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LEVEL OF STUDENT SATISFACTION WITH PROJECT BASED LEARNING MODELS IN 2D CAD COURSES

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ABSTRACT

This research aims to explore and analyze the level of student satisfaction with the application of the project-based learning (PBL) model in the 2D Computer-Aided Design (CAD) course. The research method used is a survey and data analysis involving students who take 2D CAD courses and are involved in project-based learning. This research includes collecting data from students through a questionnaire specifically designed to assess student perceptions of the PBL learning model, level of involvement in project activities, understanding of the material, and overall level of satisfaction. The data was then analyzed quantitatively to evaluate the level of student satisfaction with PBL in the 2D CAD course. The results of this research showed that the level of student satisfaction with project-based learning in CAD courses reached a maximum average score of 68% in the satisfaction category, this states that students were satisfied with learning project based learning in 2D CAD courses. This research provides insight into the effectiveness of the Project Based Learning learning model in increasing student satisfaction in 2D CAD courses, which can be used to optimize teaching methods in the future.

Keywords: *Computer-Aided Design, Project-based learning, Student satisfaction*

INTRODUCTION

The project-based learning model (Project-Based Learning or PBL) is used to enable students to understand and master concepts and skills through active participation in real-world tasks (Kong et al., 2024). In PBL, learning by students is done by working together to complete projects that reflect everyday challenges that students may encounter in the real world. Problem solving, developing critical thinking skills, communication, and collaboration are emphasized by this model (Maor et al., 2023). While carrying out a project, students are often given autonomy to identify problems, plan solutions, and present the results of student work. The aim of PBL is to connect learning with practical contexts and provide meaning to the material studied by students (Nurhikmayati & Sunendar, 2020). PBL differs from traditional learning approaches which may focus more on conveying information to students. In contrast, PBL gives

students the possibility to experience an active learning process, solve problems, and apply knowledge in real-world situations, which can increase student understanding and prepare students to face real-world situations better (Almulla, 2020)

The 2D CAD (Computer-Aided Design 2D) course is a practical course that focuses on using CAD software to design and draw 2D and 3D engineering drawings (Fakhry et al., 2021). CAD courses are designed to provide students with practical skills in using CAD software, such as AutoCAD, Inventor, Solidwork and other design software. In the 2D CAD course, various techniques and tools in 2D CAD, as well as relevant engineering design principles will be taught to students. Practical courses such as 2D CAD usually involve a practicum or exercise component that allows the concepts taught to be applied in a real environment by students (Hugo et al., 2023). This includes creating engineering drawings, designing construction details, and understanding related industry standards. The aim of the CAD course is to prepare students with practical skills that can be applied in the industrial world, especially in the field of mechanical design engineering (Pranoto, 2021). In this course, students learn to design and draw various objects and structures using 2D CAD software. The product results from 2D CAD courses in the context of machinery usually include various types of technical drawings used in machine design (Fakhry et al., 2021). This includes drawings such as detailed drawings of machine components, assembly drawings, and technical drawings that detail the specifications and dimensions of the components used in the machine. Students who take mechanical CAD courses will gain skills in using CAD software to produce these drawings with high accuracy and precision. The product results from the CAD course serve as a guide for engineers and designers in the process of designing, assembling and maintaining machines, as well as ensuring that all machine components and elements comply with the specified specifications (Novitasari, 2022).

Knowing student satisfaction with the learning model has great significance in the world of education (Frisdiantara & Graha, 2013). Student satisfaction reflects the effectiveness of the learning approach used by educational institutions (Diez-Busto et al., 2023). It reflects the extent to which teaching methods and curricula accommodate student needs and preferences. The importance of knowing student satisfaction with the learning model can be summarized in several key points: First, student satisfaction creates a more positive and productive learning environment. Students who are satisfied with the student learning model tend to be more motivated, participate actively in class, and have a high enthusiasm for learning (Wahyuningtyas & Saputra, 2023). has a positive impact on student learning outcomes. Second, student satisfaction can help identify problems and improve them (Hidayat et al., 2023). By collecting feedback from students, educational institutions can find out whether there are deficiencies in the learning model used. This helps in the process of improving the curriculum and teaching

