Education Students' Experiences, Learnings, and Views on the Production and Use of Metaverse-Based Educational Material for Teaching and Learning

Luisa A. Gelisan
luisa.gelisan@upou.edu.ph
University of the Philippines Open University, Philippines

Lexter J. Mangubat
lexter.mangubat@upou.edu.ph
University of the Philippines Open University, Philippines

Abstract: The metaverse is a computing platform that enables real-time interaction and engagement among individuals separated by time and space. In an undergraduate course on creating educational multimedia materials, students were introduced to the planning, development, and evaluation of educational multimedia materials, including metaverse-based learning materials. As a final project, students were tasked with producing an educational multimedia material of their choice, with some opting to create metaverse-based educational materials (MEM). This study explores students' experiences, insights, and perspectives on producing and utilizing MEM as a tool for teaching and learning. A focus group discussion (FGD) was conducted with students who voluntarily participated in the research. The recorded discussions were transcribed and analyzed using thematic analysis, revealing three key themes: the potential of MEM as a teaching and learning tool, the production requirements (both human and non-human resources), and critical considerations for MEM users.

Keywords: *Metaverse, multimedia, teaching, learning, educational media production*

INTRODUCTION

The continuously evolving environment has provided a plethora of challenges and disruptions in various aspects of our lives. In the education sector, the evolutions and disruptions push educators and educational institutions to adopt and reconfigure information and communication technologies (ICT) that were initially created for other human activities. The advantages and opportunities provided by ICT to everyday human interpersonal activities were adopted and reconfigured for use in the delivery of education.

Metaverse, a computing platform, provides an immersive virtual world where people can connect, interact, and collaborate in real-time. In the past decades, metaverse has been used in the online gaming industry (Hussain 2023; Tucci and Needle 2023), but its use and impact shall go beyond games and entertainment. Metaverse is considered by companies as an effective way to develop and train their staff members, as it not only can teach technical skills but also soft skills such as leadership and the capability to adjust and adapt to changes (Likens and Mower 2022).

The University of the Philippines Open University offers an undergraduate course titled Design of Educational Multimedia Materials. This course is taken by students under education and teaching programs. Before enrolling in this class, almost all of the students were already familiar with different multimedia materials, video, interactive video, PowerPoint, ebooks, animation, etc, as they have been using it as learning materials in most of their courses. The focus of this course is the concepts, principles, and methodologies in the design of educational multimedia materials as well as in the evaluation of multimedia learning materials.

In the first trimester of SY 2023-2024, the course included, for the first time, a session on metaverse-based educational material (MEM). This was also the first time as well for the majority of the students to encounter the use of metaverse for teaching and learning. Aside from the multimedia learning resources about MEM, an online workshop

on creating a metaverse using FrameVR was conducted. FrameVR is a web-based metaverse builder that has a version that can be used and accessed for free. The recording of the online workshop was uploaded to the course site to benefit students who missed the live session and to serve as a resource for review.

Figure 1

A Screenshot of a MEM Produced by a Group of Students
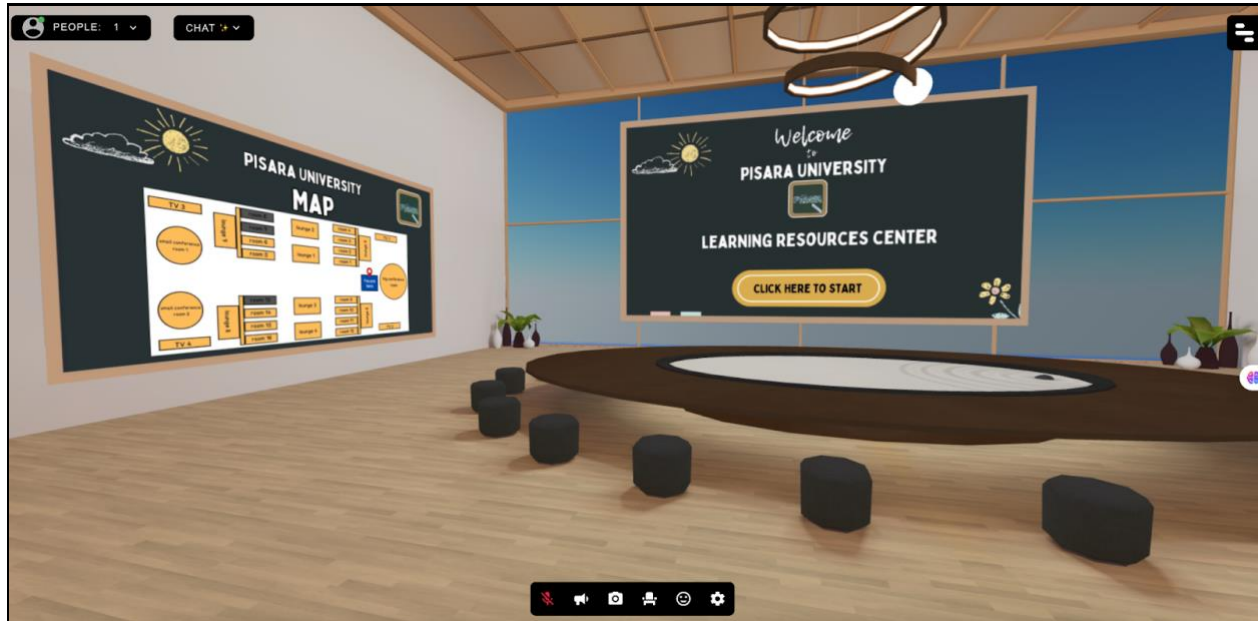
One of the requirements of the undergraduate course was for the students to plan and produce multimedia educational material, the content of which should be among the prescribed topics by the teacher. However, the students can choose what type of multimedia materials to produce; either an educational video material; a PowerPoint presentation; an ebook; or a metaverse-based educational material, among others. The class had 55 students who were divided into groups with five (5) members each. Among the 11 groups, only 4 groups opted to develop and produce MEMs. Figure 1 shows a sample of the MEM produced by one of the groups of students.

