



COMPARISON OF PHYSICS CONCEPT UNDERSTANDING ABILITY OF STUDENTS USING PHET *SOFTWARE* WITH NI MULTISIM *SOFTWARE*

Nurulwati^{1*}, A. Halim², Mailizar³, Muhammad Syukri⁴, Mawarni Saputri⁵.
^{1,2,3,4,5}Universitas Syiah Kuala, Indonesia
*nurulwati@usk.ac.id

ABSTRACT

The lack of practical equipment for physics in schools is a contributing factor to the absence of practical. This study aims to determine the differences in understanding of the concepts of students in the control class and experimental class 1 and for differences in understanding the concepts of students in experimental class 1 and experimental class 2. The research methodology involves a quasi-experimental approach employing a nonequivalent control group design. The target population consists of all students at XII IPA SMA Negeri 8 Banda Aceh. The sample for the study is derived using purposive sampling technique. Data collection is accomplished by employing essay test instruments. The independent sample t-test is utilized to assess the difference in concept understanding ability among the three classes, with a significance level of 0.05 after meeting the prerequisite test. The study findings reveal a significant disparity in concept understanding between the control class and experimental class 1, with a t_{count} value of 12.049 > t_{table} 2.068. Additionally, there is a notable difference in concept understanding between the control class and experimental class 2, with a t count value of 13.931 > t_{table} 2.068.

Keywords: PhET Software, NI multisim software, understanding concepts

1. INTRODUCTION

One of the problems facing education in Indonesia is the weak learning process (Barjum, 2022). Students only record, listen, are passive, and memorize the concepts of the material being taught. Whereas concept understanding is very important with the aim that students are able to remember the concepts of the material studied (Magdalena, 2023).

The low concept understanding ability is caused by several things, one of which is the learning process in the classroom that still applies direct learning, where teachers tend to convey information using the lecture method alone and do not use adequate learning models and media (Lisma et al., 2021). Teachers only teach abstract physics through classroom learning, not equipped with a practicum process in the laboratory (Swandi et al., 2020), even though this practicum activity must be carried out (Aria, 2022) because one of the objectives of practicum is to improve students' understanding of concepts (Mohyeden, 2021). Practical activities in the laboratory are rarely carried out even in schools that are categorized as good. This is due to the unavailability of adequate laboratories or lack of facilities in the form of practicum equipment, and so on (Yennita et al., 2022). However, along with the rapid development of technology, the limitations of practicum tools are not a problem. Because there are many supporting software that can be used as a substitute practicum tool for conducting experiments.

Software that can be used as learning support is PhET software. PhET is an interactive simulation developed by a team from the University of Colorado, USA. PhET has developed a series of interactive simulations that are very beneficial in integrating computer technology into learning (Perkins et al., 2020). In line with research (Theasy et al., 2021) which shows the results that the use of PhET software in learning can improve concept understanding, this can be seen from the results of data analysis which has increased learning outcomes with high criteria for the N-gain score of 0.732.

In addition to PhET, there is NI Multisim software that can also be used as learning support. Unlike PhET which provides several sub-materials, NI Multisim can only be used to simulate how an electronic circuit works (Amiruddin, 2021). This software can also model a variety of circuit designs with the completeness of the available components so that almost unlimited combinations of circuit designs can be made. Based on the results of observations and interviews with students and Physics teachers at SMA Negeri 8 Banda Aceh, information was



obtained that students at the high school had a relatively low average score of 45 on Dynamic Electricity material. The low learning outcomes of students indicate that students lack mastery of the concepts in the material taught. This study aims to determine the differences in understanding of the concepts of students in the control class and experimental class 1 and for differences in understanding the concepts of students in experimental class 1 and experimental class 2.

Therefore, the use of PhET software and NI Multisim software is expected to support practicum activities on dynamic electricity material so that students can understand the concepts in the material taught. Based on these problems, researchers are interested in conducting research on Comparison Of Physics Concept Understanding Ability Of Students Using Phet *Software* With Ni Multisim *Software*.

2. METHODS

This research is a quantitative approach and the type of research used in this research is a quasi experiment. This quasi experimental design has a nonequivalent control group design. The sample in this study consisted of three classes, namely class XII IPA 1 as an experimental class taught using PhET software, class XII IPA 2 as an experimental class taught using NI Multisim software and class XII IPA 3 SMA Negeri 8 Banda Aceh as a control class. Sampling in this study was done by purposive sampling technique.

The research instrument used for data collection in this study was a written test, which consists of 10 items of essay test). Data collection in this study through written tests in the form of description test questions. The test was prepared based on indicators of concept understanding developed by Anderson & Krathwohl which were then modified and adjusted to the learning objectives. The data in this study are the results of students' answers to the concept understanding test results before and after the experiment which will be analyzed the Independent sample t-test calculated using SPSS significant level of 0.05 and also N gain test. N gain test was conducted to know the increase on students' concept understanding while t test was conducted to examine whether there was a difference in the understanding of the concept of students on the material of electrical resistance circuits in experimental class 1, experimental class 2 and control class.

