

Improving Equity and Inclusion in Education using Virtual and Augmented Reality in Open Distance Learning

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Abstract

School closures due to the COVID-19 pandemic, have caused many countries to transform teaching and learning (T&L) using digital pedagogical techniques and tools. Educators and learners constantly communicated using networked devices such as smartphones and tablets to share content and to track learners' learning progress. Also, many educational institutions across the globe rapidly built online courses and developed innovative online content in ensuring learning is continuous and responding to the challenges they faced in adapting and conducting online classes. Even though several countries have re-opened schools to foster various needs of learners, the pandemic did not stop education institutions to digitize their T&L approaches. The increasing number of affordable and more durable online courses in an Open Distance Learning (ODL) environment, for example, micro-credentials, have pushed education institutions to develop innovative programs and structures in improving the effectiveness of distance education. According to Ellysse (2021), virtual, augmented, and mixed reality (VR/ AR /MR) environments are more immersive, real, and motivating for learners and should be capitalized to bring a more transformative effect on the learning process. Apart from the effectiveness and impact of learning, it is also imperative that technological applications and use in classrooms should ensure inclusive and equitable principles are included to meet the social and emotional needs of students. Coupled with this, there is also a new generation of students entering college: they are digital natives who are connected 24/7 to their mobile devices (Harris, 2012) and it is important to ensure their learning needs are met too. Research by Sung (2014) using VR/AR combined with collaborative learning and the flexibility of mobile devices for a more ubiquitous experience may aid researchers in further improving inclusivity and equity of learning. Thus, creating lessons for ODL learners using VR/ AR /MR for a more inclusive and equitable environment necessitates looking at emerging pedagogical structures. In this paper, we sought to answer the research question: What are educators' perceptions and attitudes about using VR /AR technologies to improve equity and inclusion in education? Towards this, a qualitative study on the lecturer's perception using purposive sampling was conducted. An open-ended survey questionnaire with responses from eight academicians were qualitatively analyzed using NVIVO 9. From the findings, most of the educators believe and are aware that using VR/AR in the classroom can improve equity and inclusion. Finally, this study provides recommendations to educators and stakeholders in implementing AR/VR in their T&L approaches.

Keywords | Equity in Learning | Open Distance Learning | Learners' engagement | Virtual Reality | Augmented Reality |Inclusion | Universal Design for Learning |

Background of Study

Most education systems worldwide implemented open distance learning (ODL) during the Covid-19 pandemic. The introduction of technology in education allowed learners to continue learning during the lockdown and enabled educators to continuously educate learners at a distance using synchronous and asynchronous educational technology tools. According to Dorst et al. (2001), education technology tools provide better visibility, accessibility, and interaction with learners at all levels and can support educators to better develop, design, and deliver digitally oriented learning experiences to meet the needs of learners. Sung (2014), indicated that the emergence of augmented and virtual technology (AR/VR) in learning has also facilitated learners to immerse themselves in a simulated learning environment. Immersive technologies like AR/VR are advanced learning tools and are a promising addition to the growing field of EdTech because of their immersive experiences to engage learners. This expansion can be seen in the innovation labs that have been built by universities and colleges. For example, Harvard Innovation Lab launched its AR/VR Studio which actively provides guided workshops and encourages students to explore the potential of this technology (Harvard Innovation Lab, 2021). Besides, the Immersive Reality Training Lab launched by Colorado State University was designed to enhance biomedical education with immersive simulations and has successfully accommodated 100 students for simultaneous immersive learning experiences without burdening students and faculty with necessary equipment costs (Lang, 2019). Thus, immersive technologies create opportunities to enhance learning environments for better engagement, participation, and collaboration amongst learners whilst ensuring the learning

outcomes are met (Nissim et al., 2017). The aim of this study is to determine educators' perceptions and attitudes about using VR /AR technologies to improve equity and inclusion in education.

