

UTILIZATION OF THE MILLEALAB APPLICATION AS A VIRTUAL REALITY MEDIA TO SUPPORT SELF-DIRECTED LEARNING

Muhammad Indra Alkahfi¹, Mastur², Agus Hadi Utama³

^{1,2,3} Teknologi Pendidikan, FKIP, Universitas Lambung Mangkurat, Indonesia

Email: m.indraalkahfi@gmail.com, mastur@ulm.ac.id, agus.utama@ulm.ac.id

ABSTRACT

Self-directed learning is a process of organizing, finding, and even evaluating information or learning messages without help from others. MilleaLab is a VR-based application that can provide an immersive learning experience to support learners when doing independent learning. The purpose of writing this article is to conduct a literature study related to the utilization of MilleaLab application to support independent learning. The research method used is qualitative literature study. Data collection techniques through literature study of 25 relevant research articles within the last five years. Findings: (1) MilleaLab can be used anytime and anywhere according to one's own learning initiative. (2) MilleaLab can improve the understanding of abstract concepts, learning motivation, and learning outcomes of students, (3) MilleaLab is used as an immersive and interesting VR-based alternative learning media. The results of this study not only describe the MilleaLab application, but also the utilization of VR technology through the MilleaLab application to support immersive and interesting independent learning of students.

KEYWORDS Virtual Reality (VR), MilleaLab and Self-directed Learning



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International

INTRODUCTION

In today's era, technological advancements in the field of education are rapidly progressing and can influence students' learning styles. The ease of accessing information through various internet media has been utilized by everyone to find learning materials that suit their preferences. Through effective learning processes, students are indirectly demanded to actively engage in learning activities. One way to make students more actively involved in the learning process is through self-directed learning models. Self-directed learning means learning that is done without

How to cite: Alkahfi, M.I et al. (2024). Utilization Of The Millealab Application As A Virtual Reality Media To Support Self-Directed Learning. *Journal Eduvest*. 4 (4): 2090-2103
E-ISSN: 2775-3727
Published by: <https://greenpublisher.id/>

relying on the assistance of others to manage one's own learning (Triyana I Gusti Ngurah, 2021) . In line with Schunk's opinion (in Nurhidayanti et al., 2022), students in self-directed learning can design, organize, control, and observe their own cognitive processes for personal evaluation. The benefits that students can derive from self-directed learning processes include improving cognitive, affective, initiative, and responsibility skills in completing tasks, as well as enhancing their self-directed learning skills.

However, based on previous research conducted by (Kokan, 2024), it was stated that students' learning independence in PKN subjects has still been classified as very low. This is because during the learning process, students are not focused, lack confidence, motivation, and are still dependent on teachers as the main source of information. This is due to the lack of use of media variations that can provide new immersive and interactive experiences, thus making learning activities tend to be passive and ineffective. Therefore, the use of learning media is needed to assist students when conducting their independent learning activities at home (Utari et al., 2021). According to Zaini (2017) (in Wulandari et al., 2023), to help deliver lesson material, students need intermediaries such as learning media, because with the existence of learning media, students' attention can be drawn, and it can help students solve learning difficulties, as well as help students understand difficult material. The right solution to overcome the aforementioned problem is through the use of learning media that can adapt to their learning styles, especially in creating immersive experiences that make students fully engaged in learning activities motivated by their desire to master the skills they already possess according to Jaleel & anuroofa (in Nurhidayanti et al., 2022). Therefore, the selection of appropriate media will affect the effectiveness of their self-directed learning.

Based on these problems, a transformation in more modern and effective learning media is needed to help students understand difficult abstract concepts that are not easily found in the real environment, so they need media that can transform the condition from the real environment into a digital environment to visualize these abstract concepts. By utilizing digital technology developments through the use of Virtual Reality (VR) technology-based learning media. Virtual Reality (VR) is a technology that allows users to interact directly in areas simulated by computers to create a 3D atmosphere, making users feel as if they are actually involved (Setyawan et al., 2023). VR technology can provide a more immersive and in-depth learning experience to help students better understand difficult abstract learning concepts that are not easily encountered directly (Zulfikri, 2023). The use of VR in learning opens the door to much more dynamic and realistic learning experiences. In learning, VR is also considered more efficient because it can be used anytime and anywhere as long as there is a network (Putra & Aisyah, 2021). For students, the use of VR is not only to see or hear learning material but also enables them to "experience" the material directly. They can explore simulated 3D environments, interact with objects and situations, and solve problems in real contexts. However, many schools still refuse to use VR as a learning media because of the expensive price of VR equipment, lack of understanding of teachers and students about the use of VR, and the difficulty of creating VR-based content because it requires a high-spec laptop for coding (Agusty, 2020). One of the VR-based learning media that is easy to

