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Impact of Mixed Reality on Student Learning Experience

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ABSTRACT

Twenty-first century learning environments are technologically advanced places. Mixed Reality (MR) refers to the practical blend of physical and digital environments. It offers the opportunity to significantly increase students' engagement and learning by re-imagining pedagogical approaches used in traditional educational spaces (such as teacher/learner presence, immediacy and immersion) through the affordances of digital learning.where as the current online platforms are evolving with greater challenges like (monitoring of students works, missing of real time education system , Interaction between trainers and learners.) to resolve those challenges we explore a logical extension to implementing MR in online learning, that of mobile mixed reality (MMR) which augments a user's view of the real world with location-specific information in the form of simple text, image, multimedia or 3D graphics with the growth in this mixed reality market and more so after the pandemic, education will likely account for a large percentage of that growth, which means the need for content will grow exponentially. In enhancement of new technology in online learning education to resolve the problems facing here our application as solution to overcome the challenges on current online platforms with joint with (MMR)mixed reality technology.

Keywords-Mixed reality(MR)-Education-Online-platforms-development-learning-digital environment

I.INTRODUCTION

[1]The world is facing new challenges in the digital era, especially when it is presented with the metaverse and other online platforms. The sector that is affected by this challenge is the education sector. Academics are faced with the challenge of keeping up with digital developments toward society 5.0. The challenge is in the form of online learning. The use of software in online learning still benefits for learning that is theoretical but it is ineffective in practical learning due to unsupported technology. With the emergence of Augmented Reality and Virtual Reality technology, it is possible to make online learning by combining AR and VR technology, namely Mix Reality. Mix Reality provides enormous potentiality for online learning because it provides features that cannot be provided with conventional online learning in general. The combination of haptic AR, audio AR, and gustatory and olfactory AR makes online learning possible. Its application in online practicums, MR technology, has a crucial role because teachers can use MR to produce digital content with no restrictions and interact online with their students. Either through virtual spaces or a collaborative learning environment. This article discusses details about the potential of mixed reality for online practicum learning

Mixed Reality, Augmented Reality, and Virtual Reality Before discussing MR, the author wants to discuss augmented reality, commonly abbreviated as AR. AR is a technology that displays direct or indirect 3D digital objects generated from computers with various kinds of information combined in the real world (Google Developers, 2022). AR allows you to add fields to the real world and have them run interactively and in real time so that they look like real objects. It is a natural way of exploring 3D objects and bringing these objects into real life. This AR potential supplies information in the form of object visualization, commonly used in advertising, navigation, learning, and other forms. AR is also easy to access using portable digital devices such as smartphones or other forms of AR glasses In its application, AR technology can be accessed and used in education, business, agriculture, and other sectors. This

is because AR itself can be used as a tool for collaboration. Users do not have to be in one place to interact with each other. Users can meet online and appear as if the person is in the same room. Figure 1 is an example the use of AR for collaborating online and in real-time at the same time.

Figure 1 Collaboration with real time

II.PROJECT LITERATURE

[3] To first gain a better sense of teachers' challenges and needs for support in AI-enhanced classrooms, we conducted a series of formative design studies with a total of 10 middle-school math teachers, across five schools. All participating teachers had previously used some form of adaptive learning software in the classroom, and all but one had previously used an ITS as part of their classroom instruction.

To encourage teachers to talk freely about challenges they face in AI-enhanced classrooms, without feeling constrained to those for which they believed a technical solution was currently possible, we initially avoided asking direct questions about "learning analytics." Instead, we developed a new probe: in a series of one-on-one study sessions with five teachers (across schools C and D), we asked, "If you could have any superpowers you wanted, to help you do your job, what would they be?" We first posed this question in a very broad sense, but then asked specifically about superpowers that teachers would find useful during classes in which their students work with an ITS or other adaptive learning technology.

In each study session, we asked teachers to immediately write down their "superpower" ideas on index cards the moment they thought of them pausing ongoing conversation, if need be to reduce the chance that they would lose track of an idea. In addition to identifying design opportunities within the cards teachers generated, we wanted to get a better sense of teachers' relative priorities

among superpowers, and the reasons underlying these priorities (e.g., the relative severity of the daily challenges underlying these "superpower requests"). To this end, once a teacher finished generating superpower ideas, they were asked to sort them by subjective priority, while thinking aloud about the reasoning behind their sorting (cf. Cairns & Cox, 2008; Hanington & Martin, 2012).