Problem Statement

Schools and higher institution closures have posed a challenge to the education system to ensure inclusivity and equity in education for everyone (Avanesian et al., 2021). Besides, educators are beginning to worry about the influence on student learning progress and whether learning loss has occurred. Due to school and education institutions' closure, learning loss has been one of the consequences that affected learners' progress. According to Engzell et al. (2021), learning losses are up to 60% higher among learners from low-income families, underscoring concerns about the pandemic's uneven impact on the learner and families. Learning loss contributes to one aspect of learning bordering on inclusivity and equity, and this is important to be addressed for a more inclusive and equitable learning.

Providing multiple ways for learners to engage with instructional learning content is essential to cater to the 'learning loss' issues. Hence this is something that a more concrete use of certain principles and strategies such as universal design for learning (UDL) can help especially in providing multiple means of engagement outside a formal learning environment. UDL has been identified to give benefits to learners including those who differ in their personalities, interests, needs, and abilities. However, during the pandemic, there were obstacles to implementing UDL in digital learning environment, including a lack of awareness of UDL principles, insufficient resources, time, and technical tools (Kilpatrick et al., 2021). One of the key components of successfully building emerging classrooms is implementing better learning designs that capture different needs and, in this case, inclusive and equitable learning is a focus.

Alongside the aggressive development of ODL, Micro-credentials, and MOOCs, inclusive and human-centered learning designs are needed to increase the effectiveness of remote learning. Learning barriers and innovative learning solutions are significantly important in the post-pandemic era to enable both educators and learners to adapt to rapid technological changes in an emerging learning environment. Hence, identifying educators' perceptions and opinions toward inclusive learning will carry significant weight in future education (Devecchi et al., 2012). From this perspective, ensuring equity and inclusion are vital issues for the attention of educational institutions, especially after the experiences of Covid-19 that focuses on equity and access by adopting a range of technologies which include immersive technologies like AR/VR.

Significance of Study, Applicability, and Interest to field

The findings of this research will offer knowledge of using AR/VR as an additional learning design tool for open distance learning classrooms that can provide more equity and inclusion towards education in a new generation digital learning environment. For educators' teaching competency in emerging technology-enhanced environments, this study is a valuable inspiration and reference to develop new, impactful, and engaging learning designs based on AR/VR applications relevant to their content areas. The findings of this research will also enable the education industry to implement new and emerging technologies offered in extended realities. Students and academic researchers will also be able to use this research from an academic perspective by understanding the incorporation of equity and inclusion in holistic, human-centred, and goal-oriented learning.

Literature review

Inclusivity

In the twenty-first century, inclusion has become a primary active movement in the educational sector. It is assumed that learners can access excellent and fair education through an inclusive educational approach, regardless of their ability or disability (Tilstone & Rose, 2003). The concept of inclusivity is varied and in Malaysia it began in the 1960s, when the Malaysian Ministry of Health (MOH) recommended community-based rehabilitation programmes to transition from custodial care to deindustrialization (Jaafar et al., 2020). Inclusivity also meant integrating students with special needs into mainstream classroom so that they can benefit from the same learning opportunities as other students, regardless of their status or disabilities (Adam, 1997). In line with this statement, the Ministry of Education (MOE) implemented special education such as Special Education Integration Program (PPKI), and Inclusive Education Program (PPI) in government schools at the pre-school, primary, secondary, and post-secondary levels.

One of the measures mentioned in the UNESCO Sustainable Development Goals (SDGs) is the famous line "leave no one behind". It states that societies will never accomplish the desire to empower all humans unless everyone, including those with disabilities, is fully engaged in the educational process. Recently the role of digital learning environments has necessitated that educators re-examine how to maximize or design the learning processes in these environments to ensure inclusive and equitable education is met. Digital technologies are transforming not only how education is given, but also how students learn, communicate, and engage in education (Ellison et al., 2007). Past literature shows that VR promotes engagement and inclusivity among learners (Dick, 2021a; Geerts et al. 2021; Detyna & Kadiri, 2020; Ip et al. 2016). Dick (2021a) emphasizes that while VR promotes inclusion in education, nevertheless, there are challenges that need to be addressed such as in using VR that supports available technological tools, places, and learners. Even though there were challenges in implementing VR/AR at certain levels of education, the benefits of VR/AR outweigh the disadvantages or issues faced by the educators. Hence, educators are the ones who will have to find a way of making this happen.

