Radiasi: Jurnal Berkala Pendidikan Fisika
Vol. 15 No. 1 (2022) pp. 22 - 27
http://jurnal.umpwr.ac.id/index.php/radiasi/index
p-ISSN: 2302-6111 e-ISSN: 2549-0826

Implementation of Circuit Wizard Software in Basic Electronics Course to Improving Student Motivation and Learning Outcomes

Yanti Sofi Makiyah ✉, Ihsan Nurdiansah, Ifa Rifatul Mahmudah, Rifa'atul Maulidah

Universitas Siliwangi
Jl. Siliwangi No. 24, Kotak Pos 164 Tasikmalaya, Jawa Barat, Indonesia
|yanti.sofi@unsil.ac.id ✉ | DOI: https://doi.org/10.37729/radiasi.v15i1.1844|

Abstract

All physics education student must take Basic Electronics courses at Siliwangi University. The course teaches students how to create electronic components. Due to the Covid-19 pandemic, the unprecedented shift from classroom learning to online learning has profoundly impacted levels of students' learning motivation and learning outcomes in introductory electronics course online laboratory activities. The quantitative descriptive method research was conducted to analyze the implementation of the Circuit Wizard application on students' learning motivation and learning outcomes in the introductory electronics course on the logic gate topic. Students who had recently completed the logic gate simulation were asked to write up a simulation results report. The report was used to measure students' learning outcomes. At the same time, an online questionnaire was administered to measure students' motivation. Data were collected from 46 students of physics education (fifth and seventh semesters, the academic year 2021/2022). The results revealed students' motivation was as follows: 45% were in the good category, 27% were in a low category, and 28% were a low motivation. Findings also revealed student learning outcomes identified: 35% got an A grade, 33% got a B grade, and 4% got a C grade. These findings suggested that the implementation of Circuit Wizard in basic electronics courses positively impacted students' learning motivation and learning outcomes.

Keywords: *Motivation, Learning outcomes, Circuit wizard*

Article Info:
Recieved:
04/03/2022
Revised:
23/04/2022
Accepted:
25/04/2022

1. Introduction

Technological developments has profoundly change all aspect of our lives. Living in an era where technology rapidly changing forced people to be creative, innovative, and proactive. Given the pace of technological change, higher education plays a crucial role in channeling students skills for their future opportunities. Fundamental goals of learning should systematically designed to ensure that each student is prepared to be an active participant in the future technological developments. At the higher education level, successful learning is achieved when students master the lecture material both in theory and practice, and the indicator can be identified by students' grades [1]. The basic or introductory electronics course is one of the compulsory subjects taught in higher education, especially in the physics education major at Siliwangi University. Due to the existence of the electronics sector growing in society, this course plays a crucial role in today's scientific research [2].

Basic electronics courses are the main competencies in understanding electricity and its applications, so students are required to be able to assemble electrical circuits after the lecture [3]. However, due to the Covid-19 pandemic in Indonesia, learning activities at the university level have shifted from classroom learning to online. The learning activities are limited both in terms of time and facilities. This is inline with [4] that the sudden transition to online learning greatly affects students' motivation and learning outcomes.

Motivation is a person's encouragement to change his behaviour for the better to achieve a certain goal. A person's motivation can be one of the determining factors for learning success. In online learning, learning motivation is influenced by intrinsic and extrinsic factors. Intrinsic factors are self-motivation, self-discipline, self-adaptation, and feelings of indifference. Meanwhile, extrinsic factors come from lecturers, teachers, learning media, assignments, family, friends, and the environment. The motivated student has the inner strength to improve academic performance or learning outcomes. According research [5], [6] learning outcomes are abilities an individual should achieve upon completion of a learning experience, its also inline with research by [7].

