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The Effect of PJBL and IBL on the Learning Independence of Vocational School Students

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Project-Based Learning, Inquiry-Based Learning, Student Disability

Abstract

The influence of Project Based Learning (PJBL) and Inquiry-Based Learning (IBL) learning models on students' learning independence at SMK Solo. PJBL and IBL were chosen as innovative and student-centred learning models, focusing on increasing students' independence and active involvement in the learning process. Based on the results of data analysis, it was found that PJBL provided a significant increase in student independence, with an average pre-test score of 44.01, increasing to 70.38 in the post-test. Meanwhile, students who took IBL experienced an increase from 46.85 to 59.77. The t-test showed a significant difference between the pre-test and post-test with a significance value of 0.000 (sig <0.05), indicating that both learning models contributed positively to increasing student independence. The results of the multivariate analysis supported this finding, with an F value of 3.052 and a significance of 0.018 (sig <0.05), indicating that PJBL was more effective than IBL in increasing independence. However, in the aspect of student creativity, no significant difference was found between the two models, with a significance value of 0.157 (sig > 0.05). In conclusion, PJBL is superior in encouraging student independence compared to IBL, and the results of this study provide important recommendations for educators to prioritize PJBL in the context of learning that focuses on developing student independence in vocational schools.

Keywords:
Project-Based Learning, Inquiry-based Learning, student independence

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Abstract

Pengaruh model pembelajaran Project Based Learning (PJBL) dan Inquiry Based Learning (IBL) terhadap kemandirian belajar siswa di SMK Solo. PJBL dan IBL dipilih sebagai model pembelajaran yang inovatif dan berpusat pada siswa, dengan fokus pada peningkatan kemandirian dan keterlibatan aktif siswa dalam proses pembelajaran. Berdasarkan hasil analisis data, ditemukan bahwa PJBL memberikan peningkatan yang signifikan terhadap kemandirian siswa, dengan rata-rata skor pre-test sebesar 44,01 meningkat menjadi 70,38 pada post-test. Sementara itu, siswa yang mengikuti IBL mengalami peningkatan dari 46,85 menjadi 59,77. Uji-t menunjukkan adanya perbedaan signifikan antara pre-test dan post-test dengan nilai signifikansi 0,000 (sig < 0,05), yang mengindikasikan bahwa kedua model pembelajaran ini berkontribusi secara positif terhadap peningkatan kemandirian siswa. Hasil analisis multivariat mendukung temuan ini, dengan nilai F sebesar 3,052 dan signifikansi 0,018 (sig < 0,05), menunjukkan bahwa PJBL lebih efektif dibandingkan IBL dalam meningkatkan kemandirian. Namun, pada aspek kreativitas siswa, tidak ditemukan perbedaan signifikan antara kedua model, dengan nilai signifikansi 0,157 (sig > 0,05). Kesimpulannya, PJBL lebih unggul dalam mendorong kemandirian siswa dibandingkan IBL, dan hasil penelitian ini memberikan rekomendasi penting bagi pendidik untuk mengutamakan PJBL dalam konteks pembelajaran yang berfokus pada pengembangan kemandirian siswa di SMK.

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INTRODUCTION

The development of educational technology in the 21st century has greatly facilitated humans and the world of education. Activities that initially had activities that were only in the classroom made education also develop in educational activities outside the classroom in a very short time (Afandi dkk., 2023; Bahri, 2022; Basri dkk., 2024; Zuana, 2016) Because the curriculum exchange that occurs in Indonesia emphasizes that students should interpret learning better (Asse et al., 2023). Various ways have been carried out to improve both in terms of curriculum, learning media, learning methods, and teacher performance, which continues to be improved, but the reality in the field is still not as expected as vocational schools in Solo to improve the quality of education in it (Firdaus et al., 2023) Factors that affect learning outcomes consist of internal and external factors. Other factors that also play a role include factors that exist in individuals, such as school factors and the community environment (Muflihah et al., 2024). UKBM in learning is important because of its implementation. Getting along directly with students can have a positive influence and train them to learn independently (Wardiyah et al., 2023). Students' interest in learning is the dominant factor affecting their learning outcomes. This factor can also be associated with other aspects, such as the understanding of students who continue the class because they have mastered the material and appropriate teaching methods (Nurqaidah & Hendra, 2020).

