The Effect of Immersive Learning on Students' Cognitive and Affective Aspects

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Abstract

Deep learning or what is known as "Immersive Learning" is becoming an issue that is being studied a lot because of the application of technology in the process. The role of technology in this case is utilized to realize deep learning. Immersive Learning is applied by several methods, including online and blended. However, there are not many research articles that explicitly focus on Immersive Learning. Therefore, for the purpose of this review, several academic articles dealing with the specific topic of immersive learning have been selected and studied. Several topics have been searched using keywords related to immersive learning on academic search engines such as Springer, and Google Scholar, as well as on several other reputable academic journal publishing websites. The articles reviewed were sixteen articles published in the last five years. Based on the results of the article review, it can be concluded that immersive learning not only has a negative impact, but also has a positive impact on students' cognitive and affective aspects. Cognitive aspects include understanding and other academic abilities, while affective aspects include self-efficacy, motivation, and student attitudes towards subjects at school. With this review, it is hoped that teachers and educators will pay more attention to the positive and negative effects of this immersive learning process, so that they can optimize the learning outcomes obtained by students from the learning process, especially Natural Science subjects.

Keywords: effect, affective, cognitive, immersive learning

1. Introduction

The Covid-19 pandemic has changed many things in the world of education, one of which is the change in learning methods that take place quickly and thoroughly. This will indirectly affect the student's learning experience. Learning that is usually done face-to-face in class or in a certain place, has now turned into a distance learning method with an online mode, where the teacher and students are in separate places. Distance learning requires the role of technology in it (Ong et al., 2021; van Thao et al., 2021; Herman et al., 2023). The use of technology in education is positively welcomed by students and educators. This is due to the positive impact caused by the use of technology in the learning process (Pletz & Zinn, 2020). It was further explained that the use of technology supports success in learning. Learning using technology today can be applied fully online or blended. Markowitz et al. (2018) saw that the media in immersive learning serves as a complement to conventional learning. Technological sophistication cannot completely replace the role of the instructor (teacher) (Webster, 2016; Herman et al., 2022), so the combination of using technology is considered to be a pioneer in more effective learning. The use of technology in learning is considered to be able to foster students' motivation and interest in learning, when compared to the use of traditional learning methods using only lectures and texts (Parong & Mayer, 2021; Silalahi et al., 2022). Rao & Saha (2019) in their research said that the existence of sophisticated technology can help school-level students to be able to learn independently.

The role of technology so far has supported many learning methods, especially immersive learning methods [(Markowitz et al., 2018), (Molan et al., 2022), (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Reilly et al., 2021), (De Back et al., 2021), (Cheng, 2021), (Parong & Mayer, 2021), (Rao & Saha, 2019), and (Georgiou et al., 2021)]. Immersive learning is the latest trend in education. Such learning applies a simulated or artificial environment to create a better learning experience (Rao & Saha, 2019). Virtually immersive learning can make it easier for students to access an environment that is difficult to reach or has limited exploration (Markowitz et al., 2018). Through the immersive nature of this virtual environment, it will allow students to overcome these limitations (Winkelmann et al., 2020). This makes it easier for them to access all types of environments in a relatively short time. However, according to De Back, Tinga, & Louwerse (De Back et al., 2021; Munthe et al., 2021), there needs to be adequate preparation for the application of immersive learning involving technology. Because in previous research it was found that there were obstacles in the form of network connectivity, so that it affected the use of technology in the immersive learning process (Cheng, 2021). However, if implemented properly, immersive learning will have an effect on students' cognitive and affective aspects, because the results of previous studies have shown that learning design will affect the success of implementing immersive learning (Molan et al., 2022), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Winkelmann et al., 2020), (De Back et al., 2021), (Wang et al., 2021), (Huang et al., 2020), (Georgiou et al., 2021), and (Ong et al., 2021). The cognitive aspect in question is in the form of learning outcomes and students' conceptual understanding (Markowitz et al., 2018), (Molan et al., 2022), (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Winkelmann et al., 2020), (Reilly et al., 2021), (De Back et al., 2021), (Cheng, 2021), (Parong & Mayer, 2021), (Mills & Brown, 2021), (Huang et al., 2020), (Rao & Saha, 2019), (Georgiou et al., 2021), and (Ong et al., 2021), while the affective aspect is are attitudes and concerns (Markowitz et al., 2018), (Petersen et al., 2020), (Winkelmann et al., 2020), (Mills & Brown, 2021), (Georgiou et al., 2021), and (Ong et al., 2021), self-efficacy (Molan et al., 2022), (Petersen et al., 2020), (Winkelmann et al., 2020), and (Reilly et al., 2021), interest and motivation to learn (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Cheng, 2021), (Parong & Mayer, 2021), (Mills & Brown, 2021), (Wang et al., 2021), (Huang et al., 2020), (Georgiou et al., 2021), and (Ong et al., 2021), and student performance and experience (Winkelmann et al., 2020), (Cheng, 2021), and (Wang et al., 2021). Therefore, in this article the author will discuss in more detail the role of immersive learning on the cognitive and affective aspects of students through literature studies from various articles from previous research.

