman, Yogyakarta. Proportionate stratified random sampling was used to select the participants of the study. As many as 142 students out of 240 total students from five different VHSs participated in this study. Data were collected through surveys and tests. This study employed the descriptive quantitative technique. Through this study, the researcher explains what happened regarding the current situation (Sugiyono, 2019, p. 2). In this study, the descriptive data analysis was performed to describe data in each variable that exists in each learning model syntax, a simple regression analysis technique was used to test hypotheses and a

sample-independent test was performed to test differences between learning models implemented in each VHS.

The following hypotheses are formulated:

H₀: There is no difference between project-based learning and discovery learning on learning achievements.

H_a: There is a difference between project-based learning and discovery learning on learning achievements.

III. RESULTS

The results of this study were to find out (1) the significant relationship between the project-based learning model and learning achievement, (2) the significant relationship between discovery learning and learning achievement, and (3) the difference test (t-test) of project-based learning and discovery learning models. The results are elaborated below. The project-based learning model has a significant effect on learning achievements. It can be explained by testing the hypothesis using simple regression analysis. The results of the analysis are presented in Table I.

TABLE I: MODEL HYPOTHESIS RESULTS OF PROJECT-BASED LEARNING

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	33.755	7.844		4.303	<0.001
Project-based learning	0.603	0.103	0.550	5.849	<0.001

The significance test aims to determine the significance of the variable project-based learning model on learning achievements. The hypothesis tested is whether the project-based learning model has a positive effect on the students' learning achievements in the mechanical engineering program in VHSs in Sleman Regency for the 2022/2023 academic year. The significance test at a significance rate of 5% is α ($0.00 < 0.05$). The implementation of the project-based learning model has a significant effect on learning achievements by drawing tool posts. It means that based on the analysis, the researcher concluded that H_a is accepted and H_0 is rejected. Next, the significant relationship between the discovery learning model and learning achievements is described.

There is a significant relationship between the discovery learning model and learning achievements. The tested hypothesis is that the discovery learning model has a significant effect on learning achievements (H_a) of technical drawing using inventor software for mechanical engineering students at VHS in Sleman Regency. The hypothesis testing used a simple regression analysis. The results of the analysis are presented in Table II.

TABLE II: DISCOVERY LEARNING MODEL ON LEARNING OUTCOMES

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	59.613	7.975		7.475	<0.001
Discovery learning model	0.227	0.114	0.252	2.003	0.05

The hypothesis tested is that the implementation of the discovery learning model has a positive effect on the learning achievements of mechanical engineering students

in Sleman Regency for the 2022/2023 academic year. Based on the test results at a significance level of 5%, the value obtained is α ($0.05 = 0.05$). Then, based on the analysis, the null hypothesis (H_0), which states that there is no effect of the discovery learning model on students' learning achievements, is accepted, and the alternative hypothesis (H_a) is rejected. In conclusion, there is no relationship between the discovery learning model and the learning achievements of manufacturing engineering drawings. Furthermore, the researcher explained that there were differences in the learning models measured using a comparative test.

Comparative hypothesis test analysis is a test to measure the significance of the difference between two learning achievements using a project-based learning model and discovery learning on learning achievements, which can be seen in Table III.

TABLE III: COMPARATIVE HYPOTHESIS RESULTS

	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	2.085	0.151	2.247	140	0.026
Equal variances not Assumed			2.320	139.5	0.022

The result was obtained at a significance level of 5%, and then α ($0.02 < 0.05$). Therefore, H_a is accepted, stating that there is a difference between project-based learning and discovery learning, and H_0 is rejected.

Based on the data analysis, there is a significant difference between classes using project-based learning and classes using discovery learning in Grade XII.

