Analysis of the Effectiveness of Project-Based Seamless Learning Model on Concept Understanding

ABSTRACT

Aims: The aim of this study was to identify the effectiveness of project-based seamless learning model on concept understanding.
Study design: The research method used quantitative experimental design..
Methodology: The research method used quasi experiment with research design nonequivalent pretest posttest group design, where there is an experimental group and a control group, the experimental group is given treatment and there is no treatment on the control group. The research subjects were 160 people, 80 people in the experimental group and 80 people in the control group. Data collection using tests conducted pretest and posttest. Data analysis used normality test, homogeneity test and independent sample t test.
Results: The results of research and discussion, it can be concluded that there is an effective project-based seamless learning model on concept understanding. Based on the results of hypothesis testing on the posttest, the value on the posttest of the experimental group and the control group obtained a significance value of 0.002 <0.050. And also the difference in the average posttest score of the experimental group is 84.06, greater than the lower control group of 80.56. This proves that there are differences caused by the application of the learning model in the two groups. The experimental group used a project-based seamless learning model while the control group used a conventional model.
Conclusion: there is the effectiveness of project-based seamless learning model on concept understanding. The hope is that the project-based seamless learning model can be applied at various levels of educational institutions or in various subject matters so that the quality of learning will be even better and continue to improve rapidly.

Keywords: Project Based Learning, Seamless Learning, Concept Understanding

1. INTRODUCTION

Education has a significant impact on people's and society's future. In addition to imparting knowledge and skills, education promotes character development, expands career options, empowers people, and builds a more advanced and peaceful community. As a means of preparing for the future, education is therefore a worthwhile investment that can help everyone have a better future. Both individuals and society at large can benefit greatly from investments in education. A person can increase their knowledge and abilities through education, which can increase their income and help them succeed in their career. (Bestari et al., 2023).

Understanding every aspect of early childhood education is essential, especially for students aspiring to become early childhood educators. One of the primary responsibilities of a future early childhood educator is to be able to create a creative, effective lesson plan that takes into account the needs of the students. Therefore, it is imperative that all early childhood education students have a strong conceptual understanding of learning planning, which will be used to create lesson plans. Translating, interpreting, extrapolating, applying, analyzing, synthesizing, and evaluating are all steps in a process that requires special talents when one understands concepts (Susiloningsih, 2019). Since conceptual understanding serves as the foundation

for students' ability to think critically and solve problems accurately, it is crucial to instill this ability in them during teaching and learning activities (Syafa'atun & Nurlaela, 2022). Students need to be able to connect one topic with other concepts in order to fully grasp it, not only recognize it (Adhani & Rupa, 2020). Making the connection or association between one acquired notion and another is one of the key components of understanding the concept of a conceptual science. The capacity to comprehend ideas so emerges as one of the key learning objectives (Suwarman, 2018). With a good understanding of the concept, it is hoped that prospective early childhood educators can fully understand the various concepts in the world of early childhood education and can implement them during learning activities.

One of the skills that students in education studies programs need to develop as educators is the ability to create lesson plans. The primary course designed to prepare students for planning and executing learning is called "Learning Planning." (Nurhayatin & Regina, 2024). This course is designed to prepare students to become competent and effective educators in educating early childhood. The main learning outcome expected in the learning planning course is that students can master the skills in developing appropriate learning plans for early childhood appropriately. These learning outcomes are obtained through several materials both theory and practice. The theoretical material that needs to be understood is the concept of learning planning in early childhood education (Rohmadheny et al., 2019).

Students learn how to create successful learning plans that include learning objectives, instructional resources, instructional strategies, assessment, and evaluation in the learning planning course. The demands and traits of early childhood must be taken into consideration in this approach. Teachers' lesson plans must be able to meet the goals of education while also offering early childhood education of high quality. When students enter the workplace and demonstrate their professionalism and skill as teachers, this ability may be a benefit.