3. RESULTS & DISCUSSION

N-gain Concept Understanding Test

The comparison of the increase in students' concept understanding can be seen through the N-gain score graph of the three classes presented in Figure 1.

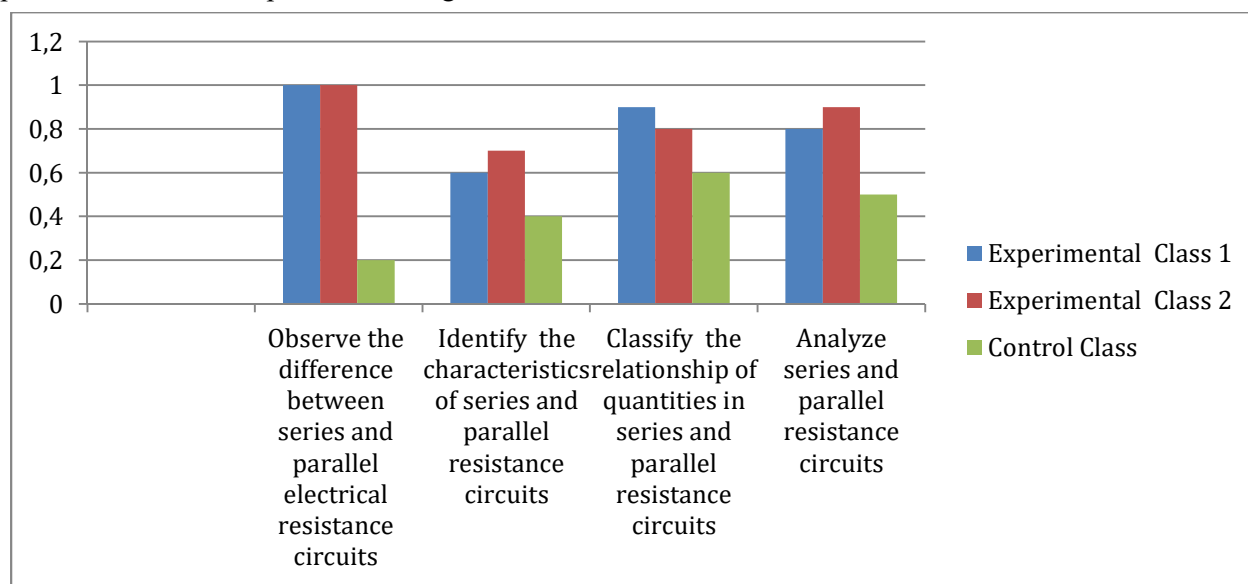


Figure 1. N-Gain Graph Of Experimental Class 1, Experimental Class 2 And Control Class



Based on Figure 1, it can be seen that there are differences in the increase in students' concept understanding in each indicator in each class, where the highest N-gain score on the first indicator is observing the difference in series and parallel electrical resistance circuits with an N-gain score of 1 in experimental class 1 and experimental class 2, and the lowest N-gain score is also found in the first indicator with an N-gain score of 0.2 in the control class.

Hypothesis Test

Hypothesis test results are presented in table 1.

Table 1. Hypothesis Tested

Hypothesis tested	t_{count}	t_{table}	Decision
Control class- experimental class 1	12,049	2,068	H_1 accepted
Control class- experimental class 2	13,931	2,068	H_1 accepted
experimental class 1- experimental class 2	4,369	2,048	H_1 accepted

Based on the results of data analysis, it is obtained that the t_{count} value in the independent sample t-test test in the control class and experimental class 1 is 12.049. Where the t_{count} value is $12.049 > t_{\text{table}} 2.068$, then hypothesis 1 is accepted, so it is known that there is a difference in understanding the concept of students in the control class and experimental class 1.

The t_{count} value in the independent sample t-test in control class and experimental class 2 is 13.931. Where the t_{count} value is $13.931 > t_{\text{table}} 2.068$, then hypothesis accepted, so it is known that there is a difference in understanding the concept of students in control class and experimental class 2.

Furthermore, the results obtained show that the t_{count} value in the independent sample t-test in experimental class 1 and experimental class 2 is 4.369. Where the t_{count} value is $4.369 > t_{\text{table}} 2.048$, then hypothesis accepted, so it is known that there is a difference in understanding the concept of students in experimental class 1 and experimental class 2.

The results of the data analysis above, show that the use of NI Multisim software can also improve the ability to understand the physics concepts of students in each indicator of concept understanding. This is because when using NI Multisim software in learning, students are more emphasized to make electronic circuits so that students are able to analyze each element used. In addition, NI Multisim software has more complete electronic measuring instruments compared to PhET software so it is suitable for conducting virtual experiments on electronics material. This is supported by research conducted by (Putri, et al 2022) which states that the use of NI Multisim software in learning is effective in improving understanding of dynamic electricity concepts with a percentage of 80%. In addition, based on research conducted by (Septianto, 2020) it was found that there was an effect of using NI Multisim software on students' concept understanding. Based on the explanation above, it is found that the use of PhET software and NI Multisim software in learning can have a significant impact on students' understanding of concepts in electrical resistance circuit material. This is reinforced by the results of hypothesis testing; it was found that the value of $t_{\text{table}} > t_{\text{count}}$ in the control class with experimental class 1 and experimental class 1 with experimental class 2.