2. Research Method

The literature review method was used in this study. First, articles related to the theme of Immersive Learning (IL) were explored. Exploration was limited to journals published from 2016 to 2022. Google Scholar, Springer, and several Q1 and Q2 sites were used to search for articles related to IL. All articles reviewed are the results of research conducted by researchers in several countries in the world. Meanwhile, because the use of the keyword "Immersive Learning" proved difficult to filter out relevant articles, the author used other terms that have similar meanings and are related to search to filter articles. Some other keywords used are Immersive Learning, Immersive Education, Learning in Immersed, Immersive Virtual Environment, and others. From a total of approximately 60 articles obtained, further selection was carried out to obtain 16 relevant articles. Next, the key points from the results and discussion of each article are analyzed. The results of the analysis will then be used to create a framework for the article. Making the outline of the article begins with writing the main sentence which will be discussed in detail in the form of paragraphs. Then, a detailed explanation is written in the results section and a discussion based on the important points that have been obtained.

3. Results and Discussion

Immersive Learning

Immersive learning or immersive learning is known to have various meanings. One of the explanations that can be concluded from the results of the study of several articles on immersive learning is learning that provides in- depth experiences for students, making students seem to be in a situation where the reality is not fully accessible to them. Markowitz et al. (2018), but with immersive learning, all these limitations will be reachable by students and provide a meaningful experience for them [(Rao & Saha, 2019) & (Winkelmann et al., 2020)]. Immersive learning provides a simulation environment to provide a better learning experience. In addition, attractive design and content are one of the key aspects of immersive learning (Rao & Saha, 2019). Meanwhile, according to Markowitz et al. (2018), immersive learning has a positive influence on students. Through this learning, students' knowledge becomes better and their positive attitude towards the environment also increases. In more detail, it was explained that the existence of a sense of connection felt by students about environmental problems during immersive learning made their concern even greater. Students feel more of the reality of these problems and stimulate their concern to find solutions.

Immersive learning supported by virtual learning provides a valuable experience for students, because the virtual scenarios created bring students into a realistic learning environment (Molan et al., 2022) and encourage the creation of inquiry learning (Cheng, 2021). That is, immersive learning is learning with a student center approach and the teacher

only as a facilitator. Students who are actively involved in immersive learning will have the potential to experience increases in learning outcomes, learning motivation (Pletz & Zinn, 2020), self-efficacy (Petersen et al., 2020), caring attitudes (Mills & Brown, 2021), and their experiences (Cheng, 2021). Immersive learning is carried out in various ways, some of which are through the use of Virtual Reality (VR) multimedia technology (Markowitz et al., 2018), (Webster, 2016), (Cheng, 2021), (Mills & Brown, 2021), (Huang et al., 2020), & (Georgiou et al., 2021), Augmented Reality (AR) technology (De Back et al., 2021), via desktop or 3D video (Petersen et al., 2020), (Winkelmann et al., 2020), & (Parong & Mayer, 2021), interactive games (Wang et al., 2021), learning platforms (Rao & Saha, 2019). All methods used in immersive learning require technology. It is this technology that is able to create an immersive virtual environment, which has untapped potential in increasing the potential for learning outcomes (De Back et al., 2021).

