Research Article

Improving Learning of Electronic Circuit Application through Proteus 8.12 Software in Industrial Electronics Engineering at SMKN2 Pengasih to Improve Student Understanding

Bagus Putra Setiyawan[1], Arya Yusuf[2], Arief Yuli Nugroho[3]*

[1,2]Department of Electrical Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta, Indonesia

[3]Department of Mechanical Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta, Indonesia

Email: [1] bagusputra.2021@student.uny.ac.id, [2] ariefyuli.2021@student.uny.ac.id,
[3] aryayusuf.2021@student.uny.ac.id

Abstract

SMKN 2 Pengasih is a Vocational High School that has an Industrial Electronics Engineering expertise program, one of the subjects taught in this expertise program is the application of electronic circuits. In its implementation, there are various obstacles in learning the application of electronic circuits, especially the lack of learning with software simulations related to the basics of electronic circuits. Proteus 8.12 software is one of the software that can be used as a learning medium to improve basic understanding in students related to the application of electronic circuits in various circuit applications. This study uses a qualitative method with a descriptive approach to review the feasibility and improvement of learning the application of electronic circuits through proteus 8.12 software simulations using questionnaires distributed to students. The results obtained in this study were that 33 students experienced an increase in understanding of electronic circuits through the proteus 8.12 simulation with an average increase value of 3.35 out of 4.0 maximum points. This indicates that the application of proteus software can be optimal in supporting learning the application of electronic circuits held at SMKN2 Pengasih.

Keywords: Electronic Circuit Applications, Proteus 8.12, Simulation Software, Student-Centered Learning, Vocational Education, SMKN 2 Pengasih, Learning Improvement, Industrial Electronics Engineering

1. Introduction

Vocational Education is a formal education that focuses on developing and improving practical skills that are aligned with a specific knowledge designed to meet the needs of the growing and sustainable world of work (Saleh et al., 2024). This education is different from other academic education which prioritizes the concept of theoretical education. Vocational education is oriented towards practical learning and hands-on training so that students will gain hands-on experience in doing the jobs required in an industry (Mahande, 2023). This education covers various aspects of the field, which consists of engineering, health, business, art, and design. Then usually vocational education units have good links to related industries so that students can build their professional careers early on (Qur'ani et al., 2024). One of the institutions that is a vocational education institution is Sekolah Menengah Kejuruan Negeri 2 Pengasih. This school is located on Jalan KRT. Kertodiningrat, Margosari, Pengasih, Kulon Progo Regency, Yogyakarta Special Region. The school was established in 1965 and has been verified as an excellent school and accredited A (Excellent). SMKN 2 Pengasih offers various expertise

PROJURNAL
Assist - Resist - Persist

programs, such as computer and network engineering, light vehicle engineering and other expertise programs that support human resources in meeting industry needs. With a total of 54 classes, 1824 students and 169 teachers and educators. SMKN 2 Pengasih is committed to providing quality vocational education that is relevant to industry needs. The school has also built cooperation with various parties to provide employment services for students and alumni of SMKN 2 Pengasih who will continue their careers in the manufacturing industry (Admin, 2024).

One of the expertise programs owned by SMKN 2 Pengasih is the Industrial Electronics engineering expertise program, this expertise program focuses on learning about electronic circuits and instrumentation, including PLC (programmable logic control), logic gates, amplifier circuits and many other materials that can be learned in this expertise program. The application of electronic circuits is one of the subjects studied in industrial electronics engineering. Learning the application of electronic circuits focuses on designing basic electronic circuits that can be developed and applied in various more complex circuits. Then in its implementation, this learning usually uses student center learning (SCL) based learning methods.

