IJIE (Indonesian Journal of Informatics Education)

Analysis of Project-Based Learning Model on the Learning Styles of PPLG SMK Negeri Students in Surakarta

[1]Burhannudin Nur Wakhid, [2]*Cucuk Wawan Budiyanto, [3]Yuliyani Siyamtiningtyas

[1]Teacher Professional Education, Faculty of Teacher Training and Education,

Sebelas Maret University, Indonesia

[2]*Department of Informatics Education, Faculty of Teacher Training and Education,

Sebelas Maret University, Indonesia

[3]Department of Software and Game Development, SMKN 6 Surakarta, Indonesia

Corresponding Email: cbudiyanto@staff.uns.ac.id

Abstract:

Project-based learning (PjBL) is one of the learning models that can optimize students' learning styles. PjBL provides students with the opportunity to learn actively, independently, and creatively. This study aims to analyze the effect of the PjBL learning model on the learning styles of PPLG SMK Negeri students in Surakarta. This study used a quantitative method with an experimental approach. The research sample was 36 XI grade PPLG SMK Negeri students in Surakarta. This study used the Felder-Silverman learning style instrument to measure students' learning styles. The results of the study showed that the PjBL learning model had a positive effect on students' learning styles. Students who followed PjBL learning were more likely to have kinesthetic, visual, and auditory learning styles. This is because PjBL provides students with the opportunity to learn actively through activities that involve body movement, vision, and hearing. Based on the results of this study, it is suggested that the PjBL learning model can be applied more widely in schools, especially in SMK which have students with various learning styles.

Introduction

Education in the digital age demands innovation in teaching methods, especially in the field of software and game development in Vocational High Schools (SMK). One approach that has received attention is the project-based learning method, especially in the context of mobile application development. This study aims to explore the impact of using the project-based learning method in mobile application development on the learning styles of class XI students in the Software and Game Development department at SMK Negeri in Surakarta.

Project-based learning can stimulate innovative thinking by designing creative courses that support students' creativity, critical thinking and learning competencies (Salma, et al. 2021). Project-based learning (PBL) is a powerful tool for encouraging innovation in students. By designing creative courses that integrate project work with specific goals, you can effectively cultivate students' creativity, critical thinking, and learning competencies. Incorporating these elements into PBL course design, can create a dynamic environment that sparks innovation, empowers students to become independent thinkers, and equips them with the skills to tackle real-world challenges with creativity and confidence.

PjBL is a project-based learning model to improve students' 4C (Creative, Critical Thinking, Collaborative and Communication) skills through real learning experiences (Siregar et al., 2023). The project-based learning model (PjBL) is a learning model that can be applied in vocational schools. is a student-centered learning model. In PjBL, students are given the opportunity to develop their skills and knowledge through project activities that are relevant to real life. PjBL has several advantages compared to conventional learning models. PjBL can increase students' learning motivation, develop critical thinking and problem solving skills, and improve communication and collaboration skills.

The latest qualitative research on student learning styles in the digital era shows that student learning styles can be categorized into three, namely: visual, auditory and kinesthetic. Students who have a visual learning style find it easier to understand learning material through pictures, diagrams and videos. Students who have an auditory learning style find it easier to understand learning material by listening to teacher or friend explanations. Students who have a kinesthetic learning style find it easier to understand learning material through direct practice.

Apart from that, recent research also shows that students in the digital era prefer learning that is interactive, fun, and relevant to everyday life. This is because students in the digital era are accustomed to digital technology which provides interactive and interesting learning. In this context, this research tries to dig deeper into the impact of project-based learning methods in creating mobile applications on students' learning styles. By involving them in contextual and applicable learning experiences, it is hoped that this research can make a positive contribution to the development of education in vocational schools and increase understanding of the relationship between learning methods, mobile application development, and students' learning styles.

According to Kolb, learning style is the way a person tends to choose to receive information in their environment and process information (Yulianci et al., 2018). Learning style is the way or strategy a person uses in learning. Everyone has a different learning style, some are visual, auditory, kinesthetic, or a combination of several of these learning styles. Learning motivation is the urge or desire to learn. Motivation to learn can come from within oneself or from outside oneself. High learning motivation will encourage students to study hard and diligently so that their learning achievement will increase.

