E.ISSN.2614-6061 DOI : 10.37081/ed.v13i1.6934
P.ISSN.2527-4295 Vol. 13 No. 1 Edisi Januari 2025, pp.794-799

THE EFFECT OF REALITY ON THE QUALITY OF PHYSICS LEARNING IN COLLEGE STUDENTS: A CASE STUDY

Oleh :
Fine Eirene Siahaan
Physics Education, Universitas HKBP Nommensen Pematangsiantar
email: fine.eirene@gmail.com

Informasi Artikel
Riwayat Artikel :
Submit, 4 Desember 2024
Revisi, 28 Desember 2024
Diterima, 13 Januari 2025
Publish, 15 Januari 2025

Kata Kunci :
Case Study,
Learning Quality,
Virtual Reality.

ABSTRACT
Virtual Reality (VR) in physics education is an innovative approach that uses technology to create a more immersive and interactive learning experience. With VR, students can interact with complex physics simulations, which helps them understand difficult concepts in a more intuitive way. This study aims to determine the effect of Virtual Reality (VR) on the quality of physics learning of HKBP Nommensen University Pematangsiantar students. This research method with One Group Design or One Group Pretest-Posttest Design (experimental research where only one group is studied). This design involves two stages of measurement: before treatment (pretest) and after treatment (posttest). The sample used in this study consisted of 15 students from the Physics Education program in the 2023/2024 academic year. The instrument used in this study is in the form of questions in the form of essays with a total of 10 questions to measure the quality of learning, namely the cognitive results of students in experimental courses, where the indicators of cognitive start from C3-C6. This instrument will be used as a pretest and posttest to be given to the students, and also as a questionnaire in the form of a questionnaire to see the satisfaction of the students in using VR in learning. This questionnaire will be administered later along with the posttest. The results showed a significant increase in students' cognitive understanding, with an average pretest score of 73.00 and an average posttest score of 80.33, resulting in a t-test p-value of 0.00, rejecting the null hypothesis. The ANOVA results confirmed a significant difference in learning outcomes with a p-value also of 0.00. Student satisfaction with the use of VR was recorded as "excellent" at 4.00.

Corresponding Author:
Nama: Fine Eirene Siahaan
Afiliasi: Universitas HKBP Nommensen Pematangsiantar
Email: fine.eirene@gmail.com

1. INTRODUCTION

Education in the digital era is currently undergoing a significant transformation, especially with the existence of new technologies that are increasingly developing. Technological advances in education have brought significant changes for lecturers in the teaching and learning process. Lecturers are required to continuously upgrade their technology to remain relevant in the digital era. These skills include the use of digital learning tools, instructional design, data literacy, as well as digital security. With adequate skills, lecturers can provide high-quality education that suits the needs of students in the 21st century (Sartika & Humairah, 2017).

Technology also allows lecturers to conduct faster and more efficient evaluation and feedback. Using digital platforms, lecturers can monitor student progress in real time and provide constructive feedback immediately. Overall, technological advancements in education provide opportunities for

lecturers to improve teaching quality and shape a more engaging and effective learning experience for students. Adapting to these technologies is key to creating a dynamic and relevant learning environment.

Lecturers are currently facing a number of key issues in the classroom learning process, mainly due to the shift to online learning and the use of technology. One significant challenge is the unpreparedness in adapting teaching methods; many lecturers find it difficult to transition from traditional face-to-face methods to online learning which requires new approaches and different tools. In addition, technological infrastructure limitations, such as unstable internet connections and lack of access to adequate devices, hinder teaching effectiveness and interaction with students. Lecturers also often have difficulties in monitoring student engagement, as there is no effective way to ensure that students are actually following the material delivered online (Adiyanto, 2021). In addition, the monotony of the learning media used can cause students to feel bored and less motivated, thus reducing the overall quality of learning. All these factors point to the need for innovation and better support for lecturers so that they can overcome the challenges in today's learning process (Astuti et al., 2022).