RESEARCH OBJECTIVES

This study examined students' experiences and insights into the production of MEM, as well as their perspectives on its use for teaching and learning. Specifically, it explored the motivations that encouraged students to engage in MEM development, identified their primary considerations during the planning and development process, analyzed the challenges encountered during the initial stages of MEM production, and assessed the issues and perceived advantages of using MEM as an educational learning material.

REVIEW OF LITERATURE

METAVERSE

The Metaverse, as described by Mystakidis (2022), represents a futuristic realm beyond reality that offers a "perpetual and persistent multiuser environment" where users engage in multisensory interactions with virtual environments, digital objects, and people (p.486). It is a virtual environment or a computer-generated world, as Wang

et al. (2023) put it, where one can interact with fellow players through their digital avatars. Nang et al. (2021, as cited in Wang et al., 2023) conceptualized the Metaverse as a "fully immersive, hyper spatiotemporal, and self-sustaining virtual shared space blending the ternary physical, human, and digital worlds" (p. 319).

METAVERSE IN TEACHING AND LEARNING

Explorations into the potential of the Metaverse as an educational tool have garnered significant attention. According to Mystakidis (2022), the fourth wave of computing innovation is anticipated to become the next widespread computing paradigm that could potentially revolutionize online education and other sectors of society (p. 486). The Metaverse offers learners the opportunity to "...have immersive experiences of times and spaces that cannot be experienced in reality, such as past or future eras" (Kye et al., 2021, p. 8).

In a study conducted by Onu et al. (2023) the term "educational metaverse" was used to classify a metaverse environment that lets students collaborate, have discussions, and share ideas, as well as access resources. They have identified several implications of Metaverse in teaching and learning. Some of these implications include the ability to offer students immersive and interactive learning experiences that go beyond traditional classroom boundaries, the capacity to facilitate personalized and adaptive learning (Onu et al., 2023), and the ability to foster international collaboration and knowledge sharing (Pricer, 2010, as cited in Onu et al., 2023).

Other studies looked at the affordances of the Metaverse as a space that can promote blended teaching and learning (Mitra, 2022) and how the Metaverse can help game designers develop gameful learning experiences (Thomas et al., 2023).

This study shall contribute to the growing interest and literature on the Metaverse as applied in the educational context. Specifically, this study will explore the views of teachers-in-training as they developed a MEM.

METHODOLOGY

RESEARCH DESIGN

This study employed a qualitative research approach, utilizing thematic analysis to explore the research questions. The data were gathered through a focus group discussion (FGD) that was conducted after the school term had ended. The FGD was held via a video conferencing platform to accommodate participants residing in different cities. The FGD lasted approximately 80 minutes and was conducted in both English and Filipino. With participants' consent, the session was recorded for transcription and analysis. The recorded FGD was transcribed verbatim for thematic analysis.

PARTICIPANTS

The participants of this study were students enrolled in a course on designing educational multimedia materials who produced MEM as their final project. They were invited via email to participate in the FGD. Only those who voluntarily accepted the invitation were included in the study.