Student center learning (SCL) is a learning approach that places students at the center of the teaching and learning process. In this learning model, students have an active role in learning with the teacher as a facilitator in providing learning references and providing direction so that learning does not get out of the learning objectives carried out. This learning has characteristics that first encourage students to actively participate in learning activities, such as discussing in finding solutions to problems, developing critical thinking skills, creativity, increasing the ability to work in teams and increasing student motivation to be more independent in learning (Pertiwi et al., 2022; Putri, 2023). Then in its implementation, learning the application of electronic circuits carried out at SMKN 2 Pengasih still has obstacles in optimizing the application of student center learning, this is marked by the unavailability of electronic circuit simulation software which is used as a learning medium that is carried out. This is certainly an obstacle considering that the design and simulation of electronic circuits has a very important role in providing a basic understanding of electronic circuits. So there needs to be a solution step applied so that learning improvement can be optimally implemented. One solution that can be applied is the use of proteus 8.12 simulation software that can be used in designing and simulating electronic circuits, the use of proteus software will certainly provide experience to students in designing electronic circuits both basic circuits to complex circuits easily. In addition, this software can also simulate the designed electronic circuit so that the circuit workflow can be known and can detect errors in the design of electronic circuits. It is hoped that through the use of proteus 8.12 software, students can be motivated to continue to improve their abilities and make it easier for students to understand the application of electronic circuits in various types of circuit applications.

The primary aim of this study is to evaluate the effectiveness of Proteus 8.12 software in improving the learning of electronic circuit applications for students in the Industrial Electronics Engineering program at SMKN 2 Pengasih. The research specifically addresses the lack of simulation tools that was hindering optimal Student-Centered Learning implementation, while measuring whether this software intervention leads to improved student understanding of electronic circuits and their applications.

2. Literature Review

2.1. Vocational Education

Vocational education is part of the education system in Indonesia and has a very important role in ensuring the availability of human resources allocated in the world of industry and the world of work. In Indonesia today, the need for a workforce that is responsive to technological advances, skilled in

both hard skills and soft skills and adaptable is very large. This certainly encourages vocational education institutions to create and equip human resources with these aspects so that they can be well absorbed in the world of work and industry (Hamdani et al., 2023).

One of the vocational education institutions is a vocational high school, vocational high schools are spread throughout Indonesia. Vocational high schools equip their students with lessons that support the needs of the world of work with learning methods that can improve students' hard skills and soft skills so that they are able to compete and survive with the ongoing work pressure. Project-based learning and student center learning are learning models that are often used in supporting the improvement of students' abilities and knowledge of learning materials in vocational high schools.

2.2. Student Center Learning

Student Center Learning (SCL) is learning within the scope of formal and non-formal educational institutions that centers on students as the main subject of learning, this learning prioritizes the teacher's role as a learning facilitator by providing triggers to students so that students have critical reasoning about the learning being carried out (Prasetyo, 2021). Then, the application of student center learning requires the right stages and strategies so that the application can be in accordance with the learning objectives set. The following are the stages and strategies that can be applied in student center learning (Medriati & Risdianto, 2020):

a.   Build good educator and learner relationships.
b.   Provide flexibility and full support.
c.   Providing relevant knowledge resources.
d.   Encourage learners to reason critically.
e.   Involve learners in learning evaluation.

2.3. Software Proteus 8.12

Proteus software is a software used to make PCB designs and is equipped with simulations at the schematic level before the circuit is carried out the final design step on a PCB board which aims to ensure the circuit functions properly and according to its purpose. Proteus collaborates the ISIS program which functions to create an electronic circuit design schematic with the ARES program which aims to create a PCB board layout from the schematic created (Madenginer, 2024; Prastyo, 2022).

3. Methods

This research uses a qualitative research method with a descriptive approach through a review of relevant literature in this study. This research method uses analysis techniques based on the results of interviews and questionnaires conducted (Niam et al., 2024; Waruwu, 2023). This research focuses on improving learning in the application of electronic circuits using proteus 8.12 simulation software which provides increased understanding of students related to simulated circuits and provides a more efficient means of student learning. The implementation of the research goes through the following stages to support the optimization of the learning carried out, there are five stages that can be described in the explanation below:

3.1. Observation

The initial stage is observation carried out by researchers in the process of introducing the learning environment which aims to find out more about learning needs and analyze the learning environment so that a learning environment analysis can be formulated.

3.2. Problem Formulation

Problem formulation is carried out to review the exiting conditions that occur in schools so that actual and applicable problem solutions can be found to be applied so that there is an improvement in educational services.