Based on observations made by researchers for several semesters in teaching at HKBP Nommensen University Pematangsiantar. Physics education lecturers face various problems in teaching practicum, which can affect the effectiveness of learning. One of the main challenges is students' lack of understanding of the basic concepts of physics, which causes difficulties when doing practicum. Research shows that students often experience difficulties in understanding practicum procedures and the tools used, so they cannot carry out experiments properly (Najmah et al., 2019). In addition, the limited number of practicum assistants is also a problem; when assistants are not available, lecturers have to handle all questions from students, which can reduce the efficiency of time and attention given to each group (Nurhidayah, 2024). The availability of adequate practicum tools and materials is also an obstacle, as there are often not enough tools for all groups, hindering the learning process (Maharani et al., 2024). Finally, the transition to online learning due to the COVID-19 pandemic has exacerbated this situation, with students struggling to apply theoretical knowledge in practice without direct guidance. All these factors point to the need for improvements in support and resources to enhance the quality of learning.

Many physics education students at HKBP Nommensen University Pematangsiantar have difficulty in understanding basic physics concepts, and the lack of availability of practicum tools and materials that can hinder the implementation of practicum optimally, so that students do not get experience Other factors also such as low mastery of material, lack of motivation, and learning difficulties can hinder the learning process in the classroom. Facing these challenges, physics education lecturers need to design effective teaching strategies such as applying more innovative and adaptive teaching methods, using technology that can help as a medium in effective learning in practicum, and improving the quality of interaction between lecturers and students to create a more supportive learning environment.

One technology that is gaining popularity in education is Virtual Reality (VR). Virtual Reality, which allows users to experience immersive experiences in a three-dimensional environment, offers great potential in supporting the learning process in various disciplines, including Physics. In this context, VR is not just a tool to deliver material, but can also create a learning experience that is more interactive, interesting, and easily understood by students

Physics learning is one of the complex and systematic subjects, it is often difficult for students to understand the basic concepts of physics. However, with technological advances, especially with the use of Virtual Reality (VR), the learning process becomes more immersive and interactive. According to (Mubarok et al., 2024), Virtual Reality is a computer-based technology that can present a picture of the real world in three-dimensional form accompanied by audio, thus allowing users to interact directly with the virtual environment. In the context of education, VR has been shown to improve understanding of physics concepts in a more dynamic and interactive way than traditional methods.

Virtual Reality (VR) applications in physics learning offer an innovative way to improve understanding of complex concepts. According to (Ubaidillah, 2024), there are several VR applications that we can use in physics learning, especially for students such as: Millealab is an application that can teach a variety of topics including Hooke's Law and global warming; VR Chosen Physics this application allows students to dive into a virtual world where students can interact with physics objects, and conduct experiments such as force, motion and energy material; Foton VR is an educational application designed for 5th to 10th grade students. This app is for exploring various physics topics visually and interactively; and many more.

With Virtual Reality (VR), students can conduct experiments that may be difficult or unsafe to do in the real world. For example, they can conduct experiments in space or under the sea to study the laws of physics under extreme conditions. This not only enhances their understanding but also allows them to learn from mistakes without real risk (Siyamsih, 2024). The use of Virtual Reality (VR) in physics learning for students offers significant advantages. Here are some of the main advantages

that can be gained from the application of VR in this context: (1). Improved concept understanding; (2). Immersive and interactive learning; (3). Development of practical skills; (4). Remote collaboration; (5). Contextualized learning; (6). Improving knowledge retention (Huryati, Ngadimin, Soewarno, 2021).

The use of Virtual Reality (VR) in physics learning has shown great potential to improve the quality of learning in students. The following are examples of case studies from previous researchers who have used VR in their research. Research conducted (Hayati et al., 2017) shows that the use of virtual simulations in physics learning has a positive effect on student learning outcomes. In this study, students who used virtual media for temperature and heat material experienced a significant increase from a pretest score of 29.35 to a posttest of 68.71. (Nurhidayah, 2024) also said that the use of VR assisted by PBL learning models on solar system mteri can improve students' science literacy skills. Students involved in learning with VR showed a significant increase in their ability to understand and apply physics concepts, and were more actively involved in the learning process. As well as in SMA Negeri 4 Denpasar and SMKN 1 Denpasar, the use of VR has been applied to improve the learning process in various subjects, including physics. Teachers report that students' enthusiasm for the use of VR is very high, and this method helps increase students' motivation and engagement in learning. The use of VR also allows teaching methods that suit each student's learning style (Bahari, et al: 2023).