use for teachers and students to support their self-directed learning is the MilleaLab application.

The MilleaLab application is an all-in-one Virtual Reality (VR) platform that can support the creation and access of Three-Dimensional and Virtual Reality (VR) based educational content easily, quickly, and affordably (Cahyaningtiyas, 2020). According to (Agusty & Anggaryani, 2021), Millealab is a platform for creating VR media with simpler features to create good realistic visualizations to support teaching and learning processes. This application contains interactive VR-based content and can be accessed online and offline. Students can access it in three modes, namely VR, 360, and non-gyro, which allow students to access content interactively and realistically (Sari et al., 2023). The MilleaLab application has several features, one of which is the "Explore" feature which contains several subjects from junior high school to high school that can be accessed for free via smartphones. The MilleaLab application also provides convenience for teachers to create VR-based content materials themselves using free provided assets without the need for coding, and for students, of course, it can provide an interesting learning experience while playing games but still able to deliver the essence of learning.

Based on the background, the author is interested in conducting literature of research contained in journal articles or theses related to the utilization of the MilleaLab application as a virtual reality media to support self-directed learning. The purpose of writing this article is to explain what the MilleaLab application is and its advantages, and to describe the Utilization of the MilleaLab Application as a Virtual Reality Media to Support Self-Directed Learning based on several previous researches as references.

RESEARCH METHOD

The type/method of research used is qualitative literature study method to describe what the MilleaLab application is, its features, advantages, and also to describe the utilization of the MilleaLab Application as a Virtual Reality Media to Support Self-Directed Learning. Literature study research is a research design used to collect reading sources or literature data through a collection of journals, books, documents, and other resources related to the topic. Meanwhile, according to Borden and Abbott (2005) (in Tri Wulandari & Adam Mudinillah, 2022), literature study is a process in which researchers locate, obtain, read, and evaluate research literature related to the issue being studied. Literature study aims to describe the main content based on the collected information (Herliandry et al., 2020) (in Syofian & Gazali, 2021). According to Kuhlthau (2002) (in Sri Rosdiana et al., 2022), the steps of literature study include; (a) topic selection, (b) exploration of relevant information, (c) clarification of the focus to be studied, (d) data collection, (e) data presentation, and (f) report writing.

The data collection technique in this research is by collecting information notes through proceedings and relevant journals within a maximum of the last five years. Starting from reading abstracts, introductions, methods, and conclusions to obtain findings and conclusions. The data sources used for writing literature studies come from journals, articles, or other research results taken from Google Scholar, SINTA, and Scopus databases containing the concept being studied, namely the

utilization of the MilleaLab application as a virtual reality media to support self-directed learning. Keywords used to search for relevant articles include utilization of virtual reality, MilleaLab, and self-directed learning.

The analysis technique used is content analysis. According to Krippendoff (1993) (in (Ummah, 2020), content analysis is used to obtain valid and repeatable information based on its context. To address misinformation, a literature recheck is conducted. There are several stages in content analysis: First, the stage of describing what is to be studied. Second, the stage of reducing all obtained information to focus on specific issues. And third, the selection stage to elaborate on the established focus into more detailed and in-depth data or information obtained.

RESULT AND DISCUSSION

Factors Affecting Self-Directed Learning

One of the biggest challenges in education today is the difficulty in facilitating the diverse learning styles of students, as each individual has their own unique learning style. To address this challenge, optimizing individual or self-directed learning methods is essential. Self-directed learning, according to Sunarto (2008) (in Mulia dkk., 2023), refers to the ability of students to engage in learning activities independently without assistance from others, based on their own desire to master a particular skill, which can then be used to solve real-world problems. Research by (Biru et al., 2020) also suggests that self-directed learning is an individual process of learning without assistance from others, supported by digital and mobile technologies, with several technology applications being developed to support the concept of self-directed learning.