IV. DISCUSSION

A. Implementation of the Manufacturing Engineering Drawing Learning Model

This study aims to determine the implementation of the learning model in each school because the learning model used for technical drawing varies. Researchers will analyze the learning model applied in 5 SMKs in Sleman Regency, one of which is SMKN 1 Sayegan, SMKN 2 Depok, Prambanan Muhammadiyah Vocational School, Berbah National Vocational School, Piri Sleman Vocational School, whose total population is 240 students. Next, in collecting research data, the researcher carried out the stages, namely, the initial step was distributing questionnaires to students, which contained the implementation of learning according to the syntax of the learning model used by the teacher.

B. Implementation of Project-based Learning

Based on the research that has been done, the implementation of the learning model using the project-based learning model at 2 SMKs, namely SMKN 1 Sayegan and SMKN 2 Depok, totals 81. The implementation of the project-based learning model has reached an average, which is defined as a high criterion. The learning model for manufacturing engineering drawings at machining engineering vocational schools in Sleman Regency learning using project-based learning is very appropriate for learning engineering manufacturing engineering drawings for class

XII. According to Satoto and Nuryadi (2013), project-based learning is learning designed for complex problems in which students carry out investigations to understand and emphasize learning with long activities. The assignments given to students are multidisciplinary and product-oriented. The results of this study support the results of previous research conducted by Aryanto (2021). This project-based learning model can be applied to overcome problems in manufacturing engineering drawing learning activities because students are required to be more creative in making products or job sheets that already have objects. The application of the project-based learning model in the manufacturing engineering drawing subject is oriented towards practical skills in making workpiece components that are appropriate for industry. According to Revelle *et al.* (2019, p. 13), project-based learning can enable education to provide ambitious instruction and create opportunities for students to build social and literacy and learn the knowledge and skills needed to become actively involved students.

C. Implementation of Discovery Learning Model

The implementation of the project-based learning model has a greater influence on learning achievements than Discovery Learning in multi-media computer system learning. In addition, based on research, which was carried out at Class X at a high school in Wonosari Regency, there was a significant effect of using the Discovery Learning model on learning achievements in Geography subjects with a significant level of $0.003 < 0.05$. The research describes the implementation of discovery learning on learning achievements, which was applied in Class XII of engineering drawing. Next, the researcher can explain the difference between project-based learning and discovery learning models as follows.

D. Test Different Models of Project-based Learning and Discovery Learning (t)

Based on the difference tests, the class using the project-based learning model with a total of 81 students obtained an average (mean) of 78.74, while the class using the discovery learning model with a total of 61 students obtained an average score average (mean) of 75.48. Thus, the class that used the project-based learning model had a higher average than that of the class using the discovery learning model. The result is at a significance level of 5%, and then α ($0.02 < 0.05$). In brief, for H_a , there is a difference between project-based learning and discovery learning.

V. CONCLUSION

A. Conclusion

Based on the discussion, the following conclusions are drawn:

- 1) There is a significant relationship between the project-based learning model and learning achievements with a value ($0.00 < 0.005$).
- 2) There is no significant relationship between discovery learning and learning achievements with a significant value ($0.05 = 0.05$).
- 3) The result obtained is at the 5% significance level, and then α ($0.02 < 0.05$).

- 4) Hence, it can be stated that there is a difference between the Project-based learning model and discovery learning.

B. Suggestions

The suggestions in this study are as follows:

- 1) Practical learning is more advisable to employ a project-based learning model in which students think creatively in completing projects that have been given by observing real objects found every day in the workshop.
- 2) Meanwhile, a discovery learning model is more recommended for use in theoretical subjects such as biology, physics, welding materials, etc. which relate more to discovery.
- 3) The teacher participated more in the training of drawing subjects, what learning models are suitable for engineering drawing, what syntax in that model should be applied, and the teacher must adjust the use of applications recommended for VHS with equality in the industry.

ACKNOWLEDGMENT

The researchers would like to thank the professors and students at SMK Negeri Sayegan, SMK Negeri 2 Yogyakarta, SMK Muhammadiyah Prambanan, SMK Nasional Berbah, SMK Piri Sleman, Who have contributed to collecting data for this study appreciation goes to all the Volunteers of Manufacturing Engineering Drawing teachers, and special thanks to a classmate for their help in fieldwork collecting all the data.

CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

REFERENCES

- Amiyani, R., & Widjajanti, J. B. (2019). Self-confidence and mathematics achievement using guided discovery learning in scientific approach. *Journal of Physics: Conference Series*, 7(4), 1-7.
- Aryanto, D. (2021). Penerapan Model Pembelajaran Project Based Learning (Pjbl) Mapel Gambar Teknik Manufaktur [Application of the Project Based Learning (Pjbl) Learning Model in Manufacturing Engineering Drawing]. *Nozel Jurnal Pendidikan Teknik Mesin*, 3(2), 99-113.
- Aspi, M., & Syahrani, S. (2022). Profesional guru dalam menghadapi tantangan perkembangan teknologi pendidikan [Teacher professionals in facing the challenges of educational technology development]. *Adiba: Journal of Education*, 2(1), 64-73.
- Desyandri, D., Muhammadi, M., Mansurdin, M., & Fahmi, R. (2019). Development of integrated thematic teaching material used discovery learning model in grade V elementary school. *Jurnal Konseling Dan Pendidikan*, 7(1), 16-22.
- Gijbels, D., Dochy, F., Van den Bossche, P., & Segers, M. (2005). Effects of problem-based learning: A meta-analysis from the angle of assessment. *Review of Educational Research*, 75(1), 27-61.
- Imron Hamzah, M. (2019). *Pembelajaran ahlussunnah waljamaah (aswaja) sebagai implementasi pendidikan deradikalisasi di madrasah ibtidaiyah nurul jadid taman grujugan bondowoso tahun pelajaran 2018/2019* [Ahlussunnah Waljamaah (Aswaja) learning as an implementation of Deradicalization education at Madrasah Ibtidaiyah Nurul Jadid Taman Grujugan Bondowoso Academic Year 2018/2019] (Unpublished doctoral dissertation). KH Achmad Siddiq State Islamic University.
- Nugroho, B. A. (2020). *Hubungan Kemampuan Penyesuaian Diri Dengan Kesiapan Kerja Pada Siswa Sekolah Menengah Kejuruan* [Relationship between Adaptation Ability and Work Readiness in Vocational High School Students] (Unpublished doctoral dissertation). University of Mercu Buana Yogyakarta.
- Riyanto, H. Y. (2010). *Paradigma baru pembelajaran* [New learning paradigm]. Kencana Prenada Media.
- Sari, W., Rifki, A. M., & Karmila, M. (2020). Analisis kebijakan pendidikan terkait implementasi pembelajaran jarak jauh pada masa darurat Covid 19 [Analysis of education policies related to the implementation of distance learning during the Covid 19 emergency]. *Jurnal Mappesona*, 3(2).
- Satoto, E. N., & Nuryadin, E. R. (2013). Pengembangan Model Pembelajaran Project Based Learning pada Mata Kuliah. *Computer Aided Design. Jurnal Pendidikan Teknologi dan Kejuruan*, 4(21), 341-347.
- Sugiyono, S. (2019). *Metode penelitian pendidikan* [Educational research methods] (3rd ed.). Alfabeta.
- Suradi, S. (2021). E_Workshop Sebagai Upaya Meningkatkan Kemampuan Guru-Guru Smk Binaan Melaksanakan Proses Pembelajaran Menggunakan Model Pembelajaran Project Based Learning Dengan Pelaksanaan Daring (Dalam Jaringan) Pada Semester Ganjil Tahun Pelajaran 2020/2021 Di Kota Batam [E_Workshop As an Effort to Improve the Capability of Assisted Vocational School Teachers in Carrying Out the Learning Process Using the Project Based Learning Model with Online Implementation (On the Network) in the Odd Semester of the 2020/2021 Academic Year in Batam City]. *Daiwi Widya*, 7(5), 121-134.
- Usman, N. (2002). *Konteks implementasi berbasis kurikulum* [Context of curriculum-based implementation]. Grasindo.