4. CONCLUSION

Based on the results of research and data analysis that has been done, it can be concluded that

1. There is a difference in the understanding of the concept of students in the control class and experimental class 1 on the material of the electrical resistance circuit at SMA Negeri 8 Banda Aceh, this can be seen from the t_{count} value of $12.049 > t_{\text{table}} 2.068$ stating that there is a significant difference (real) between the average understanding of the concept of students in the control class and experimental class 1.



2. There is a difference in the understanding of the concept of students in experimental class 1 and experimental class 2 on the material of electrical resistance circuits at SMA Negeri 8 Banda Aceh, this can be seen from the tcount value of 4.369> ttable 2.048 which states that there is a significant difference (real) between the average understanding of the concept of students in experimental class 1 and experimental class 2.

5. ACKNOWLEDGMENTS

We would like to thank the research team lecturers, the Principal and Physics teachers at SMA Negeri 8, and all parties who have been involved and participated in this research.

REFERENCES

- Amiruddin, A. (2017). Pengembangan media pembelajaran fisika dengan camtasia studio dan multisim pada pokok bahasan listrik dinamis. *Jurnal Pendidikan MIPA I*, 7(1), 22-29
- Barjum, D. (2022). PDIA for systems change: *tackling the learning crisis in indonesia*. RISE Insight Series. Foreign, Commonwealth & Development Office. Published 15 September 2022.
- Lisma, L., Kurniawan, Y., & Sulistri, E. (2021). Penerapan model learning cycle (LC) 7E sebagai upaya peningkatan pemahaman konsep aspek menafsirkan dan menyimpulkan materi kalor kelas X SMA. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, 2(2), 35.
- Magdalena, I., Nurchayati, A., Uyun, N., & Rean, G. T. (2023). Implikasi teori psikologi kognitif dalam proses belajar dan pembelajaran. *Al-DYAS*, 2(3).
- Mohyeden, J. (2021). Meningkatkan pemahaman konsep cahaya melalui penerapan metode praktikum pada siswa kelas V SDI Paupanda 3. *Ekspektasi: Jurnal Pendidikan Ekonomi*, 6(2), 143-147.
- Ningrum, A. S., Muslim, S., & Siregar, E. (2022). Multimedia simulation model on basic electrical and electronics subjects for vocational secondary school. *Journal of Education Research and Evaluation*, 6(1), 72-79.
- Perkins, K., Adams, W., Dubson, M., Finkelstein, N., Reid, S., Wieman, C., & LeMaster, R. (2020). PhET: Interactive simulations for teaching and learning physics. *The physics teacher*, 44(1), 18-23
- Putri, D. R., Hariani, L. S., & Walipah, W. (2022). Pengembangan media pembelajaran berbasis camtasia studio pada mata pelajaran ilmu pengetahuan sosial (IPS). *Jurnal Riset Pendidikan Ekonomi*, 7(1), 62-70.
- Septianto, F. B., & Kholis, N. (2015). "Pengaruh model pembelajaran kooperatif tipe stad dengan software multisim terhadap hasil belajar siswa pada mata pembelajaran mengukur besaran-besaran listrik dalam rangkaian elektronika di kelas x smk sunan drajat paciran Lamongan. *Tersedia pada* <http://ejournal.unesa.ac.id/index.php/pjurnal-pendidikan-teknikelektro/article/view/11427/4436> (Accessed on 5 November).
- Swandi, N., & Irsan. (2015). Pengembangan media pembelajaran laboratorium virtual untuk mengatasi miskonsepsi pada materi fisika Inti di SMAN 1 binamu. *Jurnal Fisika Indonesia*. 18(52), 20-24
- Theasy, Y., Bustan, A., & Nawir, M. (2021). Penggunaan media laboratorium virtual PhET simulation untuk meningkatkan pemahaman konsep fisika mahasiswa pada mata kuliah eksperimen fisika sekolah. *Variabel*, 4(2), 39
- Yennita, Sukmawati, M., & Zulirfan. (2012). Hambatan pelaksanaan praktikum IPA fisika yang dihadapi guru SMP negeri di kota pekanbaru. *Jurnal Pendidikan*, 3(1), 1-11.



Yusuf, I., Widyaningsih, S. W., & Purwati, D. (2022). Pengembangan perangkat pembelajaran Fisika Modern berbasis media laboratorium virtual berdasarkan paradigma pembelajaran abad 21 dan Kurikulum 2013. Jakarta: Pancaran Pendidikan