Self-directed learning has many benefits for students, as studies by (Mulyadi & Syahid, 2020) suggest, including improving cognitive abilities, fostering critical thinking, nurturing a sense of responsibility, training the mind, enhancing learning skills, problem-solving abilities, and fostering decision-making skills. The more honed their self-directed learning abilities are, the easier it becomes for them to engage in the learning process. There are also factors that can influence the achievement of self-directed learning, such as (Oishi, 2020):

- a. **Characteristic Factors:** This includes a student's prior experience with self-directed learning to form new knowledge supported by those experiences.
- b. **Psychological Factors:** This encompasses environmental factors that support learning and finding the right learning style for them. Interest also plays a significant role in their psyche, driving them to take initiative in learning.
- c. **Ability Factors:** This includes organizing, managing, and motivating oneself to learn independently without depending on others. These abilities help them achieve their learning goals.
- d. **Skills Factors:** The skills referred to here involve critical and creative thinking to understand abstract concepts that may be challenging to grasp. They also need to be skilled in seeking information sources and integrating that information to solve problems. According to research by (Rukmi Kusuma Ningrum et al., 2019), cognitive aspects or critical thinking skills significantly impact the learning process.

Factors that can hinder the self-directed learning process include lack of motivation, ineffective learning environments, learning experiences that do not increase student engagement, and in self-directed learning, a student's success is greatly influenced by their motivation and learning style. To enhance motivation, cognition, and provide deep learning experiences with difficult-to-find abstract concepts directly, digital-based learning environments are necessary. As Merriam & Bierema (2013) (in Jaelani, 2021) suggest, a learning environment supported by digital technology can help students meet their learning needs. Thus, it can be concluded that self-directed learning is an individual process of discovering one's own learning style based on their own desire to manage, organize, and evaluate their learning process, supported by digital technology to facilitate independent learning.

Benefits and Barriers of Using Virtual Reality (VR) in Learning

Virtual Reality (VR) is a technology that allows users to interact with a simulated real-world environment in a virtual world, making it appear real (T. D. Wulandari et al., 2022). The use of the latest technology-based media such as VR can provide beneficial learning experiences for students to face all challenges in their lives (Atsani, 2020) (in Widyawati & Sukadari, 2023). In learning, VR technology can provide immersive learning experiences and visualize difficult-to-find objects directly, making it easier for students to observe such abstract objects only through the virtual world. The use of VR in learning also has many benefits for students.

With VR, it is possible to increase student engagement and motivation (Zulfikri, 2023). This is because VR can deepen the experience by immersing users in the virtual world, leading to deeper engagement with the material and increasing motivation to learn. The use of VR in learning can also increase their curiosity about new things, as they can interact directly with 3D objects visualized realistically. Thus, they develop their own desire to learn. Another benefit of VR is that it can enhance students' creativity and critical thinking skills, as VR is immersive and interactive, encouraging them to think critically, solve problems, and make decisions in a virtual environment. Through simulation, they can explore further from different perspectives, analyze complex situations, and develop creative solutions (Arini, 2023). In line with research by (Novianty et al., 2020), VR can facilitate users in observing elements such as atoms that are difficult to observe directly, requiring high-level thinking processes. Therefore, it is necessary to use technology to visualize these atoms in digital form to facilitate learning about them. According to (Fardani, 2020), VR can also improve student learning outcomes, as they can apply their knowledge directly and personalize their learning experiences according to their own learning styles, thus supporting different instructions and improving academic achievement. Consistent with research by (Zulherman et al., 2021), who stated that the implementation of virtual reality (VR) technology in science learning in elementary schools can improve conceptual understanding, students' acceptance of VR is excellent, and teachers also feel assisted by the use of VR media to support the learning process; this conceptual understanding will affect their learning outcomes.