The findings in the field show that students' ability to make lesson plans is still lacking. Many students cannot meet the standardization in understanding the concepts and application of procedures in making learning plans. From the list of grades of the results of the study of learning planning courses in the last two years, the final grades of students in the previous academic year, the value of the results of the study of learning planning courses. Meanwhile, lecturers still generalize in providing learning materials, so that students who already have teaching experience are able to understand and implement the material, while students who do not have teaching experience become constrained and less than optimal in understanding and implementing learning materials. The learning model commonly used by lecturers is a teacher-center learning model and assignments. The output produced by learning models like this is nothing more than producing students who are less able to appreciate science, are afraid to argue, dare not try, which ultimately tends to become passive learners and poor creativity. (Chikita et al., 2023). From the explanation above, an effort is needed to create a learning process that facilitates students to be actively and independently involved in understanding basic concepts and implementing them in making learning plans based on their experiences. For this reason, an appropriate learning model is needed (Wahyuni, 2019).

Project-Based learning (PjBL) model is one type of learning model that can make students active in the learning process and improve students' concept understanding. Giving assignments is a method that encourages active students to learn both individually and in groups through the efforts of lecturers and students. This method of giving assignments or assignments can be defined as a teaching approach where lecturers instruct students on how to facilitate active learning both individually and in groups (Pertiwi et al., 2022). In the project-based learning model, students are involved in projects that require the application of learned procedures and concepts. Project work contains complex tasks based on very challenging questions and problems, and requires students to design, solve problems, make decisions, conduct investigative activities, and provide opportunities for students to work independently. Through this experience, students not only understand the theory behind the procedure but also how to apply it practically in a relevant context (Nugraha et al., 2023). Project-Based Learning is emerging as one of the attractive approaches as it not only provides students with an immersive learning experience but also enhances their own desire to learn (Riyanti, 2024).

The Project-Based learning (PjBL) model integrated with seamless learning is considered to be a good learning combination if applied in learning. Because the concept of Seamless Learning emphasizes continuity in the learning process where learning occurs in various contexts, including: formal and informal, personal and social, across time and location, real and virtual worlds, digital and non-digital, and so on so that it can help understand the application of procedures in designing learning plans. Seamless learning is not only about technology. Technology, activities or resources are the most important elements in seamless learning.

The technology used in seamless learning is referred to as the learning connector or the technological interface between the learner and the learning environment (Durak & Çankaya, 2018). Seamless learning emphasizes the use of all available technologies in addition to mobile technology for learning in any situation. Seamless learning is a student-center, uninterrupted learning approach that includes mobile devices, is linked to technology and social environments, and takes place in formal-informal environments regardless of time and space (Talan, 2021).

Seamless learning is an aspiration that aims to remove barriers that hinder the permanence of learning. For example, a learning activity may begin in the classroom and continue at home as homework, or an accidental discussion among students in an Internet forum may result in a deeper understanding of a topic learnt in class (Sharples, 2015). Seamless learning is a way to learn smoothly, connect unlimited places and times of learning, and is a way to strengthen connecting activities that take place in different times and places (Srisawat et al., 2021). The concept of continuous or consistent learning, in line with the opinion that students are expected to be given independent tasks, where students themselves determine what tasks to do, when to do them and in what way their success is proven / demonstrated afterwards (Maudiarti, 2018).

Forms of effectiveness of the combination of project-based seamless learning is supported by several previous studies that support both learning models in improving students' conceptual understanding. The results showed that the PjBL model effectively influenced students' conceptual understanding and creativity (Prajoko et al., 2023). The results of other studies show that the application of project-based learning models is quite effective in improving students' concept understanding in statistics courses at Bengkulu University, especially in the mathematics education study programme (Yensy et al., 2022). The results of other studies show that the application of the project-based learning model is effective and can increase students' motivation and concept understanding ability (AL et al., 2023). The results of other studies show that the project-based learning model has an effective effect on students' concept understanding (Sholahuddin et al., 2023). Another study mentioned that there was an effect of the PjBL model on the ability to understand mathematical concepts (Sari et al., 2018), (Novianti et al., 2018), (Putri et al., 2023). In the seamless learning research results section, it also shows that the learning process with SL strategy is proven to improve students' concept understanding and critical thinking (Safiah et al., 2020). Hasil penelitian lain menunjukkan the great potential of using seamless learning in increasing student engagement and learning achievement in school base (Riniati, 2024).