Other factors that affect learning are based on the student's interest in learning, motivation, and readiness to receive it, as well as external factors that come from the environment and facilities and practices during the learning process (AL-Momani, 2024; Fatimah dkk., 2023a; Rohmadiyah dkk., 2024). A learning model is a series of material presentations used to achieve effective learning goals. The presentation of material can be effective from various aspects of learning carried out by teachers. In addition, the learning process is used to determine the final result and achieve optimal learning interest as desired (Fadha, 2024; Sholichuddin dkk., 2023). Currently, the learning model is still dominated by teacher-centered lecture methods, with a lack of use of educational technology. Meanwhile, student development is very fast and dynamic in daily life. Good learning models include project-based Learning (PJBL) and inquiry-based Learning (IBL)(Sabariah et al., 2023).

Teachers' efforts in implementing a learning model that encourages student independence can be done through Project Based Learning (PJBL) (Masrur, 2023). Project-based learning is an innovative approach that emphasizes contextual learning through complex activities (Sarumaha & Laiya, 2023). The Project Based Learning (PJBL) model focuses on information and benefits to produce something useful for oneself and others (Nakada et al., 2018). However, the active role of students in learning is also the key to creating a good atmosphere. Every individual who learns must be active because, without activity, the learning process is impossible. There are many types of activities that students can do at school to support independence (Subaedah et al., 2023). Therefore, it is necessary to change the habits of teachers who rely only on experience

and feel inadequate in using effective learning models for the future (Arum dkk., 2024; As'ad, 2022; Maryam, 2018). Meanwhile, inquiry-based learning (IBL) is a learning model that aims to make students more active in learning activities, where the benefit of this inquiry-based learning model is to find and solve problems (Syahid et al., 2023). This right can be linked to the inquiry learning model to build student independence and enthusiasm. To achieve learning outcomes for all students and assist teachers in delivering material, it is necessary to balance it with the media in building independence (Hi ̄Bra et al., 2019). This inquiry-based lesson is an authentic learning activity to generate hypotheses and prepare interesting experiments (Van Der Graaf et al., 2020). In inquiry-based learning (IBL), there are five phases: orientation, conceptualization, investigation, conclusion, and discussion (Azizah dkk., 2024; Fauzi & Permadi, 2023). The investigation phase focuses on the students who will be confronted with the problem and is given a range to find out their interests and feelings. This phase of conceptualization provides an understanding of the concept of the problem to produce an initial answer to the problem at hand (Jami & Muharam, 2022). The investigation phase focuses on finding a solution to a question or problem. The conclusion phase provides a summary of the investigation and investigation. The discussion stage is a stage of reflection on learning and communication activities related to the results obtained (Sumarmo & Upi, t.t.).

Student independence is a learning activity that is based on activeness driven by the desire to master a competency to find out the problems that occur during learning. There are six indicators in looking at students' attitudes and independence, namely (1) independence from others, (2) having confidence, (3) behaving disciplined, (4) having a sense of responsibility, (5) behaving based on self-initiative, and (6) practicing self-control (Nasution, 2018). This study combines two learning models, Project Based Learning (PJBL) and Inquiry-Based Learning (IBL), to see how it affects Student Independence, while many previous studies have tended to focus on just one learning model. This integrative approach adds new value to the study of effective learning. The Importance of Learning Independence In the modern education era, learning independence is one of the skills that students must have to be able to survive and thrive in a changing world, especially in vocational schools that prepare students to jump directly into the world of work. (Rofifah et al., 2021) Independence in learning helps students take responsibility for their own learning process, which is an important capital in the professional world (B. T. Cahyono et al., 2024) PJBL and IBL as an Active Approach are two learning models that are considered to be able to provide relevant challenges for students, as well as foster independence because students are actively involved in the learning process (Asmawati, 2023; Basari dkk., 2023). PJBL emphasizes project completion, which helps students learn practically and deeply, while IBL helps students develop critical and analytical thinking skills through the inquiry process. Unique Vocational Context has different characteristics compared to public schools because students are not only required to master theory but also practical skills that are directly applied in the world of work (Prihatin et al., 2020). Therefore, it is important to test how