As for the explanation of the advantages of using virtual reality in physics learning, especially physics experiment courses, there are still gaps in the use of virtual reality in physics learning. The gap lies in the limited access to infrastructure and high costs that hinder educational institutions, as well as the lack of lecturer skills in integrating this technology effectively into the current curriculum. This is supported by previous researchers who say that many educational institutions, especially in remote areas, do not have adequate infrastructure to support the use of VR (Siyamsih, 2024), Not all lecturers have sufficient skills or knowledge to integrate VR into the curriculum effectively. This limitation can hinder the maximum utilization of technology in the learning process (Menhard, 2024)

Solutions that can be done to overcome this gap are: Increasing investment in technology infrastructure in educational institutions, including the provision of better internet access, so that all students can access VR-based learning content; Educational institutions can seek additional funding sources or grants from the government or private organizations to support the procurement of VR devices and the development of relevant learning content; Organizing training programs for lecturers to improve their skills in using VR technology and integrating it into the curriculum. This will help lecturers feel more confident in using this new technology; Develop high-quality VR content that is relevant to physics subject matter, and ensure that the content is easily accessible and usable by students (Siyamsih, 2024)

Based on the explanation above, the researcher will conduct research on students of HBP Nommensen University Pematangsiantar semester 3 in the advanced physics experiment course with the title "The Effect of Virtual Reality on the Quality of Physics Learning in Students: Case Study". With the aim of this study is to determine the Effect of Virtual Reality on the Quality of Physics Learning in Students: Case Study.

2. METHODS

This research was conducted on students of HKBP Nommensen University Pematangsiantar T.A. 2024/2025. The population in this study were 3rd semester physics education study program students at HKBP Nommensen University Pematangsiantar. The sample determined in this study was a single class of 15 people. This type of research is a one group experiment (experiment with one group), where the research design involves one group of subjects given a certain treatment (Sugiono, 2013). Seeing from the title brought by researchers, instruments commonly used to measure learning quality can be used several instruments such as: written tests, oral tests, practical tests, questionnaires, observations, portfolios, and projects (Kirl: 2012). From the explanation above, the instrument that can be used by researchers in this study is in the form of questions in the form of essays totaling 10 questions to measure the quality of learning, namely the cognitive results of students in experimental courses. where the indicators of cognitive start from C3-C6, and also a questionnaire in the form of a questionnaire to see student satisfaction in using VR in learning with the following:

Table 1 Cognitive Section Learning Quality Instrument for Students

No.	Cognitive Indicators		About
1.	**C3**	Executing	5
		Implementing	2
2.	**C4**	Diffrentianting	1
		Organizing	7
		Attributing	9
3.	**C5**	Checking	6
		Critiquing	3
4.	**C6**	Generating	10
		Planing	4
		Producing	8

Source: (Ulfah & Arifudin, 2023)

Table 2 Student Satisfaction Questionnaire Instrument in the Use of Virtual Reality in Learning

No.	Indikator		Skor			
			1	2	3	4
1.	**Quality of Content**	How clear is the material presented in the VR experience?				
		Is the VR content relevant to the subject matter you are studying?				

2.	**Interaction and Engagement**	How easy was it for you to interact with the elements in the VR application?				
		Did the VR experience make you more engaged in the learning process?				
3.	**User Experience**	How comfortable are you when using VR devices?				
		Did you experience any technical issues during your VR experience?				
4.	**Impact of Learning**	How much has your understanding of the material improved after using VR?				
		Do you feel more prepared to do a real practicum after using VR?				