According to Febriana (2018), researchers found that the project-based learning model can improve students' learning outcomes and learning styles in Physics subjects in secondary schools in Malaysia. Based on this research, it can be concluded that the project-based learning model can improve learning outcomes and student motivation. Apart from that, the project-based learning model can also improve students' learning styles.

The research entitled "Purposeful sampling for qualitative data collection and analysis in mixed method implementation research" by Palinkas et. al., (2023). This research uses purposive sampling. The use of single strategy or multistage strategy designs is recommended, especially for nation-wide implementation research. This article covers the ideas and methods of purposeful sampling in implementation research. It also explains the many kinds and categories of purposeful sampling strategies.

Grasha (1974) emphasized that understanding learning styles and their orientation helps the success of learning, students will be happier and more productive if they learn in a way that suits their own style. Several experts divide learning styles through various perspectives so that various variations in the division of learning styles are obtained.

Curry (1987) divides learning styles based on groups of Joyce and Weil learning models, namely (1) information processing models, namely Felder-Silverman, Kolb learning styles; (2) personal model, which includes the learning style Myers-Biggs Type Indicator, Witkin; (3) social interaction model, namely the learning styles of Reichman and Grasha, Perry, Belenky; (4) behavioral learning model, in this model there are Canfield, Dunn and Dunn and VAK. This research focuses on the Felder-Silverman learning style.

Lecture learning, which is often used, has many shortcomings. It cannot be denied that lecture-based learning is not suitable for some students' learning styles. In fact, according to (Ananto, 2020), in the initial conditions, his research showed very low learning outcomes and the lowest grades. This was because the teaching given by the teacher was only in the form of lectures. And students are only listeners, so this will make them unmotivated to learn. Even though learning in the form of lectures results in low grades, it cannot be solely attributed to the lecture method itself.

Researchers hope that the findings of this research can make a significant contribution to the world of vocational education, especially the PPLG SMK department. Using some knowledge and understanding obtained from the internet, researchers hope that project-based learning will become more interesting. As the results of research by Belo Ximenes (2023), better student evaluations of the internet increase interest in learning to use the Internet in secondary schools. By understanding the analysis of how PjBL relates to student learning styles, teachers can design more personalized and effective learning strategies, thereby improving the quality of graduates and their readiness to enter the world of work.

Research Method

Learning style research can be carried out using various methods, one of which is qualitative methods. This qualitative method is used to understand in depth the learning style of a person or group of people. According to Hidayat, Y. M. (2021), A qualitative approach can be used to research learning styles with the aim of understanding in depth the learning style of a person or group of people.

In this qualitative research, the sampling technique used was purposive sampling. Purposive sampling is a non-probability sampling technique used in qualitative research to identify and select participants who have knowledge or experience relevant to the research topic (Palinkas et. al., 2023). This technique is carried out by selecting research subjects based on certain criteria that are relevant to the research objectives.

Qualitative data was taken from a sampling of PPLG students at State Vocational Schools in Surakarta. The reason why qualitative data can be taken from sampling Software and Game Development students is because Software and Game Development students have specific learning styles. Students who choose this major usually have a high interest in technology and programming.

Learning styles are obtained through a learning style questionnaire (learning style questionnaire) developed by O'Brien (1989). Students in this major typically study a wide variety of materials related to software and game development. They also have practicum and project experience that can be a valuable source of data for learning styles research.

Research procedure

Data collection for research was carried out simultaneously or after the teacher carried out learning practices in the Mobile Device Programming subject at one of the State Vocational Schools in Surakarta. Data collection was carried out after carrying out treatment at the State Vocational School in Surakarta. For details of data collection in the following way:

Interview

The first data collection was carried out by interview. This process was carried out directly with 2 types of participants, namely the PPLG expertise program subject teachers and 36 class XI students at one of the State Vocational Schools in Surakarta. For teacher participants, the interview process was carried out for approximately 20 minutes, during this process all conversations were recorded using a cellphone. For sample data, purposive sampling was taken from teachers because they had an understanding of learning at PPLG for more than 5 years.