these two learning models can help vocational school students develop the necessary independence in a real work environment. The Gap Between Theory and Practice Many studies show that PJBL and IBL are effective in improving learning outcomes, but there is still a gap between theory and practice in the field, especially in their application in vocational schools (Alazeez dkk., 2024; B. Cahyono, 2023; Djalilah dkk., 2024). Therefore, it is necessary to test whether the implementation of PJBL and IBL can really increase students' learning independence in the context of this vocational school. This, in the setting of this vocational school, it is imperative to investigate whether the application of PJBL and IBL can actually enhance students' learning independence (Samsur et al., 2024). The purpose of this study is to determine how SMK Solo students' independence is impacted by project-based learning (PJBL) and inquiry-based learning (IBL).

RESEARCH METHODS

This descriptive qualitative research study aims to examine the relationship between variables. This study uses a pseudo-experimental method with a non-equivalent control group design (Gall, et al., 2007). The method carried out in the second grade of this class is the same material but given different treatment. The data we collected in this study consisted of learning implementation data and student creativity data. These observations are developed based on lesson plans. The basic learning model of the project starts with the following stages: initial research, initial creation and evaluation of class presentations, development of final presentations and final presentations, and publication of products.

The population in an area consists of certain numbers and characteristics that are determined to be studied (Sugiyono, 2014). In this school, the population consists of 3 classes with a total of 72 students. The restriction in sampling aims to be representative of all elements of a heterogeneous population. The sample used was 72 people, with each class consisting of 36 students. This study uses a pseudo-experimental design with a pre-test and post-test control group design.

Using an independent sample t-test, the impact of project-based learning (PJBL) and inquiry-based learning (IBL) on students' independence in vocational schools is determined. The following hypotheses are tested:

- Ha: Regarding student freedom, there is no difference in students' learning interests utilizing Project Based Learning (PJBL) and Inquiry-Based Learning (IBL).
- Hb: Regarding student freedom, there is a distinction between inquiry-based learning (IBL) and project-based learning (PJBL).

To determine the effect, an analysis was carried out on the difference in the increase in student interest and learning outcomes before and after using Project Based Learning (PJBL) and Inquiry-Based Learning (IBL) with a normalized N-gain index (g).

RESEARCH RESULTS AND DISCUSSIONS

Table 1
Descriptive Statistical Results of Student Independence

Statistical Results	*PJBL* *Pre-test*	Post-test	Experiment IBL Pre-test	Post-test	Pre-test	Control. Post Tests
Mean	44,01	70,38	46,85	59,77	35,40	59,45
Venereal Diseases	11,45	11,38	11,69	16,05	14,46	17,07

The foundation of this study is the observation of question- and project-based learning carried out in accordance with the learning plan. A post-test is given at the conclusion of the learning process, following the pre-test. Developing independence prior to the application of treatment is the primary purpose of the pre-test. Using the independence test that has been constructed in the pre-test and post-test, learning activities are conducted in the last stage of the post-test to achieve independence after receiving treatment, both pre-test and post-test.

Based on the data presented in this table, it can be concluded that the average independence of students increases in project-based learning classes and question-based classes. The data on the ability of independence in students obtained in the pre-test and post-test showed that students' independence was statistically descriptive.