However, there are several barriers encountered in learning when using virtual technology, such as the high cost of VR devices like headsets, controllers, and computers. VR software such as applications or platforms are also still quite rare and not compatible with various devices, which can limit the accessibility of VR use in learning. Additionally, there are other barriers related to the use of VR technology in learning, such as causing dizziness and nausea for students if used for too long (Shabir, 2022). Another obstacle is the creation of VR content; many teachers struggle to create VR content because creating content requires programming languages and high-spec laptops, making the creation process time-consuming. Therefore, the provision of VR-based platforms or applications that collaborate with smartphones is needed to provide convenience and reduce these barriers in learning.

MilleaLab Application

One form of convenience in using VR technology as a learning medium nowadays is through the MilleaLab application. MilleaLab is a platform/application for creation and learning based on 3D and VR media. This application utilizes cloud technology, making it easy for students to access the virtual world created by teachers. MilleaLab allows users to interact in a computer simulation environment. According to (Yanto et al., 2023), MilleaLab serves as an alternative for students who have difficulty understanding self-taught materials during remote learning. The application also provides comprehensive guidance/tutorials on how to use it, eliminating the need for assistance from others. The content material in this application can be accessed in three modes: VR, 360, and non-Gyro (Sari et al., 2023). However, on smartphones, only two modes are available: 360 Mode, which allows access to content from a 360-degree perspective, and non-gyro mode, which enables access to content using swipe buttons without requiring a gyroscope. The MilleaLab application can be downloaded for free on Play Store/App Store (Efendi et al., 2021).

MilleaLab can present a 3D virtual environment resembling a metaverse through various VR-based content materials based on school levels from junior high to senior high school. All content materials can be learned individually because VR technology can adapt to their own learning styles. MilleaLab also offers thousands of ready-to-use assets, including environments, human assets, and other learning assets, all for free. MilleaLab not only relies on learning materials from the environment but also provides information in written form, as well as audio and video (audiovisual). Some features available in MilleaLab include:

1. Pop-up information feature, which displays learning information when students interact with it. Additionally, there is an interactive feature used to create quizzes that students can work on (Anggaryani et al., 2023).
2. Cloud storage feature, which serves as storage space. When downloading VR content materials in MilleaLab, they will be saved to cloud storage, thus saving space on the smartphone's storage. The downloaded content can be accessed offline (Oktoviandry et al., 2023).
3. Standpoint interaction feature, used as a starting point for students to walk around. This feature allows students to operate their avatars.

4. Data behavior feature, through which educators can monitor students' activities and behaviors while accessing learning content (Efendi et al., 2023).

MilleaLab is one of the alternatives for using VR technology in collaboration with smartphones to create more interactive teaching media to engage students and improve learning outcomes. Based on research conducted by (Febriana et al., 2023), the development of media using the MilleaLab application in mathematics subjects in elementary schools showed excellent value for use, providing convenience and experiences for fourth-grade elementary school students with mathematical spatial building materials, as seen from the percentage response of students, which was 97.6%, categorized as excellent. According to research findings by (Agusty, 2020), MilleaLab can present VR content effectively, which can enhance understanding and interest in the concept of global warming.

Utilization of the MilleaLab Application to Support Self-Learning

The MilleaLab application can provide good accessibility in organizing and managing learning activities both within and outside the school environment, as well as offering an immersive and engaging learning experience. Below are the benefits that participants can derive, such as experiencing immersion and focusing on their individual learning styles, thus enhancing motivation, cognitive abilities influencing their learning outcomes, and optimizing their study time. There are several reasons for using the MilleaLab application as an alternative VR-based media supporting self-learning:

1. Ease of Use

This application can be downloaded for free via smartphone. Students can access content with three selectable modes from their smartphones such as VR, non-Gyro, and 360-degree content, content on MilleaLab can also be downloaded for offline access by learners. Here's the display to select the Mode under Content that can be seen through figure 1.



Figure 1. Choice of Three Content Modes

This application also does not have many features that can make it difficult for students to utilize. At MilleaLab there are also personal tutorials that can help direct students to do their learning. According to research (Darajat et al., 2022) in the development of solar systems through VR technology can be used at home for independent learning. One example of a feature available in millealab that is used to help facilitate students in learning is through the stand point interaction feature which is used as a step point for students to walk, this feature allows students to easily run their own avatars according to the points that have been given. The following display of the Stand Point interaction feature can be seen through figure 2.