Source: (Rahma et al., 2024)

The data collection technique in this study is where students will be given a pretest at the beginning to measure their initial cognitive abilities and then researchers will give treatment to students in the form of giving learning using media in the form of virtual reality. After giving treatment to students, the last researcher will give a posttest to students to measure the final ability of students after being treated in learning by using media in the form of virtual reality and given a questionnaire of satisfaction with the use of VR in learning. The data analysis technique used in this study uses 3 data analysis, namely: (1). **Statistical analysis**: using statistical tests (**t-test and ANOVA test**); (2). **Descriptive analysis**: to describe the characteristics of the data; (3). **Inferential analysis**: to make conclusions based on data. The flow of this research is as follows:

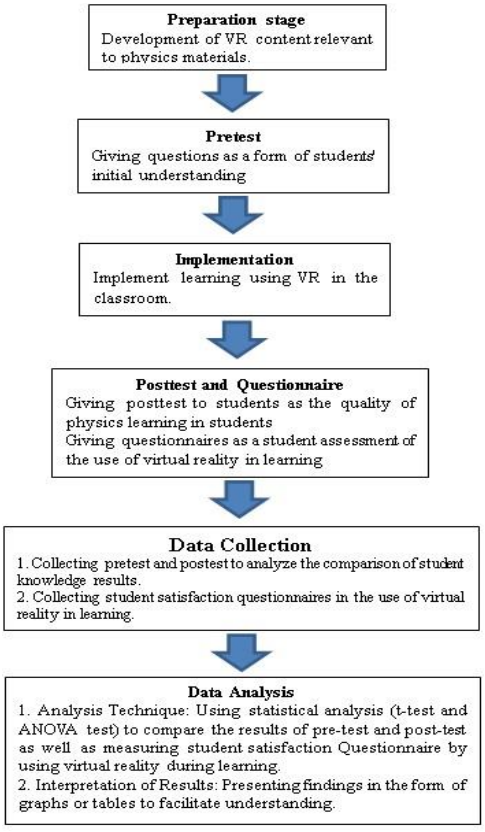

Figure 1 Research Flow

3. RESULTS AND DISCUSSION

1. Cognitive Learning Outcomes

Students' cognitive learning outcomes obtained through pretest and posttest comparisons can be seen from the distribution of data obtained using Ms. Excell, which can be seen in the following table:

Table 3 T-Test: Paired Two Sample for Means

	Pretest	***Posttest***
Mean	73,00	80,33
Variance	18,71	20,95
Observations	15,00	15,00
Pearson Correlation	0,70	
Hypothesized Mean Difference	-	
df	14,00	
t Stat	-8,26	
P(T<=t) one-tail	0,00	
t Critical one-tail	1,76	
P(T<=t) two-tail	**0,00**	
t Critical two-tail	2,14	

Based on the table above shows that (1). Mean on pretest 73.00 and Posttest 80.33 this shows that there is a significant improvement in the quality of learning through cognitive questions given to students; (2). For the t-test is p-value < 0.05, then H_0 is rejected, meaning there is a very significant difference. If the p-value ≥ 0.05, then H_0 is accepted, meaning that there is no significant difference. In table 3, the p-value results show 0.00, it can be concluded that H_0 is rejected, which means that there is a significant difference in the pretest and posttest in students.

The following data distribution of pretest and posttest results can be seen from the bar chart, which is as follows:

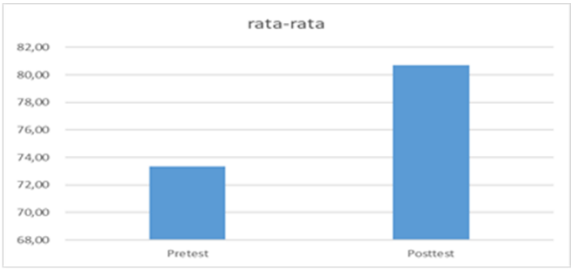

Figure 2 Histogram of One Group Pretest and Posttest Data

2. Annova Test

In addition to the t-test conducted in this study, the Annova test was also carried out. where the Anova test (Analysis of Variance) is basically used to compare the averages of more than two groups. However, the One Way ANOVA test can be used to determine whether there are significant differences in the learning outcomes of students who receive different treatments, such as different teaching methods (Arikunto, 2010). Where the results

of the one way ANOVA test in the study can be seen from the table below:

Table 4 One Group Anova Test on the Effect of Virtual Reality on Student Learning Success: Case Study

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Pretest	15	1095	73	18,71
Posttest	15	1205	80,33	20,95

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	403,33	1	403,33	20,34	**0,00**	4,20
Within Groups	555,33	28	19,83			
Total	958,67	29				

According to (Arikunto, 2010), said that the results of the data obtained from the one way ANOVA test are as follows:

1. If the P value <0.05, then there is a significant difference between the tested groups, so the null hypothesis (H0) is rejected.
2. If the P value is ≥ 0.05, there is no significant difference between the groups.