This research is very useful for educators who often use project-based learning models. Combined with seamless learning, it will be very helpful in innovating better learning activities. This learning combination can also improve the quality of learning by providing accessibility of learning to learners without time constraints and good utilisation of information and communication technology in accompanying their learning process. Based on the description above, the purpose of this study is to analyse the effectiveness of project-based seamless learning model on concept understanding.

2. LITERATURE REVIEW

The following is an explanation of the literature review that discusses the variable points in this research paper:

2.1 Project Based Seamless Learning

Project-based learning is an inquiry-based teaching approach that involves students in the production of knowledge by having them finish worthwhile tasks and create useful products (Guo et al., 2020). It is based on constructivist learning theory, which holds that learning is context-specific, students actively build their understanding by working on pertinent problems in the real world, and they accomplish their objectives by interacting with others and exchanging information (Haatainen & Aksela, 2021). Project-based learning adalah sebuah model yang mengorganisir pembelajaran di sekitar proyek (Dillon, 2023). Children are tasked to tackle real-world and contextualised problems as part of the project-based learning approach. Children are able to use what they have learnt and experienced, co-operate with classmates, and acquire various skills necessary for the twenty-first century through project-based learning. Students can work individually or in groups to build a project to produce a product when they use project-based learning techniques. Therefore, it can be concluded that project-based learning is a child-centered approach to education.

Project-based learning has been defined as an active, student-centered approach that prioritizes student autonomy, constructive investigation, communication, collaboration and reflection in practical or real-world

tasks. Project-based learning typically includes a variety of individual or co-operative tasks over an extended period of time (planning, research and reporting), driven by the need to create a final product (Becerra-Posada et al., 2022). Project-based learning as a teaching strategy presupposes the involvement of all participants, with the aim of solving real-life and authentic problems of common interest to those participating in the project (Tempera & Tinoca, 2023). In this learning environment, the teacher acts as a facilitator, offering guidance and support to encourage student enquiry (Shi et al., 2024). Such project work contributes to giving meaning to learning by engaging participants in problem-solving, decision-making and searching for answers. This process enables the development of important lifelong learning competencies, such as data collection and processing, social learning from group work, decision-making, and a spirit of initiative and creativity.

Project-based learning represents a shift in education from traditional passive learning to a dynamic student-centered approach. It empowers students to take responsibility for their learning journey, from planning to project execution, thus fostering a sense of ownership and motivation (Ly, 2024). Project-based learning presents a promising approach, proven to enhance language learning through real-world projects that encourage active participation and collaboration, offering exposure to diverse cultural and rhetorical contexts (Probert, 2024).

Seamless learning is a learning concept that allows students to learn sustainably in various contexts and environments, both inside and outside the classroom. The word seamless implies the integration of separate parts to make a whole. Seamless learning is the uninterrupted learning of individuals by communicating directly with their environment with the help of mobile, wireless, and online devices without time and space constraints, providing natural and quick access to learning resources, combining formal learning experiences in school with their daily experiences outside school without being interrupted (Şad, 2016). Seamless learning takes place continuously in formal, informal, individual and social contexts, physical, and digital platforms. It refers to the seamless integration of learning experiences in multiple dimensions and contexts and aims to increase the scope of learning by extending the learning space from home to school. Seamless learning is a borderless network, where learning takes place anywhere and anytime (Safiah et al., 2020). Seamless learning is an approach to learning in which the learner can access the right information at the right time, in the right place, with one or more personal devices, and which enables the transition from different learning scenarios easily and quickly (Yetik et al., 2019).