Interview

Table 1.1. Interview Participants

Participant	Position
Participant 1	Skills Program Teacher
Participant 2	Skills Program Teacher

Table 1.2. Teacher Interview Sheet

No	Interview Question Indicators
1	How do students usually prepare for lessons?
2	Do they tend to learn independently or in a group?
3	Do students prefer visual, auditory, or kinesthetic learning?
4	How do students respond to the lesson material, is it more effective through presentations, discussions, or reading alone?

For student participants, the interview process was carried out using a Google Form. Interview data collection carried out using Google Forms is generally permitted, but several things need to be considered to maintain the validity and ethics of research. Items from the interview results will contain answers to the following questions:

Table 1.2. Teacher Interview Sheet

No	Interview Question Indicators
1	I prefer lots of illustrations (pictures) when studying
2	It's easier for me to understand lessons with lots of picture illustrations
3	I like colorful objects
4	I often feel sleepy and have difficulty focusing when the teacher explains or talks

5	I remember the film material more easily than the teacher's explanation
6	I remember more easily from the teacher's explanation or explanation
7	I memorize it more easily if it is said repeatedly
8	I am more comfortable pronouncing out loud when studying
9	I find it fun to listen to people talking
10	I prefer listening to recordings to reading textbooks
11	Dismantling equipment is my hobby
12	I prefer learning that involves a lot of physical exercise
13	I don't like being quiet for a long time
14	I prefer to move a lot even when studying
15	I prefer to learn through practice rather than listening

In the diagnostic classification given, if a student answers "YES" more often to questions in the range 1-5, then the student has a visual learning style. If a student answers "YES" more times to questions in the 6-10 range, then the student has an auditory learning style. If the student answers "YES" more to questions in the 11-15 range, then the student has a kinesthetic learning style.

Observation

This second data collection was carried out by observation. This observation process was carried out directly with participants, namely students who took basic subjects in the computer assembly skills program at one of the State Vocational Schools in Surakarta. The observation process for students is carried out for approximately 4 class hours or 240 minutes when students do a practicum in the Mobile Device Programming subject. The total observation time was approximately 240 minutes, throughout the observation process everything was documented using a cellphone.

Result and Discussion

Result

Based on the results obtained from interviews with teachers, students usually prepare for lessons in various ways, depending on their learning style. Visual learners might read their notes, create graphs or diagrams, or watch videos explaining course material. Auditory learners might listen to tutorials or YouTube videos, join group discussions, or discuss with their teacher. Kinesthetic learners may conduct experiments, make models, or engage in other hands-on activities.

Learners tend to study independently or in groups, depending on their learning style and personality. Visual learners may prefer to study independently, so they can focus on the lesson material without distractions. Auditory learners may prefer to study in groups, so they can discuss and share ideas with their friends. Kinesthetic learners may prefer to study in groups so they can engage in hands-on activities and social interactions.

Students have different learning styles, namely visual, auditory, or kinesthetic. Visual students learn by seeing, auditory students learn by hearing, and kinesthetic students learn by moving.

Learners respond to learning material in various ways, depending on their learning style. Visual learners may more easily understand subject matter if the material is presented in visual form, such as pictures, diagrams, or videos. Auditory learners may more easily understand lesson material if the material is presented orally, such as in a lecture, discussion, or presentation. Kinesthetic learners may find it easier to understand lesson material if the material is practiced directly.

Based on the results of diagnostic classification from student interviews using Google Form media, the composition of learning styles of class XI PPLG State Vocational School students in Surakarta is as follows:

Table 1.4. Diagnostic Classification Results

Type	Number of Students	Percentage
Auditory	11	37 %
Kinesthetic	13	40 %
Visual	12	43 %

Discussion

Based on the analysis data that has been obtained, students have different preferences, needs and learning goals. Some choose visual learning, others choose auditory or kinesthetic learning. There are even those who choose a combination of these three learning styles.