Among the 20 students who opted to develop MEM, only three students volunteered to participate. All of them were practicing teachers, two were based in the Philippines and one in Thailand. They were enrolled in the undergraduate course as part of a teaching certification program, which is a program designed for non-education degree holders intending to qualify for the Licensure Examination for Teachers administered by the Philippine Regulatory Commission.

DATA ANALYSIS

The collected data were analyzed using thematic analysis, a systematic method for identifying, organizing, and interpreting patterns or themes within qualitative data (Braun & Clarke, 2012). This process included the following:

1. Familiarization. The recorded FGD was transcribed and then was reviewed to ensure accuracy and to understand the content.

2. Initial Coding. The data were coded by highlighting key phrases and statements relevant to the research questions. Both explicit and implicit meanings were looked into.
3. Identify Themes. Codes were organized into categories to identify themes that captured significant patterns
4. Review Themes. The themes were reviewed against the coded data to ensure coherence and alignment with the research objectives. Themes that overlapped were refined while those that lacked substance were discarded.
5. Define Themes. Each theme was defined or described.
6. Organization and Presentation. The final themes were organized and presented, supported by illustrative quotes from the FGD transcript. These themes were interpreted in the context of the study's research questions.

RESULTS AND DISCUSSION

The analysis of the data produced three themes.

MEM'S POTENTIAL AS A TEACHING AND LEARNING

The respondents agreed that MEM has a big potential as a learning material, not only for students but the teachers as well. All of them agreed that MEM will enable teachers to offer interesting and creative ways to share/present information on different topics in class. Learning materials -- Powerpoint presentations, videos, text-based materials, audio material, infographics and web pages -- can be incorporated into the MEM. With this, especially with the young learners who are so used to using ICT in various aspects of their lives, MEM promotes learner engagement as monotonous activities in class shall be avoided.

A respondent said:

"Students nowadays are exposed to various technologies and technologies are changing regularly, thus, teachers need to add new 'flavors' (techniques) in teaching."

This perspective is also consistent with Alizadeh's (2024) study where she underscored the importance for educators to incorporate digital tools and skills into the curriculum of students to prepare them for the demands of the 21st Century workforce. Lee and Hwang (2022) also pointed out that VR instructional content can encourage students to participate and engage in their learning.

Another respondent said:
"Metaverse-based learning material is suitable for synchronous learning since the teacher and students can navigate together through the rooms where the learning materials and activities are. Unlike in video conferencing software, there is limited engagement/interaction (among teacher and students)."

A respondent has also pointed out that by providing the class with a learning tool like MEM, the educators will then:
"...have more time to provide evaluation or feedback on the learners' activities/ accomplishments."

These mentioned potential opportunities to enhance and make learning more engaging are consistent with Zhang et al's (2022) study where they found out thatthe metaverse offers new perspectives and innovative methods for education which create opportunities to enhance learning experiences, i.e., students and teachers can interact in novel ways, overcoming physical and geographical barriers.
Furthermore in Onu, Pradhan, and Mbohwa's (2024) qualitative study on the impact of the metaverse on teaching and learning, they stated that the metaverse enables virtual simulations that enhance engagement and faciltates meaningful learning experiences.
With the potentials mentioned, the respondents all agreed that to enhance the effectiveness of MEM as a teaching and learning tool:

> "...the accessibility of the MEM should be ensured; the student should not have difficulty navigating through the MEM using different kinds of devices, whether one is using a computer desktop, laptop, tablet, or mobile phones..."

REQUIREMENTS FOR MEM PRODUCTION

To be able to create an MEM that is suitable as a tool for teaching and learning and that will enhance the learning as well as students' engagement in class, the respondents pointed out production requirements. These requirements are categorized as human and non-human resources.

A. Human Resource

For human resources, the requirement is for the developer to have or acquire 21st-century skills. The skills pointed out were categorized using the skills listed by Binkley et al (2012) in their article titled "Defining TwentyFirst Century Skills." These were as follows:

A.1 Collaboration

Collaboration, particularly online collaboration skills, was essential, as many students lived far from each other and were in different time zones. This was evident in the challenges faced and strategies employed by the participants while developing their MEM.

> "Another challenge was finding time to meet and work together online, since it is difficult to develop/produce multimedia materials for people who are coming from different places ... I'm really proud of our teammates (sic) we are being able to handle the pressure..."

> "We would have quick meetings. Members of the group will take turns taking the initiatives to start or continue working on a design or layout while other group members attend to their job responsibilities. Then each one will help out to finish a task, especially when difficulties are being met."