The indicators of learning motivation are the desire and desire to succeed, encouragement and need in learning, hopes and aspirations, appreciation in learning, interesting activities in learning and the existence of a conducive learning environment [8], [9]. This learning motivation indicator can provide an overview of the learning process carried out by someone in obtaining learning outcomes.
Study about implementation Circuit Wizard was conducted by [10] about basic electronics learning of class X Autotronics at SMKN 6 Malang. Results found significant differences in students' motivation and learning outcomes of the experiment group who used Circuit Wizard media compared to the control group who did not use the Circuit Wizard media. The experimental group's learning motivation post-test was higher than the control group, 80.20 in the experimental group and 73.47 in the control group. Similar to the learning motivation result, the post-test average of student learning outcomes of the experimental group was also higher than the control group, namely 81.63 for the experimental group and 71.23 for the control group. In line in this topics, [11] conduct a study on improving student learning outcomes in electronic circuit courses using a direct learning model assisted by circuit wizard software.

One of the topics studied in the basic electronics course is logic gates. Logic gates discuss the basics of digital electronic systems for many input signals into one output signal. Logic gates operate on a binary number system and have seven basic types of logic gates, namely AND gates, OR gates, NOT gates, NAND gates, NOR gates, Exclusive OR gates (X-OR), and Exclusive NOR gates (X-NOR) [12]. Student learning outcomes in basic electronics courses, especially in logic gate material, are still low, so it is important to increase student learning motivation. This is indicated by the average value of the logic gate material test, which is 48. To support learning logic gates in basic electronics courses, physics education students at Siliwangi University use the Circuit Wizard Software. This helps students to understand the concepts and theories of logic gates by operating circuit simulation applications. The Circuit Wizard application is an application that combines circuit design and PCB design, which provides a tool and components needed to produce a virtual circuit or electronic project, including circuit testing simulations. Students are expected to be more motivated to obtain good learning outcomes by using the Circuit Wizard application.

Based on the research needs above, this study aims to analyze the implementation of the Circuit Wizard application in the basic electronics course on logic gate material on the level of students' motivation and learning outcomes.

2. Method

The study used a quantitative descriptive research method, with the research subject being physics education students in semesters 5 and 7 of Siliwangi University. The 46 students represent the population of the number of students who had passed the basic electronics course. The research instrument is a learning motivation questionnaire and learning outcomes in the form of a simulation results report. The stages of the research carried out are the design of motivational questionnaires based on indicators of learning motivation (Table 1), distributing questionnaires, and collecting data on student learning outcomes.

Table 1. Learning motivation level

Student Learning Motivation Presentation	Description (Interpretation)
< 20,00	Very Low Motivation
21,00 – 40,00	Low Motivation
41,00 – 60,00	Enough Motivation
61,00 – 80,00	High motivation
81,00 – 100	Very High Motivation

After the data was obtained, the researcher then conducted a quantitative descriptive analysis of the level of learning motivation based on Table 1 and student learning outcomes based on Table 2 [7].

Table 2. Category of learning outcome assessment

No	Criteria	Description
81-100	A	Very good
61-80	B	Good
41-60	C	Enough
21-40	D	Less
0-20	E	Very less

3. Result and Discussion

3.1. Analysis of Student Learning Motivation

The level of learning motivation of physics education students in the basic electronics course for logic gates using the Software Circuit Wizard is presented in the following Figure 1.

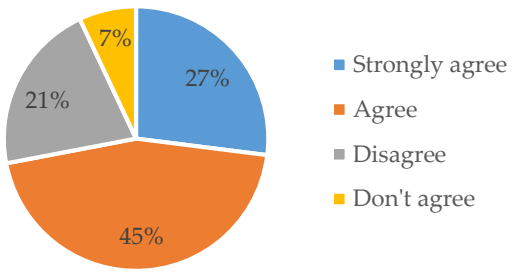

Figure 1. Percentage diagram of student motivation

Based on the Figure 1 above, the comparison of the percentage of students' learning motivations mostly agrees with the percentage of 45%, meaning that students have sufficient motivation in basic electronics courses by using the Software Circuit Wizard. The motivation of students in the low category was 27% who stated strongly agree and 21% who stated less agree, and 7% of students disagreed indicate that students have very low motivation. Recapitulation of the cumulative percentage comparison of student learning motivation questionnaires in the basic electronics course on logic gate material using the Circuit Wizard software, each indicator is as follows on Table 3.