Equity

According to UNESCO, equity is the extent to which access and opportunities for children and adults are just and fair and includes the reduction of disparities based on gender, poverty, residence, ethnicity, language, and other characteristics. Galindo et al. (2019) also emphasize this by stating that equity in education is essential as equity provides opportunities for impoverished and underserved students to overcome obstacles and achieve success at the micro-level of the T&L process, equity also means student is an achiever in attaining the learning outcomes that are stipulated. This is a basic and important learning principle that has been sidelined. The World Bank report on Learning Poverty (2018) is very disturbing and needs to be addressed by educationists. The report states "Using a measure developed jointly by the World Bank and UNESCO's Institute of Statistics, we have determined that 53 percent of children in low- and middle-income countries cannot read and understand a simple story by the end of primary school. In poor countries, the level is as high as 80 percent. Such high levels of illiteracy are an early warning sign that all global educational goals and other related sustainable development goals are in jeopardy." (World Bank, 2021, pg.2) This simply means, "learning" is not happening in poor, and low-middle income countries" There is a huge deficit in learning. What we can conclude from here is that these 10-year-olds were "left behind". This could have happened due to many reasons; however, an important reason is how learning is designed to meet the needs of children and is something that educators need to address. Besides, everyone should have the opportunity to learn in the method that best suits their learning style. Educators must also have a variety of activities to adapt to the requirements of their learners Particularly in this time of the pandemic, there should be equity and equality regarding the interests, conditions, and levels of abilities (Cabual, 2021).

According to the Malaysian Education Blueprint (2013-2025), improving access to education, raising standards (quality), bridging the achievement gaps (equity), strengthening student unity, and improving system efficiency is key to the total enhancement of education. This means that all educational institutions including the Ministry of Education (MOE) need to ensure that equity is given emphasis as the socioeconomic background is still the cause of the gap in the largest equity (*Pelan Pembangunan Pendidikan Malaysia 2013-2025*, 2012).

As noted earlier, the expanding use of ICT in higher education to assist learning and research presents both new opportunities and new challenges for ensuring access and equity for all students (Barraket & Scott, 2001). Besides, virtual reality and augmented reality devices and applications are particularly positioned to support efforts to improve equity and inclusion (Dick, 2021b). The solution to make this happen lies very much in the laps of educators.

Universal Design for Learning

Universal Design for Learning (UDL) is a set of principles for curriculum development that give all learners equal opportunities to learn. UDL provides a blueprint for creating instructional goals, methods, materials, and assessments that are effective for everyone. UDL is a one-size-fits-all solution that consists of flexible approaches that can be customized and adjusted for individual needs (Meyer et al., 2014). Hence, UDL principles of representation, action expression, and engagement enable learners with wide differences in their abilities, such as vision, hearing, speech, movement, reading, writing, English comprehension, attention, organization, engagement, or memory, to better participate in an inclusive environment (Courey et al., 2013). Besides, the use of digital technology provides individuals with opportunities for accessing information, managing their own learning processes, communicating with peers and mentors, and developing, repurposing, and sharing materials (Bocconi and Ott, 2014). Therefore, UDL

principles facilitate the development of a wide range of digital pedagogical competences to promote equitable, inclusive, and personalized learning (Redecker, 2017; Bocconi and Panesi, 2018b; Caena and Redecker, 2019).