Teachers were encouraged to generate new cards while sorting, in case the card sorting process inspired new ideas. After a teacher had finished sorting their cards, they were presented with cards generated by all teachers who had participated before them, and were given the option to include any of these cards in their own hierarchy. If a teacher found an idea generated by a

previous teacher undesirable, they were instructed to omit that card from their hierarchy. If a teacher felt that a superpower idea generated by a previous teacher was synonymous or redundant with one of their own ideas, they were encouraged to align these cards horizontally, to indicate a "tie." For example, Figure 1 shows an excerpt from one hierarchy that emerged from this iterative card generation and sorting process. One of this teacher's desired superpowers was "Omniscience," which the teacher considered synonymous with "Being able to see students' thought processes" (a card that a previous teacher had generated).

Across the card hierarchies teachers generated, some interesting regularities emerged. All five of the teachers we interviewed wanted the following abilities:

See students' thought processes. Teachers wanted to be able to see the chains of reasoning that led students from one mathematical expression to the next, without always having to ask students to "show their work," and without having to spend much time deciphering student work. Some teachers explicitly distinguished "seeing thought processes" from simply seeing percentage estimates of student's mastery over certain skills (which they were used to seeing in reports from adaptive learning software they had used previously), noting that such skill mastery estimates were less *actionable*. That is, if teachers could follow students' thought processes in real-time, this could provide opportunities for them to *"re-route"* students at the moment students *"take a wrong turn"* during a problem solving activity, rather than only providing delayed feedback once the student has moved past the relevant problem.

Know which students are truly stuck. Teachers noted that students often raise their hands during lab sessions when they don't actually need help. At the same time, teachers believed that many students who actually need help the most were the least likely to raise their hands. Being able to see which students actually need the teacher's help, at any given moment, would enable the teacher to better prioritize help across students and *"fight the biggest fires first.*"

Know which students are "almost there" and just need a nudge to reach mastery. Teachers noted that one of the most fulfilling parts of their jobs is *"seeing students to the finish line"*: working with students who are currently on the verge of understanding a new concept, and helping them reach that understanding more quickly. One teacher was initially conflicted over whether to include this superpower in his hierarchy, noting that students in this situation would likely reach mastery even without the teacher's help. But this teacher ultimately decided to keep this superpower in the hierarchy, acknowledging that, while he generally tries to spend most of his time working with struggling students, he would find it demotivating to spend *all* of his time doing so.

In addition, four out of five interviewed teachers wanted the following abilities:

Teachers wanted the ability to provide one-on-one support to multiple students simultaneously, rather than leaving real-time personalization entirely to the software. All of the teachers we interviewed reported that, while the level of personalization enabled by ITSs is one of its main attractions, such personalization also makes it more challenging for teachers to monitor their students' current activities and provide them with timely feedback.

Have "eyes in the back of my head." Teachers noted that some students take advantage of the challenges personalized learning software such as ITSs poses for classroom monitoring. They shared stories of catching middle-school students switching to non-academic websites when they thought the teacher was not watching, but then immediately switching back when they knew they were in visual range. Thus, much of these teachers' energy is spent "patrolling" the classroom and trying to make sure that everyone is on-task.

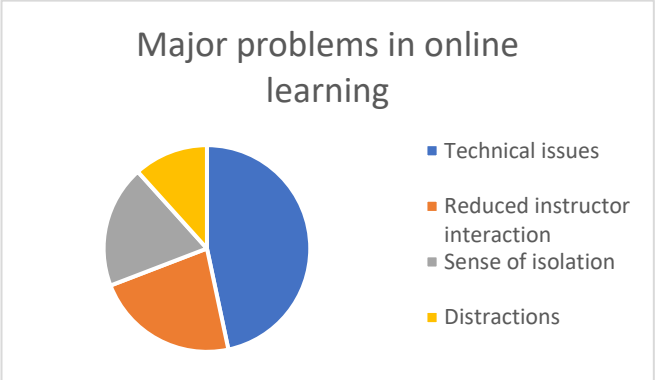
Detect students' misconceptions. Similar to teachers' desire to see students' thought processes, their desire to see student *misconceptions* was rooted in the actionability of this information. While teachers viewed "seeing students' thought processes" as enabling real-time correction of particular student errors, to help shape students' knowledge of procedures, they viewed "detecting students' misconceptions" as enabling the correction of persistent false beliefs that might hinder future learning.

Know which students are making lots of careless errors. Finally, teachers wanted to be able to more easily detect, in real-time, whether students are putting in the effort required to learn. Based on this information, they could decide on a case-by-case basis whether it would be most productive to spend their time providing additional *instruction*, or whether they should instead try to *motivate* the student.

III.The research says about online learning

Online learning can happen in a number of ways. Some of you might have heard about massive open online courses, where thousands of students from different corners of the world can connect to watch video lectures to boost their skills. They can also fill out relevant questionnaires or take exams based on lectures. Many online courses are designed with a format that is more like in-person courses. Such courses are more useful for K-12 students as they need the continuous attention of a teacher during a class. In these courses, teachers can help students to run virtual discussions, assign homework, and do a follow-up with specific students. These courses can be run in a synchronous or asynchronous mode.