With seamless learning, learning is no longer limited to the classroom, but extends to the child's immediate environment, including home and community (Parrish et al., 2022). This means that learning is no longer interrupted when children leave the classroom, but rather continues and is integrated with everyday activities. This creates opportunities to deepen understanding of concepts, apply knowledge in real contexts and broaden children's horizons. However, despite the promising potential of Seamless Learning, its application is still limited and not fully optimized, especially at the primary education level. Seamless learning is a continuation of learning and an attempt to connect multidimensional learning. The main features of seamless learning; it is formal and informal, personal and social, spans infinite places, encompasses both the physical and digital worlds, incorporates the use of multiple devices and multiple learning styles that can be constantly shifting, as well as generating knowledge synthesis and incorporating multiple teaching styles (Mouri et al., 2018).

Seamless Learning can address the challenges faced in basic learning, more effective and relevant learning strategies can be created (Lapitan et al., 2021). Seamless Learning allows students to determine when and where they will learn. In addition, the desire or emotional mood to learn can be done anytime and anywhere. So when this happens, students need to be accommodated in order to learn immediately, including the provision of learning resources, learning media and learning environments. This happens because Seamless Learning allows students to choose how they learn. They can choose the material they are curious about and move between different contexts such as between formal and informal contexts and between individual and social learning. Students can also expand their social space which allows them to interact with each other (Lubis et al., 2024).

Implementing Seamless Learning can be done in various ways, depending on the specific educational context and needs (Voon et al., 2020). One example of this implementation is to use an online learning platform that is integrated with apps and mobile devices, so that students can access learning materials anywhere. For example, schools can use online learning platforms that allow students to access learning videos, online assignments and discussion forums from their own devices. The implementation of Seamless Learning also involves the proactive role of teachers in designing and structuring technology-integrated learning (Olsen et al., 2021). Teachers need to be facilitators who are able to direct students in using various learning resources

available, both online and offline (Asghar et al., 2022). In addition, the role of schools and educational institutions in supporting the implementation of Seamless Learning is also very important (Lubis et al., 2024). In higher education, seamless learning can be realized through the use of various digital devices and platforms that allow students to learn anytime and anywhere. For example, students can access course materials, interact with lecturers and classmates, and complete assignments through devices such as laptops, tablets, or smartphones.

2.2 Concept Understanding

Concept understanding is the competence shown by learners in performing procedures (algorithms) flexibly, accurately, efficiently, and precisely (Zulkarnain & Budiman, 2019). Concept understanding is the ability of students in the form of mastery of a number of subject matter, where students do not just know or remember a number of concepts learned, but are able to re-express in other forms that are easy to understand, provide data interpretation and are able to apply concepts in accordance with their cognitive structure (Ulia, 2016). Concept understanding ability is an ability to understand, transform information into a meaningful form (Hartati et al., 2017). Concept understanding is the competence shown by students in understanding concepts and in performing procedures (algorithms) flexibly, accurately, efficiently and precisely (Syafa'atun & Nurlaela, 2022).

Conceptual understanding refers to a student's ability to understand the basic concepts of a discipline in depth, connect these concepts, and use them to solve problems. Conceptual understanding is closely related to 21st century skills as it is the basis for the development of higher-order thinking skills (Kim et al., 2019), (Darling-Hammond et al., 2020). Conceptual understanding where the activities of interpreting, interpreting, extrapolating, application, analysis, synthesis, and evaluation are a stage of the process that has its own capabilities (Susiloningsih, 2019). Concept understanding can also be done through exploring knowledge more deeply and providing appropriate and fun concepts (Radiusman, 2020).

When students have good conceptual understanding, they can not only recall facts, but can also analyze, evaluate and create new knowledge. This ability is a core competency needed in the 21st century, where individuals are faced with complex problems that require flexible application of knowledge. In addition, good conceptual understanding also enables students to think critically, solve problems, work collaboratively and communicate effectively - all skills that are critical for success in the 21st century (van Laar et al., 2020).