methods, thereby improving the quality of education. Third, student satisfaction can influence a student's decision to continue their studies or leave an educational institution. Understanding student satisfaction can have an impact on student retention and institutional development. Fourth, student satisfaction can also influence the image and reputation of educational institutions. Students who are satisfied tend to leave positive reviews and recommend the institution to potential students. This can increase the attractiveness of the institution and contribute to the growth and sustainability of the institution.

In the context of teaching 2D CAD courses, it is important to understand the extent to which the PBL approach influences student satisfaction levels. PBL emphasizes student involvement in projects, project understanding and learning, collaboration and communication as well as project benefits that require active participation and taking responsibility, but whether this approach also provides a satisfying learning experience for students in 2D CAD courses still needs to be explored. The importance of this research is to provide better insight into the extent to which PBL is successfully implemented in 2D CAD courses and whether this approach increases the level of student satisfaction with student learning. By better understanding the impact of PBL on these courses, we can design more effective teaching methods and ensure that students not only develop strong technical skills, but also feel satisfied with the student learning experience.

RESEARCH METHODS

The research method used in this study is a quantitative descriptive approach (Sudaryana et al, 2022). This approach was chosen because the research aims to describe and analyze data in detail, making it suitable for evaluating learning in CAD courses. Research data was obtained using a questionnaire as the main instrument.

The questionnaire was designed to collect student views and responses regarding student experiences in practical CAD courses. Participants in this research consisted of 53 students who were taking the 2D CAD Practice course in the 2022/2023 academic year. The selection of this sample size was based on adequate statistical considerations to produce representative results.

The instrument grid in research on the level of student satisfaction with the Project-Based Learning (PBL) learning model in 2D CAD courses will reflect various aspects that are relevant to the student's learning experience. This instrument will consist of several statements designed to measure the level of student satisfaction with the key elements of the PBL model that students experience in the context of the 2D CAD course.

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Number	Assessment Indicators
1	Student involvement in the project
2	Project learning and understanding
3	Collaboration and Communication
4	Project Benefits

Figure 1. Bicycle Project

Bicycle products are an example that is very relevant in the application of the PBL method. Bicycles, as an environmentally friendly and healthy means of transportation, not only offer a rich context for engineering and design exploration, but also integrate important aspects such as physics, mathematics, health and creativity. Through a bicycle building project, students can learn how different disciplines relate to each other and how the skills they learn can be applied in real-world situations. In this project, students will be involved in various stages from planning, design, to building the bicycle. They will work in teams, developing communication, project management and critical thinking skills. Students will also learn about the importance of sustainability and innovation in product design, as well as how technology can be used to improve the quality of life.