When we compare in-person classes and online learning, online classes are not observed to be equally effective at all levels, as compared to in-person sessions. During a survey, students were randomly divided into in-person classes and online settings, and they were asked common questions out of a course. But the accuracy rate of solving problems was higher for in-person class attendees. It was observed that when students interacted in person with a teacher, it felt easier to discuss their doubts. Moreover, classroom scenarios motivated students to perform better than their peers.



IV.METHODOLOGY

1.Learning modes

During the Covid-19 pandemic, the learning was carried out online. Online learning is a new experience for the student in Indonesia. This is what underlines the researchers to determine the effect of learning styles on student learning performance and determine if there are differences in student learning performances based on learning styles.Online Learning aims to provide learning services to educators and students.Technological development in the world of education can be felt in the online learning process. Communication between educators and student can run optimally with the help of Information and Communication Technology

2.The Virtual Classroom

- **Flexibility of schedule and place**

[4] One of the main merits of virtual education is the ability to study and learn from anywhere and anytime. This is especially beneficial for overseas students and international students as well. Students can easily adjust their schedules according to the timings suitable for them and they can learn from anywhere around the world.

Virtual education is non-restrictive and is more accommodating of students who might be working on the side or people who have graduated but need to elevate their standards of knowledge in other fields.

- **Less expensive (less cost)**

If students learn from home or anywhere else, they would not have to spend much on transportation, accommodation and travel fees for their school or university. This renders distance education a great option for people who want to do further studies without harming their wallets.

- **Simple and easy access**

Most universities and schools that offer distance education nowadays implement the system of e-learning for their students. This allows students to virtually learn through internet-based platform learning management system(LMS). These types of platforms usually offer user-friendly dashboards that ease the communication between instructor-learner.

They have also made virtual learning much easier through the option of online classes and virtual office hours. It is almost like the real class experience only without the hassle of having to physically exist there.

- **Availability of resources**

[5] Most LMS platforms also facilitate cloud-based storage that allows instructors to upload academic resources for the use of students. Instructors can also suggest online resources for the students as extra learning material. If you notice, this will also save the costs needed for buying textbooks and printing reading and studying materials.

3.Importance of virtual learning

[6]The global Covid-19 pandemic has tremendously changed the world in all aspects even in education. Schools have had to shut down and resume classes virtually. More schools now have decided to fully implement distance learning through the use of digital platforms for easier communication with the students. This sudden transformation has sparked a debate on whether virtual learning is actually beneficial for students.

Even before the pandemic, the usage of education technology was already quite high as major investments increased for its enhancements and development; they even reached more than US$18.66 billion in 2019. Research indicates that students understand and comprehend about 25-60% more material when learning virtually compared to only 8-10% in an actual classroom. This is because students are able to learn faster as virtual learning allows a self-paced learning culture and a more flexible learning lifestyle.

Figure 2 Classes during covid-19

4.Application of MR in Real-World Usage

[7]In industry, MR-based applications have been used. With the industry's desire to use MR in its operations, it has become an important reference in the industry's development. For example, in 2016, Microsoft announced an example of MR devices that were used in a game called the X-ray Project (Figure 3). In this game, the user can display several types of weapons, as shown in Figure 4, where the user displays a digital shield in the game. By using sensors in HoloLens, the computer can detect and recognize the objects it sees.

In the health sector, Oslo University Hospital has turned 2D images into augmented reality model images. Surgeons can visualize what they meet, and HoloLens helps to navigate within these AR model objects (Kramer, 2017). Apart from HoloLens, software companies such as Spatial.io are also developing digital software in the form of virtual space as a place to collaborate and discuss online and in real-time. This software makes it possible to collaborate directly in a virtual world or each other's place using AR. The virtual space was created to support interactive learning methods that allow users to share images, ideas, concepts, and other forms of media. Spatial software was created to solve a problem that arose during the COVID-19 pandemic, where users were unable to meet each other in person. In addition, this software is also made to support online meetings using virtual workspaces, which may in the future become a trend in the industry, especially with the presence of the metaverse in society 5.0. Spatial can be accessed via any digital device, including smartphones, the Oculus Rift (VR headset), and the web. With the presence of different platforms, users can access the software wherever and whenever they have an adequate internet connection. This model of MR technology has a variety of different approaches. Microsoft envisions this AR access using digital devices, namely HoloLens. While Google has a vision of implementing its MR through AR Core, Spatial.io implements it in the form of digital software that can be accessed via an application or interactive website. However, it should be noted that one important thing that the author can conclude is that to be able to apply MR to human life, access to the software is the key to making this technology usable among the wider community.