Then the results of the data obtained we can note the P-value in table 4: (1). F (F-statistic) is a value that indicates whether there is a significant difference between groups. Where in table 4. Shows 20.34.; (2). p - value (Probability) is this value indicates the probability of error in rejecting the null hypothesis (H0). Where in table 4. Shows the result of 0.00; (3) F value and F crit to confirm the conclusion. In table 4. Shows the result at F crit 4.20. To conclude the results of the Anova test is if the p-value <0.05, then the null hypothesis (H0) is rejected, meaning that there is a significant difference between groups. While the p-value ≥ 0.05, then the null hypothesis (H0) is accepted, meaning that there is no significant difference between groups. In table 4. for p-value 0.00 where it can be concluded that H0 < 0.05, which means that H0 is rejected and there is a significant difference between pretest and posttest in one group. And the F-crit got the result of 4.20.

The results obtained from the data above are also closely related to previous researchers who used virtual reality, namely, according to (Sudiarno, 2020) The level of presence of the VR application shows a value of 4.25. This value indicates that the level of presence in MilleaLab VR-based educational media is good, which means that the users already feel completely immersed in the virtual environment virtual environment that is used. According to (Menhard, 2024), also said the results of research that students who learn using VR show higher levels of engagement and better learning outcomes compared to the control group control group. This finding indicates that the integration of VR in the learning process can be an effective strategy to improve engagement and learning outcomes learning process can be an effective strategy to improve student engagement and learning out comes.

3. Student Satisfaction Questionnaire in the Use of Virtual Reality in Learning

The results obtained through the implementation sheet in the use of Virtual Reality in learning, analyzed with the following assessment:

$$\boldsymbol{RSP = \frac{\Sigma X}{N} = \frac{32}{8} = 4\ (very\ good)}$$

Description:

RSP = Average assessment score

∑X = Total score

N = many aspects of assessment

The categories of student satisfaction in using virtual reality in learning are as follows:

Table 5 Categories of Student Satisfaction Questionnaire in the Use of Virtual Reality in Learning

The value obtained	**Categories**
1,00 – 1,49	Not good
1,50 – 2,49	Less Good
2,50 – 3,49	Good
3,50 – 4,00	Very Good

The results of student engagement in the use of virtual reality above are also strongly supported by previous researchers, namely (Menhard, 2024), showing that students who learn using VR show higher levels of engagement and better learning outcomes compared to the control group. These findings indicate that the integration of VR in the learning process can be an effective strategy to improve student engagement and learning outcomes. This research makes an important contribution to the development of educational technology and offers insights for higher education institutions in implementing VR technology to facilitate more effective and engaging learning experiences.

4. CONCLUSION AND SUGGESTION

The conclusion obtained from the results of this study is that there is a significant effect on the use of virtual reality on the quality of student learning: a case study for the average value of cognitive learning outcomes in the pretest 73.00 and posttest 80.33, and the t-test value is 0.00 with the result that H0 is rejected which means there is a significant difference in the data. For ANOVA test data, the p-value also results in 0.00 which means that H0 is rejected which means that there is a significant difference in the data because H0 <0.05. For the student satisfaction questionnaire in the use of Virtual Reality entry is 4.00 in the very good category. This is very good considering the purpose of this study is to determine the effect of using virtual reality on the quality of student learning: a case study.

5. REFERENCES

Adiyanto, W. (2021). Memahami Hambatan Dosen Dan Mahasiswa Dalam Perkuliahan Online : Fenomena Antisipasi Penyebaran Virus Covid-19. *Interaksi: Jurnal Ilmu Komunikasi*, *9*(2), 98–108. https://doi.org/10.14710/interaksi.9.2.98-108

Arikunto, S. (2021). *Penelitian tindakan kelas: Edisi revisi*. Bumi Aksara. http://repo.iain-tulungagung.ac.id/1596/4/BAB%20III.pdf

Astuti, N. W. W., Murniasih, N. N., & Westra, I. K. (2022). Peranan Dan Tantangan Dosen Dalam Proses Belajar Mengajar Di Era Sistem Pembelajaran Daring Pada Masa Pandemi Covid 19. *Journal Mahadewa Indonesia*, *1*(1), 46–54.