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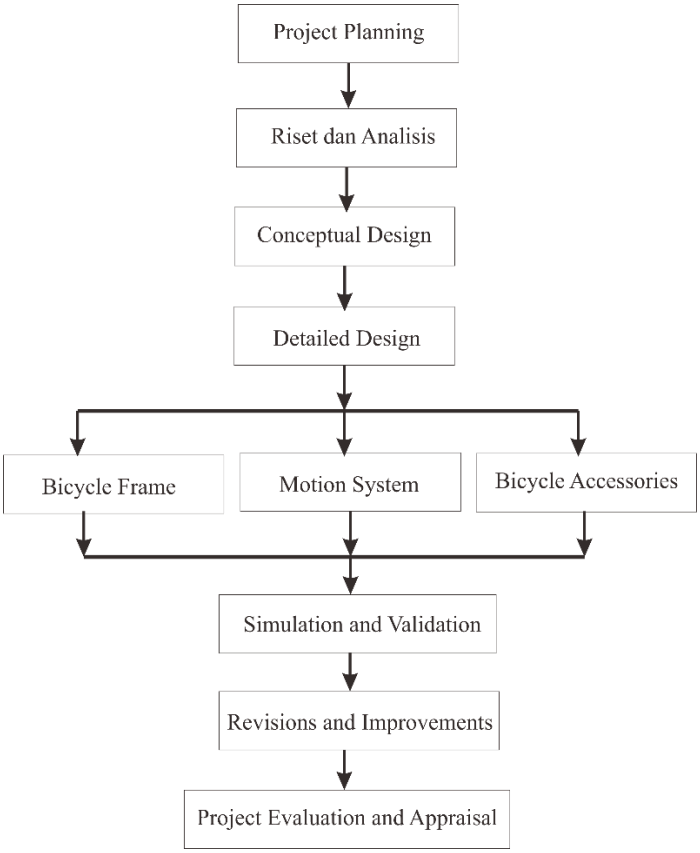
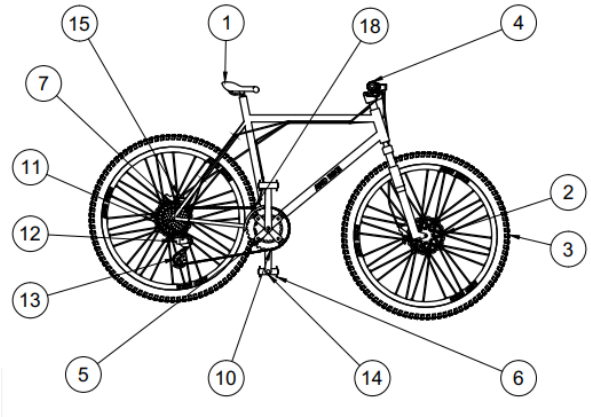


Figure 2. Research Chart



Item	Qty	Part Number
1	1	Sadle
2	1	Stem
3	2	Ban
4	1	Stang
5	1	Link Pedal
6	2	Pedal
7	1	Bracket
8	2	Hold Shifter
9	2	Handle Rem
10	1	Crackset
11	1	Disk Brakes
12	1	Rear Derailleur
13	2	Gear Rear
14	1	Link Pedal
15	1	Rim Brakes
16	2	Shifter
17	2	Holding Handle Rear
18	1	Front Derailleur

Figure 2. Distribution of student projects

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In research regarding the level of student satisfaction with the Project-Based Learning (PBL) learning model in 2D CAD courses, respondents were selected using the purposive sampling method. The purposive sampling method was used to select respondents who had relevant experience and knowledge regarding the use of PBL in 2D CAD learning. Respondents involved in this research were selectively selected based on certain criteria, such as experience in 2D CAD courses, active participation in PBL-based projects, and students' level of understanding of 2D CAD concepts. By using purposive sampling, this research can explore students' views, experiences and levels of satisfaction in depth regarding the use of the PBL model in learning 2D CAD courses. This allows researchers to gain rich and representative insights from the perspectives of the respondents involved.

RESULTS AND DISCUSSION

Based on a survey conducted on students taking 2D CAD courses with the PBL learning model, the following data has been collected:

Table 1. Frequency of respondents' answers

Assessment Indicators	Scoring Scale				
	Very dissatisfied	Not satisfied	Less satisfied	Satisfied	Very satisfied
Student involvement in the project	0	0	0	28	4
Project learning and understanding	0	0	0	27	5
Collaboration and Communication	0	0	1	15	16
Project Benefits	0	0	5	17	10

In this research, data has been presented regarding the level of student satisfaction with the Project Based Learning (PBL) learning model in the 2D CAD course. Frequency data has been processed and presented in percentage form to provide a clearer and more comprehensive picture of the distribution of satisfaction levels. This analysis aims to understand the extent to which the PBL method is accepted and appreciated by students.