Open Distance Learning

Following the global COVID-19 pandemic, online learning has evolved into a robust educational platform. With the addition of online learning that take place extensively during the pandemic, distance learning has been coined as open distance learning (ODL). ODL has the potential to improve learning for a wide range of learners in a variety of geographical and socio-cultural contexts, as well as boost intercultural understanding and communication (Gunawardena, 2014). Due to the increasing popularity of ODL ever since the coronavirus disease (COVID-19), ODL has been found to benefit learners in term of efficiency process of learning and improve learners' attendance and performance (Nkolo, 2021). Besides, open distance learning students anticipate consistency and accessibility to learning resources (Allam et al., 2020). However, there were issues that need to be solved by stakeholders. Gnawali et al. (2022) found that access, efficiency, inconvenience, and scarcity were issues of ODL that need to be solved. The lack of clear rubrics and guidelines has affected ODL's developments all over the world. Other concerns were lack of engaging learning activities (Gnawali et al., 2022); Shohel et al., 2022). Immersive technologies like AR/VR have been found to enhance ODL and could generate new ODL opportunities by allowing course content to be taught and presented in ways that would otherwise be difficult, if not impossible, to do (Childs et al., 2021). Besides, AR/VR learning activities create a more enjoyable, interesting, and engaging learning experience for the next generation digital learners. Having innovative technologies such as AR/VR implemented into classroom activities will create authentic experiential learning and increase the numbers of participation in class.

Research Methodology

This paper presents the results of a qualitative study using open-ended online survey questions related to lecturers' opinions on the relationship between virtual reality and augmented reality, and educational equity and inclusion. This study implemented purposive sampling to conduct a qualitative online survey. In this investigation the key research question was as follows:

What are educators' perceptions and attitudes about using VR /AR technologies to improve equity and inclusion in education?

The reason for using qualitative survey research is that it is a less structured research method for learning about people's underlying motivations and reasoning. Qualitative survey examines the diversity (rather than the distribution) of a population (Jansen, 2010). The aim of a qualitative survey is also to determine the diversity of a topic of interest within a specific population, rather than to define frequencies, means, or other parameters (Braun et al., 2021). Nine open-ended questions were emailed to 8 selected participants from Asia Pacific University of Technology and Innovation (APU) in April 2022. Seven junior lecturers and one senior lecturer from several schools at the APU took part in this study. Most of them have between 5 to 15 years of teaching expertise. The open-ended questions were exploratory in character, allowing for variances in participants' perceptions and experiences to emerge. A voluntary participation invitation was emailed to the study participants. The researchers received permission to perform the study and the study was conducted in person, or via email if that was not practicable. Participants were given ample time to complete the survey.

To qualitatively analyze open-ended survey results, thematic analysis was utilized. Thematic analysis is a data analysis strategy that is commonly used in all qualitative designs and is the subject of this method's evaluation (Castleberry & Nolen, 2018). The technique is deemed suited for applied and practice-relevant research, such as this study because it promotes themes to arise inductively as well as deductively from the study purposes. It is also a good method for analyzing open-ended survey responses qualitatively. NVivo 9 software has been used to analyze data thematically.

Findings and Discussion

The data was analysed according to the open-ended questions posed. Based on the analysis, data was presented here along with comments to place them within theory and literature. The participants voice (via verbatim quotes) will back the findings.

1. Equity and Inclusion Awareness

Participants' perceptions of equity and inclusion in education were characterized by two patterns, according to the thematic analysis of the data: (1) treating everyone equally and (2) a sense of belonging (6 of 8 responses). In this study, most participants perceived that equity referred to treating each learner equally, whereas inclusion referred to the sense of belonging among learners without any exception. This is based on their prior knowledge and understanding of equity and inclusion in education. For example:

'Equity refers to equal opportunity of learning. Inclusion referred to immersion and sense of belonging in the learning environment' - Participant C

'As I understand it, equity means the quality of being fair and impartial, while inclusion in this context means the practice of equal access to education and resources for all' - Participant A

2. Technology Integration in education to improve Equity & Inclusion

Participants were then asked on their perceptions on equity and inclusion through technologies:

Question: *Do you think equity and inclusion through technologies can further improve learning in emerging learning environments?*

Most of the participants agreed that equity and inclusion through technologies can further improve learning in emerging learning environments (6 of 8 responses). However, a few participants mention that equity and inclusion through technologies can foster learning depending on the developed or developing countries' existing infrastructure and economic capability.