Gambar 2. Fitur Stand Point Interaction

2. Time Efficiency

Because through MilleaLab they can explore various locations that are difficult to visit directly, with VR technology students can explore these locations easily which can be accessed via smartphones only. According to (Arsadhana et al., 2022) MilleaLab can be an alternative for students to organize their own learning which can be done anywhere and anytime without limited space and time according to the initiative of the learners themselves. This application has an explore feature that can help them to choose what material they want to learn, there are several materials that can be accessed and downloaded by students. This can streamline their learning time with a safe and controlled environment. The following is the display of the Explore feature to find material content can be seen through figure 3 below.



Figure 3. Explore Material Content Features

3. Providing Personalized and Adaptive Experiences to Participants

Because through interactive simulations and virtual tutors, learners can receive live feedback and tutorials tailored to their individual needs. With VR can adjust to different learning styles, offering various modes of interaction such as visual, auditory, and kinesthetic. This individually personalized approach encourages independent learning and helps understand complex concepts more effectively.

According to (Arini, 2023) VR allows providing a personalized learning experience to itself by fulfilling its learning style so that it supports different instructions. The immersive and interactive nature of VR will increase student engagement which affects learning outcomes. There are also features that can bring them to interact directly in the virtual world such as the use of 3D assets or interactive animations that can make them feel the virtual world as if it looks real. An example is the Pop up feature. This feature can be clicked by students to bring up information through pop ups. Here is the pop up feature that can be seen through figure 4 below.



Figure 4. Features 3D Asset Pop up and Interactive Animations

4. Enhancing Participants' Critical and Creative Thinking Skills

Through virtual environments can present learners with complex and challenging concepts. With simulation-based will encourage learners to analyze complex problems, make decisions and solve those problems. Problem-solving experiences through VR can encourage higher-order thinking skills and encourage them to think creatively and make judgments based on the information they obtain.

5. Facilitating Teachers and Participants in Delivering Materials

Through MilleaLab teachers can create VR-based material content using only the *drag n drop* system available on this application without the need for coding, so teachers will no longer have difficulty in creating VR content. Teachers can also share this created material with students through the *Classroom* feature on MilleaLab, so that students can directly enter the *classroom* through the class code

provided. Here's what the Classroom Features look like that can be seen in figure 5.



Figure 3. Fitur Classroom

Here students can carry out the learning process independently without requiring guidance from others because in the VR content itself there are virtual tutorials that can help them solve a problem. This classroom system also makes it easier for students to review material they don't understand.

6. Measuring the Ability and Knowledge of Students

MilleaLab presents a quiz system that can be used by students to measure how far they understand the material they have learned. The value of this quiz can also be used as material for evaluation of its own learning outcomes.

In addition, through providing feedback from real-time assessments that automatically appear immediately when they have completed an activity or quiz will make it easier to measure their knowledge. Feedback can also be found through the pop up feature when they are interacting with animations or assets in a virtual world. This is very helpful for students to be actively involved in their learning activities.

7. Analyzing Student Activities

Through the *Student Tracking Behavior* feature, teachers can see the progress of students when accessing the learning content created. The results of the analysis will be recorded automatically by the system on the MilleaLab dashboard. This feature can make it easier for teachers to be able to see the behavior of students when they are doing the learning process using this MilleaLab application, so that independent learning activities can still be supervised by teachers easily. Tracking student behavior is also useful as evaluation material to create a better classroom environment so that it can encourage changes to their behavior/attitudes to support their independent learning activities. The following example of the Student Tracking Behavior Feature can be seen through figure 6 below.

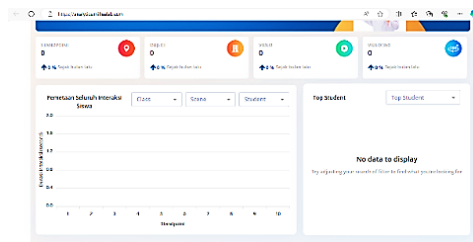


Figure 4. Fitures Student Tracking Behavior

CONCLUSION

The utilization of the MilleaLab application greatly assists learners in supporting self-learning activities, enhancing learning motivation, improving cognitive abilities that impact learning outcomes, and helping to optimize study time. Teachers also find assistance from this application as they can directly monitor their students' learning activities. With various features provided in this application, it supports self-learning because it is very easy to use. Utilizing VR technology in learning activities does not mean fully replacing the role of the teacher as a learning resource. The important role of the teacher is to teach, educate, and train to build the skills, knowledge, and morals of learners. Therefore, the utilization of the MilleaLab application as a VR media in self-learning requires the involvement of parents and teachers in equipping, supervising, and evaluating learners in its use. This ensures that they can utilize this application correctly and effectively.

