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Research Article

Effectiveness of Electrobase Applications in Increasing Understanding of Electronics Concepts

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Abstract

This research is a type of development research where the researcher aims to develop an Android-based application specifically designed to help students understand electronics concepts. This application aims to overcome the problems often faced by students in studying electronics material. The application developed has several main features designed to provide solutions to student learning problems. First, this application will provide a complete and structured basic theory of electronics concepts. Based on the results of the research and discussion, it can be concluded that there is a significant effect of the use of the Elektrobase Application and conventional multimedia on students' understanding of concepts in the third semester. This is shown by comparing the scores, where the experimental class had a higher average score than the control class. Also, in the second result from Table 7, the large Sig (2-tailed) value is 0.018, which is less than 0.05. Based on the hypothesis criteria, we reject Ho and accept H1. So, it can be concluded that there is a difference in the average understanding of concepts between the experimental and control classes. From the results in Tables 6 and 7, it can be assumed that the Elektrobase Application is more effective in helping students understand concepts compared to traditional multimedia.

Keywords: Android Applications, Learning Media, Electronics, Understanding Concepts

INTRODUCTION

Education in the digital era demands adaptation and innovation in learning methods to strengthen students' understanding of concepts (Maruf, 2023). Indonesia, through its independent curriculum, has implemented a learning process that places more emphasis on the use of technology in every learning activity (Khairatunnisa, 2022). It is believed that the Merdeka Curriculum will raise Indonesian education standards. Students can learn through the independent curriculum in a fun, stress-free, and non-intimidating way while still having the opportunity to demonstrate their intrinsic skills. Freedom in learning places great emphasis on autonomy and innovative thinking. The STKIP Citra Bakti Natural Sciences Education (IPA) study program is one of the study programs that has implemented an independent curriculum. In essence, the learning process in the science study program cannot be separated from the nature of science itself. In essence, science is a series of knowledge that includes the process of investigation and scientific attitudes(Muttaqin, 2022). Thus, science does not only focus on theoretical understanding, but also emphasizes practical experience that is relevant to the real world(Sufiyanto & Yasin, 2021). Practical learning is not only limited to students majoring in engineering, but also for science study programs. Basic Electronics is one of the key subjects for students, where a deep understanding of the basic concepts is an important foundation for developing further understanding in the field of engineering. The challenge that often arises is the lack of interest and involvement of students in understanding these concepts, where conventional approaches in delivering material have not optimally met their learning needs and interests. Electronics is an important component in the science curriculum, but many students face difficulties in studying it and integrating practical learning

Electronics courses in the science curriculum provide opportunities for students to experience theoretical concepts directly, strengthen their understanding, and prepare themselves for real-world challenges. Electronics courses are an important aspect in their preparation because they provide basic knowledge to understand theory and practice. With a strong understanding of electronics material, it is hoped that science teacher students can transfer their knowledge and skills to students using effective methods. Electronics courses not only prepare students to become technicians, but also equip them with relevant skills to become competent teachers in the future. Thus, Electronics has an important role in preparing science education students for influential and effective careers in their field. Therefore, developing basic electronics learning applications is important as an alternative that can increase student interest and understanding (Azizah, 2024). This is in line with research conducted by Devega which stated that in its implementation Android-based applications were able to increase interest and motivation as well as student learning

outcomes(Devega et al., 2022). In its development, this application can be designed to provide an interactive, visual and interesting learning experience for students, so that it can increase their motivation in the learning process. This research aims to develop basic electronics learning applications that are innovative and effective in increasing student interest and understanding. Through this approach, it is hoped that it can create a more interesting and supportive learning environment for students in understanding basic electronics material better.

Electronics learning in the Science Education study program at STKIP Citra Bakti still seems to face a number of challenges that affect its effectiveness. One of the main obstacles is the lack of supporting facilities, especially in terms of practicum activities. Practical activities in electronics subjects require a strong understanding of the material so that students can apply it well during practicum. The problem that arises is that students often have difficulty putting into practice the theory they learn because of the lack of practicum facilities available. Apart from that, the lack of interest in learning from students is also another obstacle in the learning process. This may be due to the lack of variation in teaching methods which tend to be monotonous, especially in the theoretical explanations presented in class.

To overcome this challenge, an innovative and effective solution is needed. One solution is to develop an application specifically designed to meet electronics learning needs. This application can provide various features that can improve the quality of learning, such as: Video Explanation of Electronic Components; Videos that explain electronic components in detail will help students understand difficult concepts visually. Simulation of Electronics Practical Activities; Electronics practicum simulation in virtual form will allow students to experience the practicum process without being limited by limited equipment and practicum space. Electronic Component Design Exercise; Interactively designed exercises will help students to strengthen their understanding of electronics concepts and improve their skills in designing electronic components. Various Other Supporting Features; Applications can also provide additional features such as interactive quizzes, forum discussions, and other learning resources that can increase student engagement and motivation in learning.