According to Anderson & Krathwohl, concept understanding is divided into seven cognitive categories of understanding, namely: interpreting is the process of converting images into other forms of information; exemplifying is a step to provide illustrations of concepts; classifying is the activity of forming concepts in one group category; summarizing is an action to abstract the main points or general points; inferring is the activity of making conclusions based on the information provided, comparing is the process of adjusting between two ideas, two objects and the like; explaining is the activity of finding and presenting information obtained from the concept analysis process (Al Haq & Raicudu, 2023). The indicators of concept understanding are restating concepts that have been learned, classifying types of objects based on certain characteristics in accordance with the concept; determining examples and non-examples of concepts, stating concepts from different points of view with mathematical representations, obtaining information on sufficient conditions and necessary conditions for a concept; Selecting certain steps in using and utilizing an operation; applying concepts in accordance with problem-solving algorithms (Rahayu & Pujiastuti, 2018). I Other concept understanding indicators are using pictures to help solve problems, giving examples and non-examples for a concept, classifying examples into a concept, being able to apply mathematical equations between concepts and procedures, understanding and using appropriate patterns to solve problems, applying equations or differences to solve problems, explaining the solution. (Mayasari & Habeahan, 2021).

3. MATERIAL AND METHODS

3.1 Research Design

This design uses a quantitative approach, with the type of experimental research. The experimental research conducted was a quasi-experiment. Quasi experiments test whether there is a causal relationship between the independent and dependent variables. (Loewen & Plonsky, 2016). The independent variable is tested as the variable that influences the dependent variable, which is the impacted variable, in this quasi-experimental study. Nonequivalent pretest-posttest control group design is the type of quasi-experimental design that is

employed. This design uses an empirical comparison of two groups (Gribbons & Herman, 2019), Specifically, the experimental group and the control group have been divided up. The experimental group and the control group are groups that come together naturally, like classrooms, and can be tested using a pretest. One group may then receive treatment under the researcher's supervision, and after receiving treatment, another test may be administered using a posttest. The control group in the pretest-posttest nonequivalent control group design is matched to the group that received the intervention rather than being randomly assigned (Miller et al., 2020).

3.2 Research Subject

This study examines the effect of the independent variable on the dependent variable. The independent variable is project-based seamless learning model. While the dependent variable is concept understanding. The participants of this study were 160 students of S1 Study Programme in Early Childhood Education, Faculty of Psychology and Education, Universitas Muhammadiyah Sidoarjo.. The research object was divided into two treatment groups, namely the experimental group 80 students and the control group 80 students

3.3 Data Collection and Data Analysis Techniques

Data was collected using a test, this study was conducted on both treatment groups, namely the experimental group and the control group. The experimental group was treated using a project-based seamless learning model and the control group used a conventional model. The research gave a pretest with the aim of knowing the initial ability of students in each class, both classes were given a pretest-posttest with the same test tool.

Descriptive statistics and independent sample t-test were used to analyse the data. This study aimed to determine the statistical significance of the effectiveness of project-based seamless learning on concept understanding. Before this analysis was conducted, normality and homogeneity tests were conducted to ensure that parametric assumptions were met. Normality test using Kolmogorov-Smirnov technique and homogeneity test using Levene's test technique.