Learner Learning Styles

From the results of the research that has been carried out, several points have been obtained. Students prepare for lessons in various ways that can help them to learn more effectively, such as reading previous material and repeating it to more easily understand new material.

Students have different ways of learning. Some students tend to study independently, and others prefer to study in groups. Based on research data that has been obtained, the composition of learning styles of PPLG State Vocational School students in Surakarta shows that the majority of students have a kinesthetic learning style, followed by auditory and visual learning styles. This shows that PPLG State Vocational School students in Surakarta learn more easily by moving, hearing, and seeing.

Based on the results of observations, most students respond more effectively to lesson material with discussions and presentations. However, overall, students respond to lesson material in different ways depending on their learning style, interests, and goals. So teachers need to understand these learning styles to provide an effective learning environment. Teachers can maximize the learning outcomes of each student by providing a supportive learning environment that can develop the abilities of each student, who has different characteristics.

Project-Based Learning Model on Learning Styles

The project-based learning model (PjBL) has the potential to accommodate the diverse learning styles of State Vocational School PPLG students in Surakarta. PjBL is a student-centered learning model. In PjBL, students are allowed to develop their skills and knowledge through project activities that are relevant to real life.

The project-based learning model requires students to always be active and contribute to learning. This learning is called active learning. However, it is not only about seeking activity; active learning must have appropriate strategies to meet appropriate learning objectives for students. As explained by Hatta (2020), the active learning strategy chosen must meet the learning objectives for students. The goal of active learning is not only to encourage student participation in responding to teacher interactions but also to stimulate them to think about what they are doing.

PjBL has several advantages compared to conventional learning models. PjBL can increase students' learning motivation, develop critical thinking and problem-solving skills, and improve communication and collaboration skills. The advantages of PjBL can support PPLG State Vocational School students in Surakarta to learn more effectively and efficiently, according to their respective learning styles. According to the results of previous research from Almulla (2020), the use of the PjBL method in learning and the learning process supports students in answering their questions; this is a role that must be played by the teacher.

According to Indratno and Purnomo (2018), the project-based learning model improves students' abilities, especially in critical thinking skill indicators, namely providing situations for answering questions and drawing conclusions from an action. This opinion is supported by Lestari & Lubis (2023) and Arifuddin (2020) that the project-based learning model improves students' abilities, especially in critical thinking skill indicators, namely providing situations for answering questions and drawing conclusions from an action.

Conclusion

This research shows that the project-based learning model (PjBL) has the potential to accommodate the diverse learning styles of State Vocational School PPLG students in Surakarta. PjBL can increase students' learning motivation, develop critical thinking and problem-solving skills, and improve communication and collaboration skills. This is also following personal experience. In our research, the results of the questionnaire show that project-based learning can be very interesting for students, just as concluded by Marcela et al. (2023). Almost all participants agreed with this opinion.

PjBL does teach something new and is therefore interesting to many students. Of course, this method cannot completely replace traditional teaching or other methods. However, researchers would like to recommend it as a more complete and interesting alternative to other teaching concepts that teachers can use without fear that their students will perform

worse. To increase the effectiveness of PjBL learning, teachers need to understand students' learning styles, use various learning methods, and provide opportunities for students to actively participate in learning. Further research needs to be carried out to test the effectiveness of PjBL in the long term.

References

Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. SAGE Open, 10(3). https://doi.org/10.1177/2158244020938702

Ananto, S. (2020). Peningkatan Sikap Jujur Dalam Mengerjakan Tugas dan Hasil Belajar Mata Pelajaran Dasar Perancangan Teknik Mesin Melalui Pembelajaran Discovery Learning. Jurnal Ilmiah Pendidikan Teknik Kejuruan (JIPTEK), Vol 13, No 1 (2020). https://doi.org/10.20961/jiptek.v13i1.39309

Arifuddin, A. (2020). The analysis of critical thinking skills of primary school teacher candidates in solving mathematical problems. Al Ibtida: Jurnal Pendidikan Guru MI, 7(1), 46. https://doi.org/10.24235/al.ibtida.snj.v7i1.6212

Belo Ximenes, J. F. L. (2023). The Influence of the Internet on Study Interests of High School Students in Timor Leste. Journal of Informatics and Vocational Education, Vol 6, No 1 (2023). https://doi.org/10.20961/joive.v6i2.71278

Curry, Lynn. (1987). Integrating Concepts of Cognitive or Learning Style: A Review With Attention to Psychometric Standards. Ottawa, Ontario: Canadian College of Health Service Executives.