3.3. Solution Analysis

Based on field analysis and review, the solution that can be proposed is the application of an educational approach method or model that is able to improve students' understanding theoretically and practically well. Then the approach taken hopes to be able to improve students' critical thinking skills so that students will be triggered to be more familiar with the learning material being implemented.

3.4. Implementation

The implementation of learning is carried out over a span of 2.5 months with reference to the program matrix that has been prepared, the implementation of learning that applies the theory and practice of the literature review that has been done.

4. Results and Discussion

Learning the application of electronic circuits carried out in the industrial electronics engineering expertise program of SMKN 2 Pengasih is one of the subjects that provides knowledge to students related to the basic application of electronic circuits in various circuit applications, this learning focuses on designing, modeling, and calculating electronic circuits. The learning model applied in this lesson is the student center learning model, where learning focuses on increasing students' understanding and ability to participate in learning. The teacher has a role as a facilitator and is authorized to control the course of learning so that it can achieve the expected learning objectives. Then in its implementation, there are still many obstacles in the application of the student center learning model in the industrial electronics engineering expertise program at SMKN 2 Pengasih. These obstacles include, among others, the lack of student motivation in understanding the learning taught, the unavailability of electronic circuit simulation software and the lack of material available.

Based on this problem, of course, there needs to be a solution step so that learning improvement can run and have a positive impact on students' ability to understand, analyze and find solutions to learning problems. The use of Proteus 8.12 software aims to provide increased knowledge to students related to the design and simulation of electronic circuits so that an in-depth analysis of the design of electronic circuits is obtained. In addition, the use of proteus software is also able to provide a significant increase in student learning motivation in learning the application of electronic circuits because students can experiment through circuit simulations. Below is an explanation of learning before and after the use of proteus software conducted in the subject of applying electronic circuits.

4.1. Student Understanding Data Before the Use of Proteus 8.12 Simulation Software

The following data was collected from 33 students of class XI TEI of SMKN 2 Pengasi who have filled out a questionnaire related to students' initial understanding of learning the application of electronic circuits. The questionnaires distributed were expressed with "yes" or "no" answers that reviewed students' understanding of the learning materials that would be implemented during classroom learning as well as reviewing students' knowledge of proteus simulation software. The data collected states that most students do not know the learning materials that will be implemented, and

students as a whole expect the use of proteus software to be optimally used in learning the application of electronic circuits. The following is an explanation of the graph shown in figure 1.
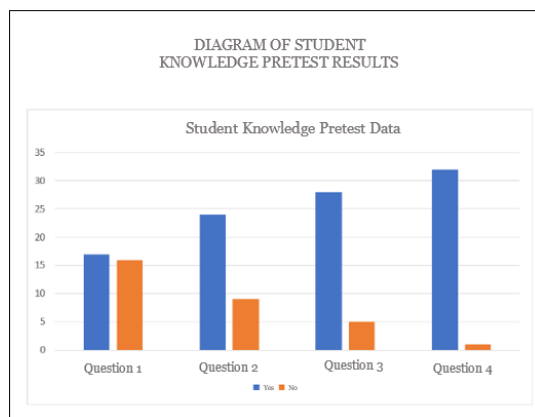

Figure 1. Result Pre-Test
Source: Personal Document

Then after obtaining the pre-test data, the next step is the optimization of learning carried out by applying proteus software as a learning medium carried out in the subject of applying electronic circuits. The use of proteus software aims to make students more facilitated in learning so that increased learning is created and provides experimental space for students so that students are able to think critically, creatively and collaboratively in class learning carried out, analysis of the results of the practicum can also be an increase in student knowledge related to theoretical and practical matters.