'Yes, as the shift in learning through learning via technology has increased. However, this may not be viable for under-develop and developing countries for economic reasons, that also contributes to infrastructure reasons.' - Participant E

'Many learners from different countries may not have easy access to the technologies we have around the world, but I personally think there can be a sweet spot that is fair to all so that learning can be effective.' - Participant A

To address the equity and inclusion issue related to the technology, Coughlin (2020) suggested that the government should making issues of equity and inclusion part of the broader national agenda for businesses, non-profits, and make sure to provide a technology social safety net for all while addressing market failure. Besides, while making learning design decisions, educators and anyone participating in online learning design should consider the impact of culture to ensure educational equity and inclusivity (Reedy, 2019).

3. Open Distance Learning (ODL) Awareness

Participants were asked to describe- Open Distance Learning (ODL) based on their perceptions. From the analysis, three sub-theme areas emerge. The sub-theme areas were (1) flexibility in learning, (2) effective T&L delivery, and (3) different teaching modes. All participants believed that ODL that provides flexibility in T&L, different teaching mode available to educators and effective T&L delivery to expand learning communities beyond their classrooms.

'From my personal experience, ODL learning provides a flexible environment for T&L. The learner can access the T&L activities from anywhere. However, it also gives a lot of other limitations, especially from the interaction with the learner.' - Participant F

'Learning via different method & hybrid.' – Participant D

'All the T&L activities through implementing, integrating, utilizing ICT tools and features and allow the activities been carried out remotely to achieve the objectives of learning flexibility, equal opportunity, seamless accessibility and other learning modes.' - Participant C

Based on past study, flexibility in learning allows learners to study at their own speed using ODL, which allows them to learn at any time and from any location (Amir & Borhan, 2022). Besides, Musa et al. (2020) suggested that educators should implement different teaching modes delivery in ODL to ensure every learner can access the T&L process. This is to avoid any difficulties faced by our learners especially during the pandemic.

4. Universal Design for Learning (UDL) Awareness

Participants were asked on their understanding of UDL and its examples. Six out of eight participants have the UDL awareness including understanding the UDL and has experience UDL principles for T&L. The following responses are examples:

'UDL is an educational framework been developed scientifically to achieve of flexible learning environments to adapt different individual unique learning.' - Participant C

'Flexible learning design to accommodate all types of students despite background, skill set etc. Some components integrated in classes – practical activities, group discussion, quiz, mini assignment.' - Participant B

'Simplistically, by applying UDL, I am providing multiple options for students to perceive, express themselves, and engage in activities. I have used different platforms presentation platforms that incorporates live interaction activities tool during lessons and have created asynchronous activities to be done individually or as a group while making myself available for consultation either online/F2F' - Participant G

The findings are in line with the three principles of UDL which are (1) multiple means of engagement, (2) multiple means of representation, and (3) multiple means for action and expression (Iniesto & Hillaire, 2022). Thus, UDL is essential to be used by the educators in their teaching.

5. Perceptions on AR/VR

The theme perceptions on AR/VR are based on the combination of three sub-themes, which are (1) Prior Knowledge on AR/VR, (2) AR/VR Training, and (3) AR/VR in ODL. Based on the analysis, all participants were aware that AR/VR are immersive technology tools that improved T&L. Besides, most of them agree to participate in AR/VR training if provided (7 from 8 responses). The participants perceived that AR/VR has something to do with theory/skills-based class and having full utilization of technology. The below excerpts show the responses from the participants.