4. RESULTS

The results of the research findings in the form of the results of the pretest and posttest of the two groups are described below, following the results of the normality test on the pretest and posttest scores of the experimental group and control group:

Table.1 Normality Test

One-Sample Kolmogorov-Smirnov Test					
		Pretest_Experiment	Posttest_Experiment	Pretest_Control	Posttest_Control
N		80	80	80	80
Normal Parameters[a,,b]	Mean	34.81	84.06	33.13	80.56
	Std. Deviation	6.910	7.075	7.563	6.889
Most Extreme Differences	Absolute	.136	.140	.135	.140
	Positive	.132	.135	.134	.140
	Negative	-.136	-.140	-.135	-.140
Kolmogorov-Smirnov Z		1.217	1.254	1.211	1.255
Asymp. Sig. (2-tailed)		.103	.086	.106	.086

Table 1 shows that the normality test yielded significance values of 0.103 and 0.106 for the experimental and control group pretests, respectively. And showed that the normality test resulted in a significance value of 0.086 and 0.086 for the posttest of the experimental group and the control group. Thus all the results of the normality test on the pretest and posttest of the experimental and control groups above the significance value> 0.050, so the data results of the two groups were declared statistically normally distributed.

The results of the homogeneity test on the pretest and posttest of the experimental and control groups are as follows:

Table.2 Homogenity Test

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.

Pretest	1.983	1	158	.161
Posttest	.075	1	158	.784

Table 2 shows that the homogeneity test resulted in significance values of 0.161 and 0.784 for the pretest and posttest of the experimental and control groups, respectively. Thus all the results of the homogeneity test on the pretest and posttest of the experimental and control groups above the significance value> 0.050, so the data results of the two groups were declared statistically homogeneous.

The following are the mean results on the pretest and posttest of the experimental and control groups after statistical testing as follows:

Table.3 Mean Pretest Posttest

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Experiment	80	34.81	6.910	.773
	Control	80	33.13	7.563	.846
Posttest	Experiment	80	84.06	7.075	.791
	Control	80	80.56	6.889	.770

Table 3 shows that the mean resulted values of 34.81 and 34.81 for the pretest of the experimental and control groups, respectively and shows that the mean resulted values of 84.06and 80.56 for the postttest of the experimental and control groups, respectively. Thus, the mean pretest of the two groups is not much different, while the mean on the posttest in the two groups is much different.

The following are the results of hypothesis testing on the pretest and posttest of the experimental and control groups after statistical testing as follows:

Table.4 Hypothesis Test

Independent Samples Test						
			Pretest		Posttest	
			Equal variances assumed	Equal variances not assumed	Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances		F	1.983		.075	
		Sig.	.161		.784	
t-test for Equality of Means		t	1.473	1.473	3.170	3.170
		df	158	156.729	158	157.888
		Sig. (2-tailed)	.143	.143	.002	.002
		Mean Difference	1.688	1.688	3.500	3.500
		Std. Error Difference	1.145	1.145	1.104	1.104
	95% Confidence Interval of the Difference	Lower	-.575	-.575	1.319	1.319
		Upper	3.950	3.950	5.681	5.681

Table 4 shows that the independent sample t test produces a significance value of 0.143> 0.050 for the pretest of the experimental group and the control group, thus there was no difference in the initial ability of students in the sense that the problem-solving skills were not much different. And that the independent sample t test resulted in a significance value of 0.002> 0.050 for the posttest of the experimental group and control group, thus concept understanding increases with the application of the project-based seamless learning model.

5. DISCUSSION

Based on the results of the study, the experimental group and control group data were normally distributed and statistically homogeneous. As based on the independent sample t test on the pretest, it shows that there is no difference in the initial ability of students in the sense that critical thinking skills are not much different. Meanwhile, based on the independent sample t test on the posttest, it shows that students' concept understanding increases with the application of the project-based seamless learning model.

Examining the difference between the experimental and control groups' pretest scores, which were 34.81 and 33.13, respectively, reveals that there is little variation in the two groups' pretreatment means or students' starting skill levels. Regarding the difference, the experimental group's mean posttest score was 84.06, which was greater than the lower control group's score of 80.56. This is because, whereas the control group employed a traditional learning paradigm, the experimental group adopted a different one the project-based seamless learning model. This is the reason why the two groups' averages differed following the research process.