It is known from the analysis of several research articles that success in immersive learning depends on how well the lesson plans are and how well the learning methods are applied in immersive learning (Molan et al., 2022), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Winkelmann et al., 2020), (De Back et al., 2021), (Wang et al., 2021), (Huang et al., 2020), (Georgiou et al., 2021), & (Ong et al., 2021). If immersive virtual learning tools are designed and applied appropriately in learning and effectively engage students, it will improve their learning outcomes (Molan et al., 2022), further explained that virtual scenarios bring students to a realistic environment and offer an easier process (Winkelmann et al., 2020), so that it can help them acquire the knowledge in question. Positive acceptance of the usefulness of technology and the ease of application of learning methods affect student learning outcomes (Pletz & Zinn, 2020), so that students' prior knowledge becomes something that must be taken into account (Ong et al., 2021). Therefore, according to Petersen et al. (2020), adding training before learning is something that can reduce students' cognitive load while studying, so that students can work better during learning. The same thing was also expressed by De Back et al. (2021), because students who do not have prior knowledge will experience difficulties during the learning process (Wang et al., 2021). Educators and school policy makers also need to pay attention to the learning characteristics of students in the digital era when designing learning methods, so as to produce methods that are most appropriate to the character of students (Huang et al., 2020). Through immersive learning, students feel they have the opportunity to collaborate with their friends, so that they can exchange ideas and ideas (Georgiou et al., 2021).

The Effect of Immersive Learning on Students' Cognitive Aspects

Immersive learning has a positive role in the development of students' cognitive aspects (Markowitz et al., 2018), (Molan et al., 2022), (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Winkelmann et al., 2020), (Cheng, 2021), (Mills & Brown, 2021), & (Georgiou et al., 2021). However, there are several other studies that show the opposite result, namely a negative impact on students' cognitive aspects after engaging in immersive learning (Reilly et al., 2021), (Parong & Mayer, 2021), (Huang et al., 2020), & (Rao & Saha, 2019). The cognitive aspects referred to in the results of this study are students' understanding and cognitive abilities, both understanding of the material or concepts in learning (Markowitz et al., 2018), (Molan et al., 2022), (Petersen et al., 2020), (Winkelmann et al., 2020), (Cheng, 2021), & (Georgiou et al., 2021), the ability to run platforms or learning media (Pletz & Zinn, 2020) & (Winkelmann et al., 2020), and students' ability to create works as immersive learning products (Mills & Brown, 2021). Starting from the first cognitive aspect, which is about students' understanding of learning materials or concepts. After learning to use Immersive Virtual Reality, it is known that students' knowledge has increased along with their increasing curiosity about the topic of the material being studied (Markowitz et al., 2018). The same results are also presented by Molan et al. (2022) and Petersen et al. (2020) in their research. Knowledge and mastery of students' concepts increase after learning with the Immersive Learning method. Students also experienced an increase in their procedural knowledge after conducting immersive experimental-based learning (Winkelmann et al., 2020). Through immersive learning, students can also understand abstract concepts that are difficult to explain in conventional ways. In addition, immersive learning can also encourage inquiry learning, so it is considered useful for expanding students' knowledge (Cheng, 2021). Students get higher scores because they show better mastery of learning content (Georgiou et al., 2021), because the Immersive Virtual Reality simulation and inquiry-based learning process is rated positively and welcomed by students.

Students' knowledge and ability to operate platforms or media used in immersive learning are also highlighted in this literature review. Through immersive learning students can learn to use a tool or machine virtually, and with visual aids students can control a tool, so that with this they can be skilled and have the ability to apply a tool, even without learning with an actual tool or just simulation (Pletz & Zinn, 2020). This virtual immersive learning offers students convenience in carrying out procedures in the laboratory, including the use of laboratory equipment (Winkelmann et al., 2020). It was further explained that the use of a mouse and keyboard provided significant benefits for students, their kinesthetic skills were increasingly honed. Students can learn their kinesthetic abilities through a virtual environment. The results of the study Winkelmann et al. (2020) show that the use of a virtual environment in learning trains students' ability to operate learning devices that can connect students to the virtual world.