REFERENCES

- Agusty, A. I. (2020, October 17). Millealab Media Pembelajaran Fisika Berbasis Virtual Reality untuk Mengajarkan Topik Pemanasan Global. *SEMINAR NASIONAL FISIKA (SNF) 2020*, 104–110.
- Agusty, A. I., & Anggaryani, M. (2021). Teaching Global Warming with Millealab Virtual Reality. *Jurnal Pendidikan Fisika*, 9(2), 134–144. <https://doi.org/10.26618/jpf.v9i2.5084>
- Anggaryani, M., Prastowo, T., Suprpto, N., Lassa, J., Madlazim, Alifteria, F. A., Agusty, A. I., & Lestari, N. A. (2023). Virtual Reality as Experiential Learning to Promote STEM-DRR in Tertiary Education. *ASM Science Journal*, 18. <https://doi.org/10.32802/ASMSCJ.2023.1370>
- Arini, R. E. (2023). Merangkul Teknologi: Mengintegrasikan Realitas Virtual dalam Pengalaman Pembelajaran. *Jurnal Pendidikan West Science*, 01(06), 350–356.
- Arsadhana, I. W. A. S., Dewi, N. K. R. S., & Putri, N. K. J. K. (2022). APLIKASI PEMBELAJARAN BERBASIS VIRTUAL REALITY SEBAGAI INOVASI PENDIDIKAN BERKELANJUTAN DI ERA SOCIETY 5.0. *Prosiding Webinar Nasional Pekan Ilmiah Pelajar (PILAR)*, 736–740.
- Biru, R. C. B., Saepudin, A., & Sardin. (2020). ANALISIS LITERASI DIGITAL TERHADAP PEMBELAJARAN MANDIRI DI MASA PANDEMI

- COVID-19. *INDONESIAN JOURNAL OF ADULT AND COMMUNITY EDUCATION*, 2(2), 61–69.
- Cahyaningtiyas, J. (2020, December). *MILLEALAB-Solusi Virtual Reality Terintegrasi bagi Dunia Pendidikan*. LinkedIn. <https://id.linkedin.com/pulse/millealab-solusi-virtual-reality-terintegrasi-bagi-cahyaningtiyas>
- Darojat, M. A., Ulfa, S., & Wedi, A. (2022). PENGEMBANGAN VIRTUAL REALITY SEBAGAI MEDIA PEMBELAJARAN SISTEM TATA SURYA. *JKTP: Jurnal Kajian Teknologi Pendidikan*, 5(1), 91–99. <https://doi.org/10.17977/um038v5i12022p091>
- Efendi, Y., Muzawi, R., Rio, U., & Lusiana, L. (2021). Aplikasi 3D VR Class Sebagai Inovasi Media Pembelajaran Ditengah Pandemi. *Jurnal Teknologi Dan Sistem Informasi Bisnis*, 3(2), 419–424. <https://doi.org/10.47233/jteksis.v3i2.304>
- Efendi, Y., Nasution, T., Yanti, R., & Riau, S. A. (2023). Workshop Virtual Reality bagi Guru untuk Meningkatkan Inovasi Pembelajaran pada SMK Muhammadiyah 2 Pekanbaru. *Community Education Engagement Journal*, 5(1), 1–13. <http://journal.uir.ac.id/index.php/ecej>
- Fardani, A. T. (2020). E-Tech Penggunaan Teknologi Virtual Reality Untuk Sekolah Menengah Pertama Pada Tahun 2010-2020. *E-Tech*, 08(1), 1–11. <https://doi.org/10.1007/XXXXXX-XX-0000-00>
- Febriana, D., Asih, I. V., & Subhan Pamungkas, A. (2023). PENGEMBANGAN MEDIA PEMBELAJARAN VIRTUAL REALITY BERBANTU MILLEA LAB PADA MATA PELAJARAN MATEMATIKA DI SEKOLAH DASAR. *Jurnal Pendidikan Dasar*, 11(2), 2023.
- Jaelani, A. J. (2021, November 30). LITERASI DIGITAL DAN PEMBELAJARAN MANDIRI. *Prosiding Seminar Nasional Pendidikan Sultan Agung (SENDIKSA-3)*, 3, 30–41.
- Kokan, K. (2024). FAKTOR-FAKTOR PENYEBAB RENDAHNYA KEMANDIRIAN BELAJAR SISWA KELAS VII PADA MATA PELAJARAN PKN DI SMP NEGERI 2 WAIGETE KECAMATAN WAIGETE KABUPATEN SIKKA. *Compas: Journal of Education and Counselling*, 1(3), 32–43.
- Mulia, E., Aprison, W., Zakir, S., & Sesmiarni, Z. (2023). Pengaruh Model Pembelajaran Mandiri Tipe Savi (Somatic, Auditory, Visualization, Intellectually) terhadap Kemandirian dan Minat Belajar Santri pada Pembelajaran Fiqh Kelas VIII di MTsS PPMTI Bayur. *Journal on Education*, 05(02), 6001–6011.
- Mulyadi, M., & Syahid, Abd. (2020). Faktor Pembentuk dari Kemandirian Belajar Siswa. *Al-Liqo: Jurnal Pendidikan Islam*, 5(02), 197–214. <https://doi.org/10.46963/alliqo.v5i02.246>
- Novianty, I., Sholihah, W., & Aditama, Y. (2020). Aplikasi Virtual Reality Atom Kimia Di Seamolec. *MATRIK: Jurnal Manajemen, Teknik Informatika Dan Rekayasa Komputer*, 19(2), 257–262. <https://doi.org/10.30812/matrik.v19i2.718>