Hayati, S. N., Hikmawati, H., & Wahyudi, W. (2017). Pengaruh Model Pembelajaran Inkuiri Dengan Menggunakan Media Simulasi Terhadap Hasil Belajar Fisika Siswa Kelas X MIA SMAN 1 Lingsar Lombok Barat Tahun Pelajaran 2016/2017. *Jurnal Pendidikan Fisika Dan Teknologi*, *3*(1), 48–54. https://doi.org/10.29303/jpft.v3i1.323

Huryati, Ngadimin, Soewarno, S. (2021). Kendala Mahasiswa dalam Perkuliahan Eksperimen Fisika Dasar I Berbasis Laboratorium Virtual pada Prodi Pendidikan Fisika FKIP Universitas Syiah Kuala. *Serambi Akademica Jurnal Pendidikan, Sains, Dan Humaniora*, *9*(7), 1134–1140.

Maharani, A., Falah, M. M., Pramesthi, N., Jati, A., Fisika, J. P., Matematika, F., & Alam, P. (2024). *PENGALAMAN ASISTENSI PRAKTIKUM TERMODINAMIKA*. *8*(2), 334–346.

Menhard. (2024). Dampak Virtual reality terhadap keterlibatan mahasiswa dan hasil belajar di perguruan tinggi the society 5 . 0 era in indonesia. *Jurnal Cahaya Mandalika (JCM)*, *5*(2), 643–656.

Mubarok, W. K., Surabaya, U. N., Anugrah, S., & Surabaya, U. N. (2024). Analisis Media Pembelajaran Berbasis Virtual Reality Melalui Pendekatan Steam Guna Meningkatkan. *AL-IRSYAD: Journal of Psysics Educations*, *3*(2), 57–68.

Najmah, S., Saehana, S., & Sari, N. I. (2019). Deskripsi Kesulitan Mahasiswa Prodi Pendidikan Fisika dalam Melaksanakan Praktikum di Laboratorium. *Jurnal Kreatif Online*, *7*(4), 1–10.

Nurhidayah, A. (2024). *Pengaruh virtual reality (vr) berbantuan model problem based learning (pbl) untuk meningkatkan kemampuan literasi sains siswa*.

Rahma, N. A., Soekamto, H., & Masruroh, H. (2024). Model Probing Prompting Menggunakan Media Virtual Reality Materi Mitigasi Bencana untuk Meningkatkan Motivasi Belajar Geografi SMA. *Journal of Education Action Research*, *8*(1), 1–10. https://doi.org/10.23887/jear.v8i1.67448

Sartika, D., & Humairah, N. A. (2017). Analisis kesulitan memecahkan masalah pada mata kuliah fisika modern mahasiswa calon guru fisika. *Jurnal Pendidikan MIPA*, *7*(1), 7–11.

Siyamsih, D. (2024). Persepsi Mahasiswa Terhadap Penggunaan Virtual Reality dalam Pembelajaran Praktikum Laboratorium. *EduTech Journal*, *1*(1), 25–29. https://doi.org/10.62872/12tsrd26

Sudiarno, A. & G. M. (2020). Evaluasi Media Edukasi Berbasis Virtual Reality: Studi Kasus Virtual Building and Learning SMP Negeri 3 Purwokerto. *Jurnal Teknik Its*, *9*(2), 1–6.

Sugiono. (2013). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (Issue January).

Ubaidillah. (2024). Jurnal Phi Visualisasi Pembelajaran Fisika Menggunakan Virtual Reality Pada Materi Ajar Hukum Hooke. *Jurnal Phi: Jurnal Pendidikan Fisika Dan Fisika Terapan. Vol 10 (1), 2024; ISSN: 2549-7162 Hal. 55-62*, *10*(1), 55–62.

Ulfah, & Arifudin, O. (2023). Analisis Teori Taksonomi Bloom pada Pendidikan di Indonesia. *Jurnal Al-Amar*, *4*(1), 13–22.