With this application, it is hoped that students can be more involved in the learning process, increase their understanding of the material, and be able to apply the theory they learn in a more real context. Apart from that, this application can also be an alternative solution to the problem of the lack of practicum facilities available on campus. Thus, the implementation of this electronic learning application is expected to increase learning effectiveness and student interest in learning at STKIP Citra Bakti.

Learning applications are a form of multimedia learning that combines various types of media to create interactive and interesting learning experiences(Astuti, I.A.W., Dasmo., 2018). Research conducted by Domi shows that the use of learning applications can increase students' interest in learning with an increase in interest percentage reaching 56%. This increased interest in turn can influence understanding of the concepts being taught.

These findings are in line with research conducted by Handayani, et al which also shows that the use of learning applications in learning activities can increase students' understanding of concepts. Thus, the integration of technology in learning, especially through learning applications, not only increases interest in learning, but also deepens students' conceptual understanding of the material being taught(Handayani Non, 2022).

Thus, it can be concluded that the use of learning applications as part of technology integration in learning activities can significantly increase students' interest and understanding of concepts. This emphasizes the importance of using technology in the context of modern education to create a more effective and attractive learning environment for students.

METHODS

This study is a research and development project that uses data analysis methods with a quasi-experimental approach, specifically a non-equivalent control group design. This means the participants in the experiment and the control group were not chosen through random selection. The research design, which is the non-equivalent control group design, is shown in Table 1.

Table 1. *Nonequivalent control group design*

Sample	Early	Treatment	End
A	Y_1	X_1	THE_2
B	Y_3	X_2	THE_4

Information:
A = experimental class using the electro base application
B = control class using conventional multimedia
O_1 = experimental class pretest
O_2 = experimental class posttest
O_3 = control class pretest
O_4 = control class posttest
X_1 = treatment using the Elektobase Application
X_2 = treatment using conventional Multimedia

This research was carried out on 2-13 September at STKIP Citra Bakti with the research population being 3rd semester students. The samples were selected using purposive sampling, which is a sampling technique based on specific considerations. Class B was part of the experimental group, and Class A was the control group. The tools used in the research were lesson plans, the Electro Base app, and questions from a concept comprehension test. The data gathered came from the results of the concept comprehension test. This data was analyzed for normality, homogeneity, and to test the research hypothesis using the SPSS 23 software.

To check if the data was normally distributed, we looked at the significance value. If it was greater than 0.05, the data was considered normally distributed. The homogeneity test was used to see if the data had similar variance. Determining the homogeneity of data follows the criteria as in Table 2.

Table 2. Homogeneity Test Criteria

Homogeneity	Information
Say. < 0.05	Heterogeneous population variance
Say. > 0.05	Homogeneous population variance

To determine whether there is a difference in conceptual understanding between the experimental and control classes, the data analysis process uses an independent sample t test with the research hypothesis, namely:

H_0 : There is no difference in the average understanding of students' concepts between the experimental class and the control class

H_1 : There is a difference in the average level of understanding of concepts between the experimental group and the control group.

The criteria for the independent sample t-test can be seen in Table 3.

Table 3. Hypothesis Criteria

Conditions	H_0	H_1
Sig. (2-tailed) > 0,05	Accepted	Rejected
Sig. (2-tailed) < 0,05	Rejected	Accepted

RESULT AND DISSCUSSION

Data normality test results

Table 4. Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	**Statistic**	**df**	**Say.**	**Statistic**	**df**	**Say.**
Concept Understanding	Pertest Experiment	.139	28	.200*	.959	28	.333
	Experiment Posttest	.145	28	.138	.948	28	.179
	Pretest Control	.132	28	.200*	.954	28	.254
	Posttest Control	.120	28	.200*	.963	28	.403

Data homogeneity test results

Table 5. Test of Homogeneity of Variances

Concept Understanding

Levene Statistic	**df1**	**df2**	**Say.**
.003	1	54	.959

Table 6. Group Statistics

	Class	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Concept Understanding	Experiment	28	74.4896	17.39938	3.28817
	control	28	62.9243	18.20671	3.44075