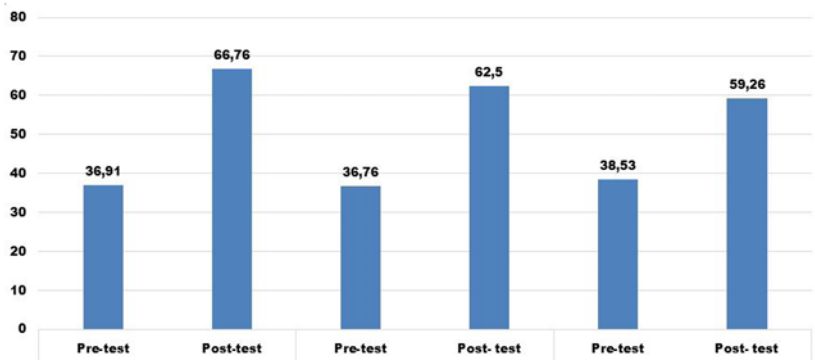

Figure 1. Descriptive Statistical Results of Student Independence

According to the descriptive analysis's findings, pupils' average ability to be autonomous rises after completing learning activities based on learning projects, learning models, and 5M. This data analysis covered every independent variable that was measured during student training. The treatment comparison aimed to determine how well the experimental class balanced project-based and

question-based learning on average. In the classroom, 5M independence lessons are taught concurrently, and average comparisons are limited to the average post-test of continuous independence.

The purpose of comparing the post-test averages is to evaluate the hypothesis regarding the impact of each learning model on each independent variable. The purpose of this average comparison is to compare the effects of 5M, the issue learning model, and the proven learning model on student independence. The paired sample t-test was used to determine the learning model, also known as the project-based learning model, problem-based learning model, and 5M to develop student independence. The distinction between independence before and after a class test is also ascertained using this test.

5M demonstrates a significant difference, which is indicated by a significance value of 0.000 (sig, = 0.05), based on the findings of the paired sample t-test, the results of independence in the project-based learning model, and the problem-based learning model. This indicates a difference between the pre-test and post-test average scores. In summary, learning is predicated on question-based learning. to look into how different questions and the 5M learning model affect students. This multivariate test's independence is verified and maintained via an un-test. Normality and homogeneity tests are two precondition tests that must be completed before starting a multivariate test. Considering the outcomes of the independent Kolmogorov-Smirnov normalcy test in the

A multivariate test was run to find out how project-based learning models, question-based learning, and 5m affected independence. The purpose of this multivariate test is to evaluate post-test independence. Statistical trace hotelling is employed as a multivariate test. Two sets of independent variables are analyzed using hotelier traces. Independence provides multivariate statistical findings using trace hoteling in this investigation.

Table 2: Multivariate Statistics

Effect	Value	F	Sig.
Learning Model	0,126	3,052	0,018

The hoteling trace test findings of the multivariate analysis above revealed a value of 0.126 and a F value of 3.052. Ho was disproved since the significance value was less than 0.05, at 0.018. The analysis's findings lead to the conclusion that there is an average difference in independence between the group using the problem-based learning model and the 5M. An un-variate test was performed on

the value of the student's independence post-test to examine each variable that displayed the findings of the un-variant test after a multivariate test of the post-test independence results was completed.

Table 3. Univariate Test Results

Inter-Subject Effects Test			
Source	**Dependent Variation-able**	**F**	**Sig.**
Learning Model	Independence	5,812	0,004
	Creative Thinking	1,885	0,157

According to the analysis of the univariate test on the post-test value, the independent dependent variable had a number of F equal to 5.812 and a significant value of less than 0.05 (sig = 0.004). None of the three learning models significantly impacted positive and significant independence, according to the univariate test results for creative thinking ability, which revealed a greater than 0.05 (dig = 0.157).

Following the univariate test, each learning model's impact on students' independence and original thought was evaluated. This test is administered to students who use the Tukey test, and it is based on each test's average of independence and post-test ability. The study's findings also demonstrate that there is a substantial difference in the average independence of the two learning models, with the significance value of the question-based and project-based learning models being less than 0.05 (Sig = 0.012). A significant value of less than 0.05 (Sig = 0.010) was obtained from the study of the project-based learning model and 5M, indicating that there was a difference in the average independence of the two learning.