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Tabel 2. Percentage of respondents' answers

Assessment Indicators	Scoring Scale				
	Very dissatisfied	Not satisfied	Less satisfied	Satisfied	Very satisfied
Student involvement in the project	0%	0%	0%	88%	13%
Project learning and understanding	0%	0%	0%	84%	16%
Collaboration and Communication	0%	0%	3%	47%	50%
Project Benefits	0%	0%	16%	53%	31%

Level of Satisfaction with dimensions of student involvement in the project

Student involvement in CAD (Computer-Aided Design) practical projects has a significant impact on the development of their technical skills and professionalism. Through these projects, students apply theoretical knowledge to real-world situations, using CAD software for a variety of projects, from design to product testing. This project helps students improve their skills in designing, drawing, and analyzing products with CAD technology, as well as learning about teamwork, project management, and effective communication. Based on Figure 1, the level of student satisfaction with involvement in the project shows 88% are satisfied and 12% are very satisfied.

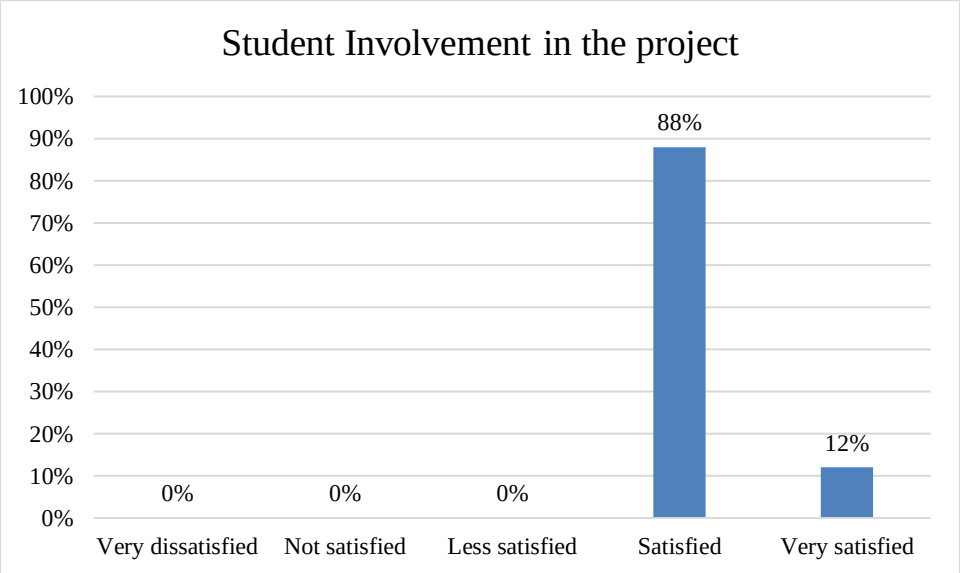

Figure 3. percentage of satisfaction level with student involvement in the project

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Level of Satisfaction with the learning and understanding dimensions of the project

Project-Based Learning (PBL) learning in 2D CAD courses provides in-depth and contextual learning experiences for students (Aziz et al., 2010). In PBL, students not only learn engineering theory and 2D CAD concepts, but also apply them in real projects, which helps them hone their design, modeling, and analysis skills. Linking theory to practice through 2D CAD projects enhances understanding and allows direct evaluation of student progress. The high level of satisfaction with PBL in 2D CAD courses may be closely related to the immersive experience that engages students and provides real value in the application of knowledge. Based on Figure 2, the level of student satisfaction with learning and understanding the project shows 84% satisfied and 16% very satisfied.