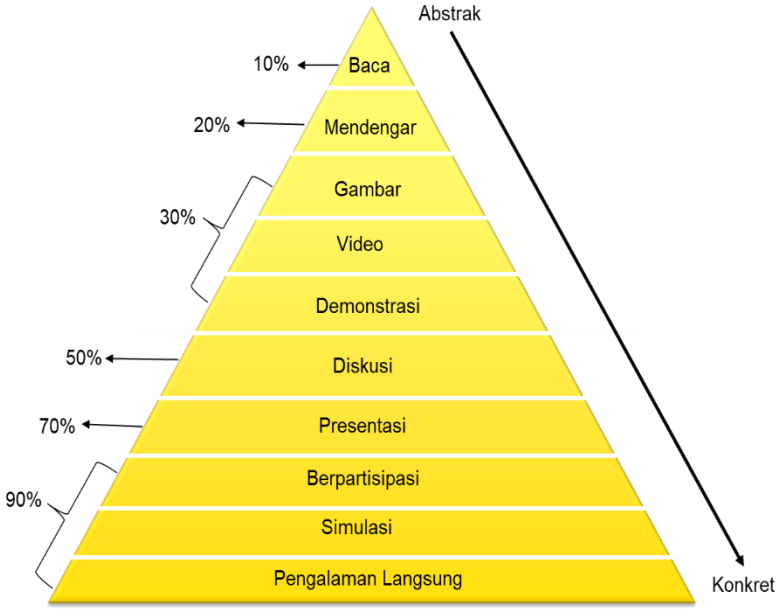
Independent sample test results

Table 7. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Say.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Concept Understanding	Equal variances assumed	.003	.959	2.430	54	.018	11.56536	4.75929	2.02356	21.10715
	Equal variances not assumed			2.430	53.889	.018	11.56536	4.75929	2.02311	21.10760

The results of the normality analysis of pre-test and post-test scores for the experimental and control classes, known that the data is normally distributed. This is because the value is significant *Kolmogorov-Smirnov*[a] or *Shapiro-Wilk* greater than 0.05. SPSS 23 test analysis output results homogeneity variance of experimental class and control class data In Table 5, the significant value of understanding the concepts of the experimental class and control class is 0.959. In accordance with the homogeneity criteria in Table 2, where the Sig value. (0.959) > 0.05, so it can be concluded that the variance of data on conceptual understanding for the experimental class and control class is homogeneous. Based on the results *of Group Statistics* in Table 7, a comparison of values is obtained to mean the experimental class and control class are the values that mean the experimental class is greater than the value *mean* control class. Thus, it can be concluded that there is a significant difference in the average understanding of the concept between the experimental class and the control class. Meanwhile, in the second output in Table 7, a large Sig value was obtained. (2-tailed) is 0.018 < 0.05. In accordance with the predetermined hypothesis criteria, Ho is rejected and H1 is accepted. Therefore, it can be said that there is a difference in the average understanding of concepts between the experimental class and the control class. Based on the results in Table 6 and Table 7, it is clear that the Electrobase application is better at improving students' understanding of concepts compared to regular multimedia.

In the experimental class, the Elektrobase application helps improve conceptual understanding because it combines multimedia with local keris wisdom, which is a special and unique part of the students' learning environment. Schunk suggests that young students are more motivated when they learn concepts that are connected to things in their own environment. Edgar Dale, as explained by Arsyad, categorizes learning styles from abstract to concrete, as shown. in Figure 2.



Picture 2. Edgar Dale's Cone of Experience

The characteristics of the development of the Electrobase application which combines multimedia elements such as simulations enable students to learn and interact with the environment virtually. Based on Figure 2, the learning process using simulations and direct experience in the Elektrobase application is very effective in helping students remember the concepts or material they are studying. This is backed by Çetina's research, which shows that virtual simulations let students interact with a virtual environment that is almost like the real one, and this can help them better understand ideas and develop their skills [9]. In addition to simulations, the Elektrobase application also uses audio and video. Audio helps guide users on how to use the app and explains the concepts, while video shows real-life examples to make the information clearer. Based on Edgar's experience cone in Figure 2, the ability to involve the senses of sight and hearing is an advantage of the Elektrobase Application which supports its use as an independent learning medium. In addition, the interactive feature of the Elektrobase Application allows students to take part in learning activities, making the learning environment fun and reducing the focus on teacher-centered instruction. Besides environmental aspects, the animation, simulation, and video elements in the Elektrobase Application create a strong sense of interest and curiosity, encouraging students to explore and understand the real-world concepts more deeply. This is supported by research conducted by Hsieh which shows that there is a significant increase in understanding of concepts when students are involved in actual experimental processes with animated content(Hsieh, 2017). The results of other research conducted by Mohtadi show that the use of animation and video is very effective in helping students learn and understand the concepts given compared to conventional teaching methods which are still teacher-centred(Al-Mohtadi et al., 2022). The media features in the Elektrobase Application play a key role in helping students become more interested in learning and grasping the ideas taught. Because of this, using the Elektrobase Application for learning is more

effective and helps students understand the material better than traditional multimedia tools. Also, when using the Elektrobase Application, the teacher's job is mainly to guide and support students as they work through things they find difficult.

CONCLUSION

Based on the research and discussion, it can be said that the Elektrobase Application is more effective than traditional multimedia in helping students understand concepts in semester 3. This is shown by comparing the scores, where the average score of the group using the Elektrobase Application is higher than the average score of the group using traditional methods. In the second part of Table 7, the Sig value (2-tailed) is 0.018, which is less than 0.05. This meets the criteria for the hypothesis, so we reject Ho and accept H1. This means there is a significant difference in the average understanding of concepts between the two groups. From the results in Tables 6 and 7, it is clear that the Elektrobase Application is better at improving students' conceptual understanding compared to conventional multimedia.

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