During the COVID-19 pandemic, academics were given challenges in facing online learning. Applications in online learning can be made using digital devices that use online learning software such as Moodle, Google Classroom, Microsoft Teams, and other forms of software. The purpose of unifying conventional learning with learning using technology is to help students' learning processes. However, not all online learning processes can be replaced by online learning processes, especially with the practicum learning method. With the presence of technology such as MR, practicum learning will be easier. The obstacle to learning online practicum today is that students cannot have experience in creating/ experimenting (learning by doing). Existing online learning is limited to two-way communication and virtual interaction spaces (Moodle, Google Classroom, and Microsoft Team). Due to the limited tools available to students, this learning method is insufficient for practicum, and the learning experience, including the trial-and-error process, cannot be obtained as easily as with collaboration. Collaboration in learning is important for students to help each other and complement each other's knowledge when conducting projects or assignments. When discussing real experiences with friends, student involvement is essential. Digital devices produce digital products, and digital content can be created indefinitely. Content can be created and developed to learn, for example, photography techniques. Computers can make "digital" cameras that can be displayed in the real world through MR devices. There is also necessary information, such as settings in the camera, which can be adjusted in this way. MR can create all of the learning contexts and make it appear as if the actual photographic object is in front of them. MR has enormous potential to fill the current gaps in the use of online learning. With MR, educators can use it to create useful digital content as if it were real and interactive. Teachers can create learning content, which students can use by utilizing their respective digital devices. Figure 4 depicts the use of augmented reality to teach the anatomy of the human body. This can make it easier for students to be able to see and explore directly using their respective digital devices.

Figure 3 learning with virtual reality

V.OVERVIEW OF PROJECT

Over the last decade, several universities with the common goal of pushing educational innovation forward have invested in centers for educational innovation with a focus on emerging technologies. Some of the most popular emerging educational technologies are virtual reality, blockchain, internet of things, artificial intelligence, among others. Particularly, virtual reality is in a crucial moment to be implemented massively, due to several reasons. Some characteristics of virtual reality make it a favorite candidate for its application for teaching and learning in higher education as a technological tool, it can be directly applied to the teaching-learning process. Its current technological maturity stage has allowed for the development of hardware and software that can be incorporated into the educational context. At the same time, the costs have been generally reduced, making the incorporation into the educational context more viable. It can boost curiosity among students and for most students, the university is the only place where they can access this technology.

Virtual environments are becoming relevant in different areas of science education, including natural, medical and computer sciences. Many studies about the use of VR in science education focus on students' learning outcomes, motivation, and attitude when using VR. The literature reports no significant differences in learning outcomes when comparing VR with other active learning experiences but some studies do report learning gains when comparing VR with traditional learning The literature on the use of VR about abilities and attitudes in science students reports improvements in students' achievement, interests and learning experience in STEM education The relevance of the use of VR to improve certain scientific skills, such as visualization of abstract concepts, has been highlighted by some studies .

The use of virtual reality in education has enabled the possibility of representing abstract concepts and virtually manipulating them, providing a suitable platform for understanding mathematical concepts and their relationship with the physical world. Many physical quantities, such as force and acceleration, are mathematically modeled with vectors for describing, computing, and predicting the physical world. Therefore, understanding and working with vectors is necessary for learning physics. The literature highlights the benefits of using VR in science learning. Different studies have reported the development of AR applications for learning vectors, their properties, and operations. In this contribution, we present a study with the objective of evaluating students' learning and experience when using a virtual reality tool to learn about three-dimensional vectors in a university physics course. We first present a literature review on the basic concepts of virtuality and educational technology. We define the context of the study and present the research questions. We provide the methodology for the study, the description of the participants, instruments, data collection, and analysis. We present the quantitative and qualitative results and discuss the relations between them. Finally, we conclude the article with some recommendations for implementing educational technologies in the science classroom.

VI.CONCLUSION

Since the introduction of smartphones into human life, public access to digital devices has been implemented. This means that access can be made anywhere. Through the application, developers may be able to modify the process of this learning method. Coupled with the presence of digital device technology that supports MR applications, new experiences can be presented to users, both in learning and direct online interaction. MR technology is presented to meet human limitations by holding activities separately and presenting them on one platform. New learning methods are likely to be applied to society using MR, particularly when interacting in real-time as we do in the real world. Using mixed reality in distant learning facilitates practical learning since practicum requires skills and expertise with the "learning by doing" method to gain knowledge. This approach is extremely rare if it is done online at first; it differs from theoretical learning, which does not involve "learning by doing."

However, using technology-enhanced learning approaches such as augmented reality, virtual reality, and mixed reality, students may be able to seek new experiences in learning that require hand skills and other experiences connected to physical mobility. Mixed reality, augmented reality, and virtual reality are the most appropriate approaches for learning practicum. We have aimed to develop an application for online learning collaborated with mixed reality. The surveys and drawbacks collected from staffs and instructors during online classes are the major causes and we aimed to overcome the problems with mixed reality application for future use.

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