'VR completely in the virtual environment, AR allow users to control or interact the virtual elements in the real world.' - Participant C

'If there are trainings on how to implement VR /AR in my learning designs, I would be very happy to attend.' - Participant A

'New technology that able to be used to improved students' engagement and motivation.' - Participant D

'My perception using VR and AR will be beneficial when it comes to theory classes. However, when it comes to practical and hands-on activities, VR and AR may not be fully utilized.' - Participant F

Introducing augmented reality and virtual reality (AR/VR) into today's classrooms can help to engage and motivate students while also giving them with hands-on experiences (Ebinger. Buttke & Kreimeier, 2022). It will also help educators to improve learners' engagement in learning. Therefore, AR/VR should be promoted to be used to support T&L, especially to ensure equity and inclusivity in education.

6. Comfort Level for Change in Learning

A question was asked for participants to identify whether they were comfortable for change in learning.

Question: *Are you comfortable to adapt with changes using VR / AR in ODL to improve inclusivity and equity in education?*

Most of the participants were comfortable to adapt with changes using AR/VR in ODL to improve inclusivity and equity in education (5 from 8 responses). It will however depend on the participants' intention to use VR/AR in ODL due to factors such as content suitability, learning needs and availability of financial and technical resources. Thus, government or higher institutions administration should provide clear guidelines, infrastructure, technology tools and adequate training to educators before any AR/VR implementation decision is made. The following responses are examples:

'Yes and no – depends on the needs of what the learning needs to be. Not all learning must go through VR/AR.' - Participant E

'NO: not for region/nation/countries without luxury, financial and fortunate for the equipment.' - Participant C

7. Aid Learning Loss

To identify whether participants agree that AR/VR will help to cater to the 'learning loss' to increase, engagement, participation, and creativity among learners, a question as below was asked.

Question: *Do you think AR/VR will help to cater the 'learning loss' to increase, engagement, participation, and creativity among learners?*

The analysis resulted in two sub-themes which are increase engagement, and supplementary tools for learning. Most of the participants perceived that AR/VR will help to cater the 'learning loss' which means to increase, engagement, participation, and creativity among learners (7 from 8 responses). Based on the analysis, they agreed that AR/VR will increase learners' engagement in learning and AR/VR can act as a supplementary support to their T&L.

'Yes, it will help to reduce the gaps and solve the issues of engagement, participation and creativity of the students.' - Participant H

'Yes. I believe it could increase engagement and participation. However, I think further investigation may be needed to study how long a learner could stay engaged, and whether is it suitable for long-term activity.' - Participant F

Recommendations

In view of the importance of equitable and inclusive learning practices the following recommendations are suggested when using AR and VR technologies in T&L:

1. To conduct mixed-method survey for a larger group of educators amongst higher education institutions (HEIs).
2. To instill awareness of using AR/VR in non-technology fields such as business, accounting, and language.
3. To incorporate UDL principles into their T&L planning that related to the use of AR/VR
4. To increase engagement by using AR/VR for more holistic learning experiences
5. HEIs should provide adequate training or courses to educators on how to prepare lessons for AR/VR

Conclusion

The findings suggest several challenges and benefits of using AR/VR in ODL to enhance learning. With the development and implementation of AR/VR in ODL, these immersive technologies enable more personalized, adaptive, and immersive learning in a blended learning environment. This study revealed that it is therefore essential to determine educators' perceptions and attitudes regarding equity and inclusion in education and how they view

inclusive education for both students with and without disabilities. From the findings, most of the educators believe and are aware that using VR/AR in the classroom can improve equity and inclusion. Besides, AR/VR helps to cater for the 'learning loss' to increase engagement and participation among learners. Thus, learners will be able to engage, participate, and collaborate using the latest technological tools in an immersive learning environment for a better learning experience.

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