Table 3. Motivation analysis of each indicator

No	Student Learning Motivation Presentation	Percentage (%)	Interpretation
1	There is a desire and desire to succeed	59	Enough
2	There is a drive and a need for learning	54	Enough
3	There are hopes and aspirations for the future	51	Enough
4	There is an appreciation in learning	49	Enough
5	There are interesting activities in learning	46	Enough
6	There is a conducive learning environment	55	Enough
	Average	52	Enough

The analysis table for each motivation indicator shows that students have sufficient motivation towards indicator 1 with a percentage of 59%, indicator 2 with a percentage of 54%, indicator 3 with a percentage of 51%, indicator 4 with a percentage of 49%, indicator 5 with a percentage of 46%, indicator 5 with a percentage of 49%, and indicator 6 is 52%. The average percentage of each indicator is 52% with a sufficient category.

3.2. Analysis of Student Learning Results

Student learning outcomes on logic gate material using the Circuit Wizard Software are shown in the following Table 4.

Table 4. Descriptive analysis of student learning outcomes

Descriptive Statistics							
	N	*Minimum*	*Maximum*	*Sum*	*Mean*	*Std. Deviation*	*Variance*
Learning outcomes	46	28	100	3318	72.13	24.105	581.049
Valid N (listwise)	46						

Based on the Table 4 above, it can be seen that the lowest score obtained is 28 and the highest score obtained is 100 out of 46 students representing the population of students who have passed basic electronics courses. The average value obtained by students is 72.13 which shows the value criteria are in the range of 61-80 where in this range student learning outcomes show a good category value. Otherwise, student learning outcome of physics learning with software shown by Figure 2.

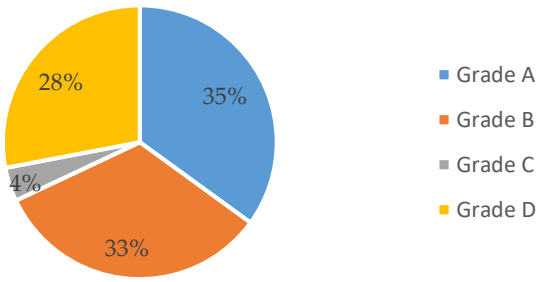

Figure 2. Percentage diagram of student learning outcomes

Based on the Figure 2 above, student learning outcomes in logic gate material for basic electronics courses using the Circuit Wizard Software, out of 46 students, 16 students with a percentage of 35% got an A, 15 people with a percentage of 33% got a B, 2 people with a percentage of 4% got a C score, 13 people with a percentage of 28% got a D score and no students got an E. However, about 32% of students still got scores below the good criteria.

Based on the results of research using Circuit Wizard Software in basic electronics courses on the motivation and learning outcomes of physics students at Siliwangi University, it can be seen from the data that the average student learning motivation is in the sufficient category and for learning outcomes in the good category, this is because there are some students who still don't understand the use of the Circuit Wizard Software, and the lack of student learning motivation so that in making the circuit it's still not right. This is in line with the research of Widodo [10] which states that students who have high motivation will have a lot of energy in learning so that learning outcomes will be maximal as expected when there is high motivation.

Circuit Wizard software one of a solution as a learning tool that presents various types of electronic components, simple circuits, printed circuit board designs, and a list of components along with their types and prices, can also perform simulations, especially in logic gate material without losing the learning objectives [8].

In addition, the Circuit Wizard software can be used by students and on other materials, such as direct current (DC) and alternating current (AC) electric circuits, so that student learning outcomes have increased after using the Circuit Wizard software, supported by teacher creativity in combining technology, media, and teaching materials [9]. Overall, Circuit Wizard Software can assist students in solving abstract electronics problems so that students can be motivated to learn basic electronics courses and improve learning outcomes.

4. Conclusion

The results of data analysis showed that learning motivation in basic electronics courses using media the Circuit Wizard was in the good category by 45%, 27% in the low category, and 28% of students had very low motivation. As for student learning outcomes on logic gate material, 35% got an A grade, 33% got a B grade, and 4% got a C grade so it can be concluded that the use of the Circuit Wizard sufficiently affects student learning motivation and shows good learning outcomes on logic gate material at basic electronics course. Through activities with this software can increase student learning motivation even though it is in the medium category. meanwhile for learning outcomes in the good category on the topic of logic gates. So that this media can be used in learning as a tool to support learning and understanding basic electronics course material.