Other research results show that the learning stages of project based learning strategy could empower the students' metacognitive skills, concept understanding, and retention (Rumahlatu & Sangur, 2019). The results showed that the PjBL model effectively influenced students' conceptual understanding and creativity (Prajoko et al., 2023). The results of other studies show that the application of project-based learning models is quite effective in improving students' concept understanding in statistics courses at Bengkulu University, especially in the mathematics education study programme (Yensy et al., 2022). The results of other studies show that the application of the project-based learning model is effective and can increase students' motivation and concept understanding ability (AL et al., 2023). The results of other studies show that the project-based learning model has an effective effect on students' concept understanding (Sholahuddin et al., 2023). Another study mentioned that there was an effect of the PjBL model on the ability to understand mathematical concepts (Sari et al., 2018), (Novianti et al., 2018), (Putri et al., 2023). In the seamless learning research results section, it also shows that the learning process with SL strategy is proven to improve students' concept understanding and critical thinking (Safiah et al., 2020). The results of another study show the great potential of using seamless learning in improving student engagement and learning achievement in primary schools (Riniati, 2024). This indicates that either project-based learning or seamless learning can improve the quality of learning, improve students' skills or abilities, innovate learning models and provide new things in the process of teaching and learning activities.

The effectiveness obtained is due to the advantages of PjBL and seamless learning. The advantages of PjBL are one of the choices of learning models that will be used to empower concept understanding (Halimatusyadiyah et al., 2022), (Markula & Aksela, 2023). Because PjBL is learning that connects academic content with real-world contexts in accordance with the demands of the 21st century that can involve students in the design of learning, arouse students' enthusiasm in problem solving, and decision making. PjBL is learning where students respond to questions around the real world or solve problems through a process of inquiry, developing thinking skills, creativity, and encouraging them to work together in a team (Fatimah, 2018), (Issa & Khataibeh, 2021). PjBL can also create an environment that helps students to build meaningful knowledge and be active in student-centered learning, as well as encourage them to collaborate and solve problems with relevant knowledge and skills (Chiang & Lee, 2016). PjBL can encourage the development of higher cognitive levels and offers various forms of performance assessment (Ngereja et al., 2020), (Almulla, 2020), (Zhang & Ma, 2023). That PjBL can increase students' motivation in learning science, problem solving skills and improve learning achievement (Shin, 2018). The project-based learning method had a positive and high level effect on the visual arts lesson achievements and attitudes (Ozkan, 2023). Collaboration is the cornerstone of this approach, reflecting real-world teamwork dynamics and enhancing students' social and communication skills. The reflective practices embedded in this strategy encourage a growth mindset, enabling students and educators to assess and improve their learning processes (Jia et al., 2023), (Morales-Navarro et al., 2024). With the description of the advantages of project-based learning, it will be highly recommended that project-based learning and seamless learning models be applied in learning.

The limitation of this research is that the application of project-based seamless learning is only applied at the university level, S1 Study Programme in Early Childhood Education, Faculty of Psychology and Education, Universitas Muhammadiyah Sidoarjo. It has not explored the application at other educational levels. It is expected that further research can combine project-based learning and seamless learning models with other learning models, applied at different levels of education or can also be applied to different subject matter and courses. With a note of still paying attention to the needs of learning objectives, material characteristics and characteristics of students well in order to determine which learning model is relevant to use during the learning process.

6. CONCLUSION

The results of the research and discussion show that the application of project-based learning models can improve concept understanding. The results of the normality test showed significant statistically normally distributed data, the results of the homogeneity test showed statistically significant homogeneous data and

the results of the independent sample t test on the posttest showed a significant value greater than 0.050, and the average difference between the posttest of the experimental group and the control group provided evidence that students' concept understanding had increased. Because the control group used a conventional model, the experimental group used a project-based seamless learning model approach. It is hoped that future research can take a closer look at the project-based seamless learning model to improve the abilities or skills of other students, perhaps at different levels of education and of course can also be used in combination with other learning models.

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