The Effect of Immersive Learning on Students' Affective Aspects

It is known from the results of the study of several articles in this literature review that there are several affective aspects that are influenced by immersive learning, including the attitudes and feelings of concern for students (Markowitz et al., 2018), (Petersen et al., 2020), (Winkelmann et al., 2020), (Mills & Brown, 2021), & (Georgiou et al., 2021), self-efficacy or confidence in students' abilities (Molan et al., 2022), (Petersen et al., 2020), (Winkelmann et al., 2020), & (Reilly et al., 2021), students' learning motivation (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Cheng, 2021), (Parong & Mayer, 2021), (Mills & Brown, 2021), (Wang et al., 2021), (Huang et al., 2020), (Georgiou et al., 2021), & (Ong et al., 2021), and student experience (Winkelmann et al., 2020), (Cheng, 2021), (Wang et al., 2021), & (Ong et al., 2021). The first affective aspect, namely the attitude and concern of students. Students who study with Immersive Virtual Reality show more positive attitudes, especially towards the environment (Markowitz et al., 2018). The same thing was also expressed by Petersen et al. (2020), that students showed a significant increase in the intention to give treatment to the problem of climate change. It can even arouse students' empathy for the object that is the subject of discussion (Mills & Brown, 2021). Student attitudes seem to support educational values (Georgiou et al., 2021). However, different results were shown by Winkelmann et al. (2020), students did not experience a change in attitude after immersive virtual learning. The attitude of students towards the material remained the same as before doing the lesson, both for male and female students. Limited time and learning design are two of the factors that influence it (Winkelmann et al., 2020).

The second affective aspect is self-efficacy or students' belief in their abilities. According to Molan et al. (2022), because aspects of knowledge and self-efficacy are dichotomous variables, then after experiencing a series of immersive learning, students' confidence in their abilities increases significantly. It was further explained that the increase was due to the involvement of students in their learning experience. One of the exclusive learning experiences supported by immersive virtual learning is learning with the inquiry method, where before conducting an investigation students are provided with training (Petersen et al., 2020), therefore students feel confident in their abilities because of the pre-training they received previously. However, opposite results were found in the study (Winkelmann et al., 2020). The results of this study indicate that students' lack of self-efficacy occurs because they think that learning through a real environment will still be more effective in providing an immersive experience for them, and is believed to be the only best way and cannot be completely replaced by virtual learning. It is different with research Reilly et al. (2021), it is stated that students experience an increase in their scientific self-efficacy, even through good self-efficacy it can encourage an increase in other non- cognitive aspects.

The third affective aspect is students' motivation and interest in learning. Several studies explain the relationship between immersive learning and student learning motivation, both positively and negatively (Wang et al., 2021). However, the majority of articles showed a positive relationship between immersive learning and students' learning motivation (Webster, 2016), (Pletz & Zinn, 2020), (Petersen et al., 2020), (Cheng, 2021), (Parong & Mayer, 2021), (Mills & Brown, 2021), (Huang et al., 2020), (Georgiou et al., 2021), (Ong et al., 2021). Another ability of immersive learning, in this case using Virtual Reality-based media, in addition to increasing learning outcomes scores, can also increase student learning motivation. The availability of immersive learning scenarios that are more interesting, innovative, easier and safer can increase student interest and involvement in the learning process, thereby triggering an increase in student interest in learning (Webster, 2016). Positive acceptance of the technology used in immersive learning motivates students to support the success of the learning process (Pletz & Zinn, 2020). Educators can choose content and media that are important to be given to students in supporting the learning process, both before and during learning (Petersen et al., 2020). Teachers can also choose five instructional approaches to be implemented in immersive learning in the classroom with the aim of increasing students' learning motivation, including advance organizers, extension learning, learning evaluation, collaboration, and role playing (Cheng, 2021). Teachers perceive that instructional activities can enrich students' experiences when engaged in immersive learning.