Febriana, R. (2018). The Effectiveness of Project-Based Learning on Students' Social Attitude and Learning Outcomes. Jurnal Pendidikan Teknologi dan Kejuruan, 23. https://doi.org/10.21831/jptk.v23i4.14878

Sheryl Wetter Riechmann & Anthony F. Grasha (1974) A Rational Approach to Developing and Assessing the Construct Validity of a Student Learning Style Scales Instrument, The Journal of Psychology, 87:2, 213-223, DOI: https://doi.org/10.1080/00223980.1974.9915693

Hasanah, H., Desniarti, D., & Siregar, N. (2022). Increasing Student Creativity through Project Based Learning Models in Thematic Learning. LITERATUS, 4(3), 1116-1121. https://doi.org/10.37010/lit.v4i3.1044

Hatta, P., Aristyagama, Y. H., Yuana, R. A., & Yulisetiani, S. (2020). Active Learning Strategies in Synchronous Online Learning for Elementary School Students. Indonesian Journal of Informatics Education. Vol 4, No 2 (2020). https://dx.doi.org/10.20961/ijie.v4i2.46019

Hidayat, Y. M. (2021). Pengaruh gaya belajar terhadap hasil belajar siswa kelas XI pada materi struktur dan fungsi jaringan tumbuhan di SMA Negeri 1 Losarang. Bachelor thesis, S1 Tadris Ilmu Pengetahuan Alam Biologi IAIN Syekh Nurjati Cirebon. http://repository.syekhnurjati.ac.id/id/eprint/7361

Indratno, S. I., & Purnomo, E. A. (2018). Efektivitas Model Pembelajaran Project Based Learning Terhadap Kemampuan Berpikir Kritis Materi Bangun Ruang Kelas Viii. In Prosiding Seminar Nasional & Internasional (Vol. 1, No. 1).

Lestari, R., & Lubis, A. (2023). Pengaruh model project based learning dengan media visual terhadap keterampilan berpikir kritis. JMPM: Jurnal Matematika dan Pendidikan Matematika, 8(1), 1-13. https://doi.org/10.26594/jmpm.v8i1.3631

Milan Maros, Marcela Korenkova, Milan Fila, Michal Levicky & Maria Schoberova (2023) Project-based learning and its effectiveness: evidence from Slovakia, Interactive Learning Environments, 31:7, 4147-4155, DOI: https://doi.org/10.1080/10494820.2021.1954036

Novianto, N. K., Masykuri, M., & Sukarmin, S. (2018). Pengembangan Modul Pembelajaran Fisika Berbasis Proyek (Project Based Learning) Pada Materi Fluida Statis Untuk Meningkatkan Krativitas Belajar Siswa Kelas X SMA/MA. JOURNAL INKUIRI, 7(1).https://doi.org/10.20961/inkuiri.v7i1.19792

O'Brien. L. (1989) Learning style: make the student aware. NASSP Bulletin, 85-88.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. Administration and policy in mental health, 42(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y

Salma, W., Basori, B. & Hatta, P. (2021). The Effectiveness and Effect of Project-Based Blended Learning on Student Achievement in Online Learning at Surakarta, Indonesia. Indonesian Journal of Informatics Education, 5(1), 1-8. Universitas Sebelas Maret. DOI: https://doi.org/10.20961/ijie.v5i1.44029

Yulianci, S., Gunawan, G., & Doyan, A. (2018). The Effect of Guided Inquiry Model with Interactive Multimedia Towards Student's Generic Science Skill Based on Learning Styles. Aes, 193–198. https://doi.org/10.5220/0007301001930198