One of the learning methods that promotes independence and may be used in a variety of scientific domains is project-based learning. With this methodology, students can work on projects both inside and outside of the classroom, individually and in groups. It is also advised to use alternative learning methods, such inquiry-based learning, in all areas of education. With this alternate method of instruction, educators can select a model of learning that best fits the needs of their students and the subject matter they are teaching. Even so, creative thinking questions are integrated into unique thinking tasks for every student. Differently thinking, questions typically inspire students to provide more autonomous responses rather than focusing on just one possible response. The questions in this study are formatted according to local (Kaufman & Sternberg, 2011). According to the data above, students in project-based learning classes have

a higher post-test average for independence than students in question-based learning classes and 5 million classes. Students' experiences with activities and learning through project-based learning models have an impact on this higher average as the foundation for student development, and independence in the learning context starts with the process of identifying and observing issues, both at home and at school. It entails making educated guesses about an issue, evaluating them, and testing them. The next step is to make changes, test them, and then present the findings.

Discussion

The first stages of project-based learning include the team's introduction and planning, information retrieval and gathering, creation, and pre-delivery evaluation. Subsequently, there is an iteration of the final presentation development or research phase, followed by the completed product or data publication. Questions that motivate students are referred to as project-based learning (Bender, 2012; Thomas, 2000), and breathing materials are directly associated with these questions. Posing questions can assist pupils in becoming more adept at actively solving problems to increase their independence (Aini dkk., 2022; Margaretha dkk., 2023). The main questions that guided the exercise were how examples of human activity affect the functioning of human systems in respiration and how humans make efforts to make or urge individuals to cut back on smoking. The key inquiries at the start of tutoring are (Suhermanto dkk., 2024).

A word is used to present a learning-based project to pupils and draw their attention to it at the start of the learning process. Journals and publications were consulted for this lesson or research in order to create a straightforward instrument that would guarantee teachers' ability to impart knowledge. Students should be regularly encouraged to discover issues that impact lung frequency and lung capacity in smokers during this project-based learning experience. Students first identify the issue and then construct and design a simple device to measure a person's lung capacity. The device was developed to demonstrate that a variety of circumstances can impact an individual's lung capacity. The pupil works and behaves.

The first project using project-based learning produced a basic device to gauge a person's lung capacity. Students learn to be sensitive to the issue of each person having distinct lung frequencies and lung capacities during the instrument-making process. There are several reasons for the discrepancy. Pupils receive instruction on the distinctions between human lung frequency and lung capacity. Students design the instrument with guidance from the teacher. In the

meantime, students receive training in product creation utilizing basic materials and scientific ideas to provide measurement findings with good precision for examining human lungs.

Making a visual to serve as a reminder of the risks associated with human smoking is the second endeavor. In the second assignment, the students learned how to recognize smokers in their immediate surroundings. As a kind of preventive education to urge individuals to abstain from smoking, students are urged to draw illustrations. Images are created by putting aside a number of factors, including uniqueness to facilitate student work, the image's components, language, and the veracity of the data they present. This assignment can be extremely helpful in helping kids build their cooperation skills. Peer evaluation is another crucial tool for demonstrating students' ability to collaborate effectively in a group. As evidenced by the value provided,

There are differences between project-based learning and question-based learning in terms of features and educational facets. One may evaluate the distinction between project-based learning and question-based learning by looking at the way knowledge is organized, the kind of knowledge that students possess, the roles that teachers and students play, and the kinds of activities that are done during class. In question-based learning, scenarios and challenges are presented clearly and freely, while in project-based learning, the activities are structured and organized by the teacher. in the form of knowledge acquired through projects and actual application, and in the shape of constructives and contingents in question-based learning. Inquiry-based learning and project-based learning involve distinct roles for instructors and students throughout instructional activities. With project-based.