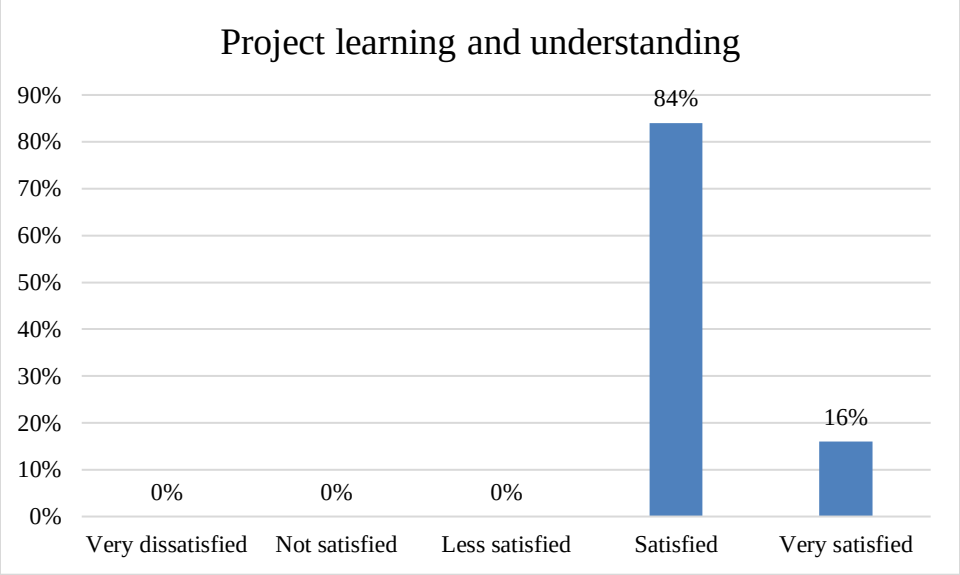

Figure 4. percentage of satisfaction level with learning and understanding of the project

Level of Satisfaction with the Collaboration and Communication dimensions

The level of student satisfaction with collaboration and communication in the Project-Based Learning (PBL) model in 2D CAD courses is very important. Collaboration involves teamwork, sharing ideas, and mutual support to achieve project goals (Dianawati, 2022). PBL allows students to discuss, solve problems together, and develop design solutions, broadening their understanding. The communication aspect in PBL is also emphasized, where students must convey ideas, interact with lecturers, and provide constructive feedback. Understanding of 2D CAD design and techniques demonstrated through project results and communication and collaboration skills. Based

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on Figure 3, student satisfaction with collaboration and communication is 3% less satisfied, 47% satisfied, and 50% very satisfied.