- Nurhidayanti*, A., Nofianti, E., Kuswanto, H., Wilujeng, I., & Suyanta, S. (2022). Analisis Kemandirian Belajar Peserta Didik SMP Melalui Implementasi LKPD Discovery Learning Berbantuan Augmented Reality. *Jurnal Pendidikan Sains Indonesia*, 10(2), 312–328. <https://doi.org/10.24815/jpsi.v10i2.23719>
- Oishi, I. R. V. (2020). PENTINGNYA BELAJAR MANDIRI BAGI PESERTA DIDIK DI PERGURUAN TINGGI. *IKRA-ITH Humaniora*, 4(2).
- Oktoviandry, R., Affandi Arianto, M., & Arni, R. (2023). Developing Virtual Reality-Based Learning Media in Introduction to Psycholinguistics Class. *Journal of English Language Teaching*, 12(1), 361–371. <https://doi.org/10.24036/jelt.v12i1.122393>
- Putra, A. S., & Aisyah, N. (2021). SISTEM PEMBELAJARAN ONLINE MENGGUNAKAN VIRTUAL REALITY. *Prosiding Seminar Nasional Pendidikan*, 295–303. <https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/610>
- Rukmi Kusuma Ningrum, N., Toenlio, A. J., & Abidin, Z. (2019). ANALISIS PEMANFAATAN SEARCH ENGINE DALAM MENINGKATKAN SELF-REGULATED LEARNING MAHASISWA TEKNOLOGI PENDIDIKAN. *JKTP*, 2(2), 149–157. <http://journal2.um.ac.id/index.php/jktp/index>
- Sari, I., Sinaga, P., Hernani, H., Mudzakir, A., & Santria, A. (2023). Using Virtual Reality as Learning Tools on Chemistry: Advantages and Challenges. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, 8(1), 49–60. <https://doi.org/10.24042/tadris.v8i1.14593>
- Setyawan, M. D., El Hakim, L., & Aziz, T. A. (2023). Kajian Peran Virtual Reality (VR) Untuk Membangun Kemampuan Dialogis Siswa Dalam Pembelajaran Matematika. *Jurnal Pendidikan Indonesia*, 4(02), 122–131. <https://doi.org/10.36418/japendi.v4i02.1592>
- Shabir, A. (2022). Ujicoba Penggunaan Teknologi Virtual Reality sebagai Media Pembelajaran. *JURNAL PENDIDIKAN TAMBUSAI*, 6(1), 696–702. <https://www.youtube.com/watch?v=I3E7LtxySmk&list=PLVefD23kvZxXIxesJLXF4BwC>
- Sri Rosdiana, L., Gusti Amparan Wangi, R., Febyanti, R., & Hidayatullah Firmansyah, F. (2022). Analisis Pengaruh Bimbingan Karir terhadap Siswa SMK: Studi Kepustakaan. *Jurnal Ilmu Kependidikan*, 11(1).
- Syofian, M., & Gazali, N. (2021). Kajian literatur: Dampak covid-19 terhadap pendidikan jasmani. *Journal of Sport Education (JOPE)*, 3(2), 93. <https://doi.org/10.31258/jope.3.2.93-102>
- Tri Wulandari, & Adam Mudinillah. (2022). Efektivitas Penggunaan Aplikasi CANVA sebagai Media Pembelajaran IPA MI/SD. *Jurnal Riset Madrasah Ibtidaiyah (JURMIA)*, 2(1), 102–118. <https://doi.org/10.32665/jurmia.v2i1.245>
- Triyana I Gusti Ngurah. (2021). 1425-2758-1-SM. *PURWADITA: JURNAL AGAMA DAN BUDAYA*, 5(1), 25–30. <http://jurnal.stahnmpukuturan.ac.id/index.php/Purwadita>