It is also possible to distinguish between project-based learning and question-based learning when engaging in educational activities. Learning activities in project-based learning are centered on problem-solving and problem-management techniques. The development of strategies to support teams and learners is the main emphasis of learning activities in inquiry-based learning. The project-based learning utilized in this research serves as an example of ideation learning. Students are allowed to design and produce items in accordance with their expectations through the projects assigned to them, resulting in distinct outcomes but the identical objectives for two groups of students.

Students can learn constructivist learning, or project-based learning, most effectively if they can create a history, which will enable them to use their memories to participate more fully in learning activities. capable of creating a well-written report that includes their own unique titles, aims, methods,

materials and tools, results, discussion, and conclusions. Students can also gather information from their surroundings regarding the risks associated with smoking and incorporate it into images. Students' creativity can be fostered through problem-based learning, which presents a range of viewpoints from diverse students, and learning that fosters imagination through chances for creative writing.

Because children are now constantly interacting with screens, the learning process allows them to locate and investigate the information required for learning activities. Therefore, it is anticipated that the learning process will enhance the following aspects of question-based scientific creativity: aspects of unusual use, sensitivity to scientific problems, capacity to improve products' usability and value, scientific imagination, creative problem-solving abilities, experimental design skills, and product design under the project (Fatimah dkk., 2023b; Safi' dkk., 2024). Compared to students in project-based learning programs, students who learn using problem- and question-based methods are less independent on average. When utilized for long-term learning, question-based learning approaches are more effective and enhance student

According to the findings, there was no discernible difference in the degree of student independence between 5M, inquiry-based learning, and project-based learning. Learning activities can be one of the numerous elements contributing to these consequences. The problem-based learning methodology informs the learning activities that are implemented with it. Problem orientation is the initial step in the learning process. The second is setting up the students for in-class research. Based on these issues and the questions they are ready for, students form groups and give homework. An independent or group investigation is the third step. Instructors only advise students to use their school time to conduct activities that will provide them with the knowledge they need to solve difficulties and discover answers to queries. Following the experiment, the kids created.

Students pre-test on the consequences of cigarette content on human health through question-based learning. Students are expected to conduct research and gather data from multiple sources in order to determine the reason for the dangers associated with cigarette materials. After that, the students talk about an illness that is brought on by the material in cigarettes or cigars, including its causes, treatments, and prevention strategies. This is all part of the project- and question-based learning about diseases related to cigarettes. Authentic difficulties are employed in the learning processes. This study addresses the question of how some compounds included in cigarettes affect students' health when they are not in an educational setting. One of the learning

models that might help students strengthen their critical thinking skills is question-based learning.

CONCLUSION

The application of Project Based Learning (PJBL) and Inquiry-Based Learning (IBL) learning models has proven effective in increasing student learning independence at SMK Solo. The data showed that students who took the PJBL experienced an increase in the average independence score from 44.01 in the pre-test to 70.38 in the post-test, while students who took the IBL showed an increase from 46.85 to 59.77. The results of the t-test showed a significant difference with a significance value of 0.000 (sig < 0.05), indicating that there was a positive influence of the two learning models on student independence. The results of further multivariate analysis, with a Hotelling trace value of 0.126 and F of 3.052 (sig = 0.018), also support that both learning models have a significant influence on increasing student independence. In addition, the univariate test showed that PJBL had a stronger influence with an F value of 5.812 and a significance of 0.004 (sig < 0.05), making it a more effective learning model compared to IBL in the context of learning independence. However, in terms of creative thinking ability, no significant difference was found, with an F value of 1.885 and a significance of 0.157 (sig > 0.05), indicating that neither PJBL nor IBL had a significant impact on students' creativity. Overall, this study concludes that PJBL and IBL are both effective in increasing student independence at SMK Solo, with PJBL providing a more significant influence. These results provide an important guide for educators to choose and implement the PJBL model to maximize the development of students' independence, which is crucial in preparing them to enter the dynamic world of work.

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