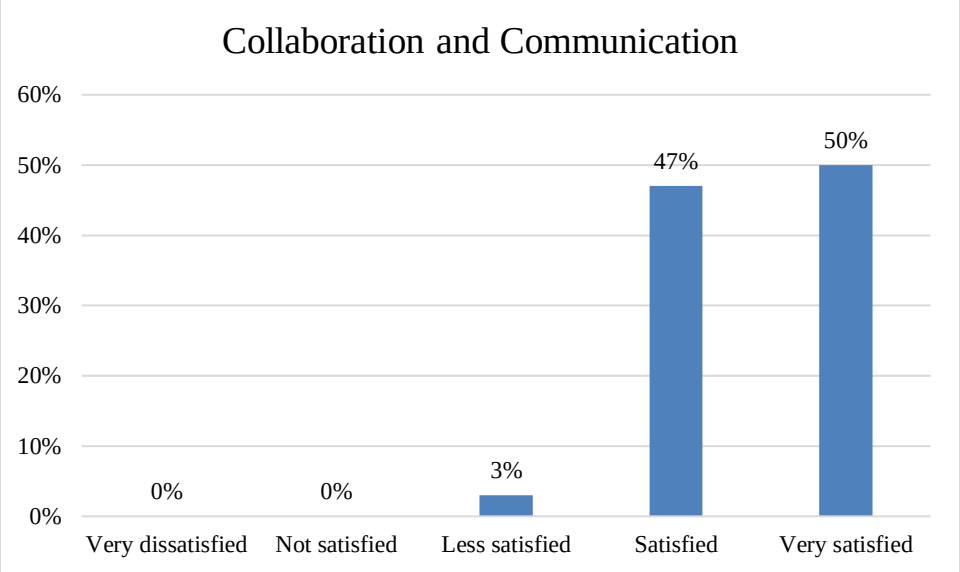

Figure 5. Percentage of satisfaction level with collaboration and communication

Level of Satisfaction with Project Benefits

The level of student satisfaction with the usefulness of projects in Project-Based Learning (PBL) in 2D CAD courses is very important for evaluating learning effectiveness. Project usefulness includes the extent to which students feel the value and benefits of the project they are working on. In this context, projects are closely related to students' ability to apply knowledge and skills to the real world, such as creating 2D designs, developing models, or solving design problems. Satisfaction increases if students see how 2D CAD concepts are applied in projects and feel the benefits. Based on Figure 4, student satisfaction with the usefulness of the project is 16% less satisfied, 53% satisfied, and 31% very satisfied.

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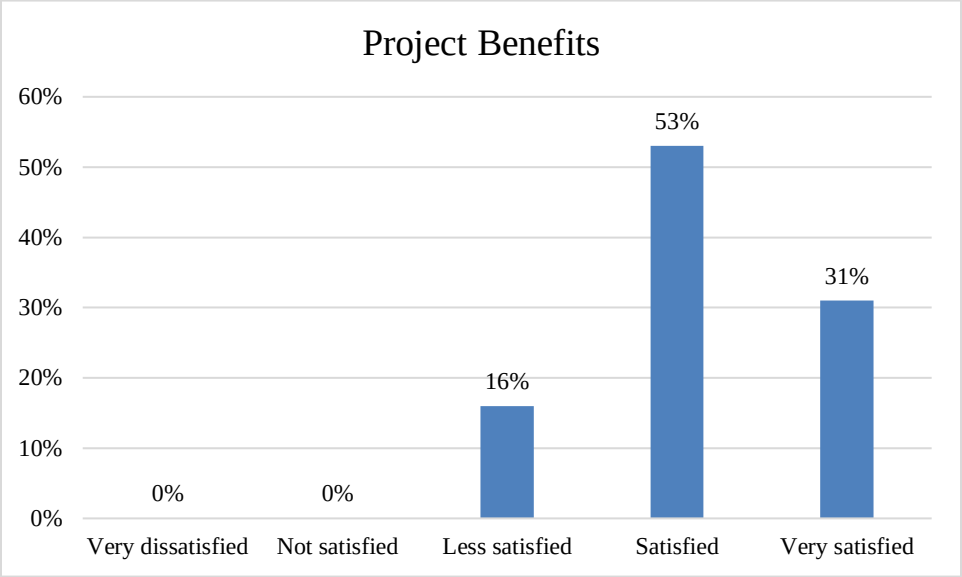

Figure 6. percentage of satisfaction level with project utilization

The results of the percentage level of student satisfaction with the Project Based Learning (PBL) learning model in the 2D CAD course revealed that 27% of respondents said they were very satisfied, 68% of respondents said they were satisfied and 5% of respondents said they were not satisfied. Student involvement in projects provides important benefits in the learning process. Through hands-on experience in practical projects, students not only gain theoretical knowledge, but also develop practical skills relevant to the world of work. This process allows students to deepen their understanding of the subject matter by applying these concepts in real world situations. Collaboration and communication between students in the project team also plays an important role. This not only improves social skills, but also broadens students' views of possible solutions.

CONCLUSION

The results of the questionnaire that have been analyzed provide a fairly clear picture of students' views regarding the 2D CAD course. Most of the respondents (68%) stated that the students were satisfied with the teaching methods used in this course. This shows that the current learning approach has received approval from most students. Apart from that, data from the questionnaire also revealed that the majority of students answered the contents of the questionnaire with the level of satisfaction with student involvement in the project reaching (88%) in the satisfied category, the level of satisfaction with learning and understanding the project reaching (84%), the level of satisfaction with collaboration and communication (50%) in the category very satisfied and the level of satisfaction with the usefulness of the project reached (53%) in the satisfied category. feel that the material taught in this course is relevant to student

learning objectives. This is a positive indication that the 2D CAD course is in the satisfied category according to student needs

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