- Ummah, L. (2020). STUDI KEPUSTAKAAN ART THERAPY TERHADAP PERILAKU HIPERAKTIF ANAK AUTIS. *JURNAL PENDIDIKAN KHUSUS*, 1–5.
- Utari, E. N. D., Sulton, S., & Adi, E. P. (2021). Pengembangan Media Pembelajaran Daring Materi Sistem Pernapasan Manusia Untuk Pebelajar Sekolah Menengah Pertama. *JKTP: Jurnal Kajian Teknologi Pendidikan*, 4(3), 260–269. <https://doi.org/10.17977/um038v4i32021p260>
- Widyawati, E. R., & Sukadari. (2023). Pemanfaatan Media Pembelajaran Berbasis Teknologi sebagai Alat Pembelajaran Kekinian bagi Guru Profesional IPS dalam Penerapan Pendidikan Karakter Menyongsong Era Society 5.0. *Proceedings Series on Social Sciences & Humanities*, 10, 216–225. <https://doi.org/10.30595/pssh.v10i.667>
- Wulandari, A. P., Salsabila, A. A., Cahyani, K., Nurazizah, T. S., & Ulfiah, Z. (2023). Pentingnya Media Pembelajaran dalam Proses Belajar Mengajar. *Journal on Education*, 05(02), 3928–3936.
- Wulandari, T. D., Widiyatmoko, A., & Pamelasari, S. D. (2022). KEEFEKTIFAN PEMBELAJARAN IPA BERBANTUAN VIRTUAL REALITY UNTUK MENINGKATKAN KEMAMPUAN KOGNITIF SISWA SMP DI ABAD 21: REVIEW ARTIKEL. *PROCEEDING SEMINAR NASIONAL IPA XII*, 106–115.
- Yanto, B., Supriyanto, A., Riki Mustafa, S., & Jawa Kota Solok, K. (2023). PELATIHAN PENINGKATAN INOVASI VIRTUAL REALITY (VR) MILLEALAB BAGI GURU SDN 05 KAMPUNG JAWA KOTA SOLOK. *Communnity Development Journal*, 4(2), 1782–1788.
- Zulfikri, A. (2023). Dampak Implementasi Teknologi Virtual Reality dalam Pembelajaran Matematika pada Siswa Sekolah Dasar di Kabupaten Sukabumi. *Jurnal Pendidikan West Science*, 01(06), 258–265.
- Zulherman, Z., Aji, G. B., & Supriansyah, S. (2021). Android Based Animation Video Using Millealab Virtual Reality Application for Elementary School. *JPI (Jurnal Pendidikan Indonesia)*, 10(4). <https://doi.org/10.23887/jpi-undiksha.v10i4.29429>