References

[1] Y. Fransisca, "Meningkatkan Hasil Belajar Mahasiswa pada Mata Kuliah Rangkaian Listrik menggunakan Model Pembelajaran Direct Instruction dan Software Circuit Wizard," *J. Vocat. Tech. Educ. …*, vol. 3, no. Dc, hlm. 7–11, 2019.

[2] W. Wahyudi, "Analisis Hasil Belajar Mahasiswa pada Pokok Bahasan Hukum Ohm dan Kirchoff dalam Matakuliah Elektronika Dasar I," *J. Pendidik. Fis. Dan Teknol.*, vol. 1, no. 2, hlm. 129, 2017, doi: 10.29303/jpft.v1i2.248.

[3] I. Islahudin, "Pemanfaatan Laboratorium Virtual Berbasis Software Electronics Workbench (Ewb) Untuk Menunjang Pemahaman Konsep Mahasiswa Pada Mata Kuliah Elektronika Dasar I," *ORBITA J. Kaji. Inov. Dan Apl. Pendidik. Fis.*, vol. 5, no. 2, hlm. 96, 2019, doi: 10.31764/orbita.v5i2.1394.

[4] A. Besser, G. L. Flett, dan V. Zeigler-Hill, "Adaptability to a sudden transition to online learning during the COVID-19 pandemic: Understanding the challenges for students.," *Scholarsh. Teach. Learn. Psychol.*, 2020.

[5] T. Byers, M. Mahat, K. Liu, dan A. Knock, "Systematic review of the effects of learning environments on student learning outcomes," 2018.

[6] F. Firman, B. Baedhowi, dan W. Murtini, "The effectiveness of the scientific approach to improve student learning outcomes," *Int. J. Act. Learn.*, vol. 3, no. 2, hlm. 86–91, 2018.

[7] A. M. Nasrah, "Analisis Motivasi Belajaar dan Hasil Belajar Daring Mahasiswa Pada Masa Pandemik Covid-19," *Ris. Pendidik. Dasar*, vol. 3, no. 2, hlm. 207–213, 2020.

[8] A. D. Wardani *dkk.*, "Student learning motivation: a conceptual paper," 2020, hlm. 275–278.

[9] R. Wati, "Hubungan Antara Motivasi Belajar Mahasiswa, Kualitas Pelayanan Dosen dan Karyawan serta Ketersediaan Fasilitas Belajar dengan Prestasi Belajar," *Univ. Sanata Dharma Yogyak.*, hlm. 1–164, 2009.

[10] A. S. Widodo, I. M. Nauri, dan A. Martiningsih, "Pengaruh penggunaan software circuit wizard terhadap motivasi dan hasil belajar dasar elektronika siswa kelas X Ototronik di SMK Negeri 6 Malang," *J. Tek. MESIN*, vol. 22, no. 2, 2017.

[11] Y. Fransisca, "Meningkatkan Hasil Belajar Mahasiswa pada Mata Kuliah Rangkaian Listrik menggunakan Model Pembelajaran Direct Instruction dan Software Circuit Wizard," *J. Vocat. Tech. Educ. JVTE*, vol. 1, no. 1, hlm. 7–11, 2019.

[12] S. S. Putro, "PEMANFAATAN APLIKASI ELECTRONIC WORKBENCH (EWB) PADA MATA KULIAH LOGIKA INFORMATIKA MATERI GERBANG LOGIKA Sigit Susanto Putro," *Semin. Nas. Teknol. Pendidik. UM*, hlm. 336–345, 2015.

[13] A. Paolini, "Enhancing Teaching Effectiveness and Student Learning Outcomes.," *J. Eff. Teach.*, vol. 15, no. 1, hlm. 20–33, 2015.

[14] B. Darmawan dan T. Rijanto, "Pengembangan Perangkat Pembelajaran Problem Based Learning Berbantuan Media Circuit Wizard pada Mata Pelajaran Dasar Listrik dan Elektronika di SMK Negeri 1 Pungging Mojokerto," *J. Pendidik. Tek. Elektro*, vol. 8, no. 2, 2019.