Students show an increase in their learning motivation after learning using 3D videos (Parong & Mayer, 2021). It was further explained that the use of immersive media in learning can stimulate students' emotions. An immersive virtual environment offers students a new simulation world and greater immersion increases students' interest in the material they are studying (Mills & Brown, 2021). However, it was found that the freedom given to students was too excessive and they tended to lose their learning motivation, therefore, it is important for educators or instructors to plan and design meaningful learning for students so that they can achieve learning goals (Wang et al., 2021). It is also necessary to consider student learning styles, because understanding the learning styles of today's digital generation students is not only how to successfully integrate immersive learning design in the teaching process, but also consider information and communication technology that suits student needs (Huang et al., 2020), because visual processing has become a the main and common way of learning for students of the digital generation. The students highlighted the positive impact of visualization that supports the representation of phenomena or abstract concepts related to the material (Georgiou et al., 2021), because all activities supported by technology have a good impact on students' interest and motivation to learn. Students find it easier to learn with the rapidly growing digital learning environment (Ong et al., 2021). Besides having an effect on students' learning motivation, immersive learning will also be successful if students have high enthusiasm and

motivation to learn (Webster, 2016), (Pletz & Zinn, 2020), & (Cheng, 2021). Therefore, these two things have a two-way relationship which has a significant effect.

The last affective aspect that is influenced by immersive learning based on the results of a review of several literatures from previous research is student experience (Winkelmann et al., 2020), (Cheng, 2021), (Wang et al., 2021). From the three research results, there is a negative relationship between immersive learning and student learning experiences (Winkelmann et al., 2020), and there is also a positive relationship (Cheng, 2021) & (Wang et al., 2021). Students who learn using conventional methods (learning directly in the real world) with those using immersive learning methods (through a virtual environment) have a similar experience (Winkelmann et al., 2020). It was further explained that activities that can be carried out in the real world are difficult to do through virtual and vice versa, so that each of them is considered to have their own shortcomings, so that neither one of them provides a positive experience. This is different from the results of research Reilly et al. (2021) which shows that immersive learning assisted by Virtual Field Trips can enrich students' experiences, because through this learning students can access difficult- to-reach environments. The maximum use of technology can enrich students' learning experience in class (Wang et al., 2021).

4. Conclusion

Based on the results of the analysis of 16 reference articles that discuss Immersive Learning (IL) or those with the theme of IL such as Immersive Virtual Learning, Immersive Education, Learning in Immersed, Immersive Virtual Environment, and others, resulted in a conclusion that shows that immersive learning , whether done virtually or a mixture of virtual and real, and both using sophisticated technology and simple technology, have an influence on the development of cognitive and affective aspects of students. After participating in immersive learning, students show an increase in knowledge about material concepts and their learning outcomes, besides the ability to operate a media is also influenced by the learning. In addition, through immersive learning students can also hone their abilities in producing quality learning outcomes.

The effect of immersive learning on the affective aspect includes matters relating to students' attitudes and concerns about the material being studied, students' beliefs about their abilities, students' interest and motivation to learn, and meaningful learning experiences. Students show a positive attitude towards the subject matter in the material after participating in immersive learning. However, there are also previous research results which show the opposite result, students' attitudes tend to be the same towards the material, in fact there is no increase in attitudes at all. Students' confidence in their ability to achieve good learning outcomes increases after students learn immersively. Even with their motivation and interest in learning. After learning immersively students' motivation showed a significant increase. Meaningful experiences in learning are also obtained by students after immersive learning.

The success of immersive learning in increasing students' knowledge and learning outcomes, attitudes and concerns, self-efficacy, interest and motivation to learn, as well as meaningful experiences for students is the result of good Immersive Learning planning and implementation, so that the output it produces is good. Therefore, it is very important to consider how the immersive learning design will be applied and how effectively it will be implemented in the field. Because the planning and implementation of immersive learning that is not good will affect student learning outcomes, both cognitive aspects in the form of knowledge and understanding of concepts, as well as affective aspects in the form of student attitudes and concerns, self-efficacy, interest and motivation to learn, and meaningful learning experiences. So do not be surprised if there are research results that show the negative effect of immersive learning. This indicates that there is a need for improvements to the immersive learning design and the results of the evaluation of the learning implementation.

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