4.2. Student Understanding Data After the Use of Proteus 8.12 Simulation Software

The following is the post-test data that has been carried out, the results show that proteus software provides increased knowledge and skills to students so that student learning outcomes are better and optimal. This data proves that the application of proteus software as a learning media is very significant in influencing students' abilities in learning the application of electronic circuits. The data displayed shows the amount of effectiveness with an average of 3.35 points out of 4.0 maximum points.
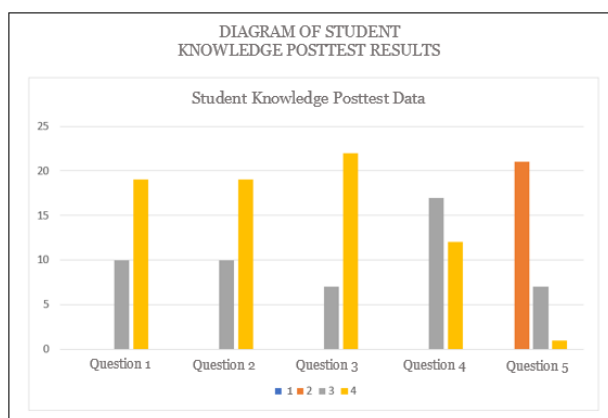
Figure 2. Result Post Test
Source: Personal Document

Based on the data above, it is certainly necessary to develop more advanced learning for future learning so that student learning outcomes can be more optimal and can be an increase in student competence.

5.   Conclusion

The improvement of learning the application of electronic circuits carried out with proteus software has proven to have a significant impact on learning motivation, basic knowledge and students' ability to design and analyze electronic circuits. The amount of improvement points of 3.35 points is considered quite good considering that at the beginning of learning students do not understand much about the learning material being implemented so that this has a positive impact on the sustainability of learning. The improvement that occurs is certainly a sustainable step that needs to be applied by schools so that the positive impact of the learning carried out will always be created. It is hoped that through this research, improvements in student center learning-based learning will always be created and provide references to improved learning, especially in the subject of applying electronic circuits.

6.   References

Hamdani, H., Jalinus, N., Refdinal, R., & Ranuharja, F. (2023). Pendidikan Vokasional Dalam Perspektif Filosofi Pragmatisme. *Jurnal Pendidikan Teknologi Informasi Dan Vokasional*, 5(2), 145–153.

Madenginer. (2024). *Mengenal Software Proteus 8 Professional, Tools dan juga fitur-fiturnya*. https://madenginer.com/apa-itu-proteus-8-professional/

Mahande, I. R. D. (2023). *Pengantar Pendidikan Kejuruan*. Indonesia Emas Group.

Medriati, R., & Risdianto, E. (2020). Penerapan pendekatan student centered learning (SCL) untuk meningkatkan keterampilan berpikir kreatif dan komunikatif mahasiswa pendidikan fisika semester III universitas Bengkulu. *Jurnal Kumparan Fisika*, 3(1 April), 67–74.

Niam, M. F., Rumahlewang, E., Umiyati, H., Dewi, N. P. S., Atiningsih, S., Haryati, T., Magfiroh, I. S., Anggraini, R. I., Mamengko, R. P., & Fathin, S. (2024). *Metode penelitian kualitatif*.

Pertiwi, A. D., Nurfatimah, S. A., & Hasna, S. (2022). Menerapkan metode pembelajaran berorientasi student centered menuju masa transisi kurikulum merdeka. *Jurnal Pendidikan Tambusai*, 6(2), 8839–8848.

Prasetyo, T. (2021). Pendekatan Pembelajaran Berpusat Pada Siswa. *Jurnal Pendidikan Dasar UNJ, July*, 1–23.

Prastyo, E. A. (2022). *Penjelasan Tentang Software Proteus*. Edukasi Elektronika.

Putri, C. A. (2023). Model Pembelajaran Berorientasi Student Centered Menuju Transisi Kurikulum Merdeka. *Ibtidaiyyah: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, 2(2), 95–105.

Qur'ani, B., Niza, A. K., Muliani, M., Purnamasari, F., Bahar, A. S., Ridwan, W., & Hamsar, I. (2024). Pendidikan Vokasional Era 5.0. *Penerbit Tahta Media*.

Saleh, H. I., Nugraha, D., & Handoko, I. (2024). Potensi Pendidikan Vokasional (Vocational Skill) bagi Alumni di Pondok Pesantren Daarul Quran. *Journal of Management and Business*, 1(1), 16–25.

Waruwu, M. (2023). Pendekatan penelitian pendidikan: metode penelitian kualitatif, metode penelitian kuantitatif dan metode penelitian kombinasi (Mixed Method). *Jurnal Pendidikan Tambusai*, 7(1), 2896–2910.