The MEM developers shared that they decided on the division of work among members of the group based on the application or software a member is familiar with as well as the familiarity of the developers of the topics/contents for inclusion in the metaverse.

Regarding resolving conflicting opinions on matters related to the development of the MEM, they have discussions and weigh the options presented, then conduct voting, if needed, as to what options to take. The decision of the majority shall be followed.

> "...we would usually just ask for opinions and comments from different members of the group. If they think something can be done differently or if they think like this should not be included or not like we always try to include everybody ... then if we have to come or arrive to a decision, we vote for it, so if majority naman po yun ang yung pumili okay lang..." (*If the majority chose that, it's okay*)

A.2 Flexibility, including resetting oneself to learn new things.

The student respondents of this study are all new to the Metaverse. The first time they experienced using a Metaverse was during an online presentation conducted by one of the teachers of the course. These MEM developers have become learners themselves as they need to know how to use the application, its different features and how the features can be maximized for teaching.

> "I realized that I can explore and learn how to use the VR framework. At first, I was hesitant if I could learn to use the application. I realized that I need to reset myself, I need to focus so I can learn the application. Even if one has finished graduate degrees, learning VR apps is a different experience; it feels like I am a toddler who is exploring to start learning."
> "As an MEM creator, I realized I became a learner again. I have to start teaching myself again to learn, which I learned is one of the 21st Century Skills. Creators and/or educators in the Department

of Education need to explore the development and use of metaverse. It is difficult not only to explore the different features of metaverse, learn to integrate different topics presented using different presentation formats like Canva, Youtube, or PDF that can be included in the VR frame application."

As the research respondents-developers learned more about the VR application and its capabilities, through experimentations and trials and errors, adjustments and changes in the original concept notes were also done to accommodate what they found to be doable and not. They also made adjustments in the instructional design and the design of the MEM to make sure that they target learners or users of the MEM will be able to navigate smoothly through the environment, learn the topic, as well as enhance engagement and learning experiences by using the MEM.

"If I am the student and I see this, would I get the sense of what it is for? If there are many contents, would they be overwhelming?"

"Give more consideration to students. Think of how students will use or study through metaverse-based learning material. Will the material be overwhelming to students?"

"Has realized that to become a better teacher, one needs to learn more or use other ways of teaching that will interest the students, thus it is also important to know what may interest the students, specially that they have different learning needs/styles."

Flexibility, including the ability to reset oneself to learn new things, aligns closely with previous findings regarding requirements for adopting the Metaverse for teaching and learning. As the Metaverse introduces a wide range of emerging technologies, educators are required to continuously update their technical knowledge and skills (Tlili et al., 2022) and undergo training to develop proficiency in using Metaverse platforms (Onu et al., 2024). Tlili et al (2022) and Mbohwa (2024) added further that using Metaverse requires a mindset shift, enabling teachers to explore new pedagogical strategies to be able to develop dynamic and collaborative virtual platforms for students. Teachers must remain open to revisiting and refining their strategies as new challenges and opportunities arise in Metaverse-based education (Onu et al., 2024).

B. Non-Human Resource

B.1 Concept Note
The concept note or plan serves as the foundation of the production process, providing a clear guide for MEM developers. It defines the scope of the MEM's content in relation to what is feasible, considering factors such as the size of the development team, the division of tasks among members, and the time available to meet the production deadline. Additionally, it offers an overview of whether the MEM content is designed appropriately for the target learners. This includes evaluating the content's relevance, coverage, presentation of topics, and the estimated time learners will need to engage with each frame, among other considerations.

It should be noted that an approved concept note is a requirement before the group can proceed with their MEM production.

"The planning part is the most difficult. One needs to look at the bigger picture. Plan first the contents, before you start designing the rooms (inside the metaverse)."

B.2 ICT Hardware and Software
In the FGD, the participants said that MEM production uses different production software -- for video editing, graphics design, animation, sound editing, etc -- that would require a computer with a fast processor, good video card, and large storage capacity. In particular, loading or accessing the online metaverse platform and uploading or linking the assets on the metaverse is time consuming. A fast and stable Internet connection would also enable the development of the MEM easier, faster, and more efficiently.

"(Development of) one lesson would really take a lot of time. Before you can attach a picture on the wall, you need to wait for the loading. You really need to have good internet access, a device that can accommodate the metaverse app..."

The respondents also noted that it is not only the MEM developers who need to have good ICT hardware and software but also the learners who will use the MEM for learning. Zhang et al (2022) study has also pointed out the importance of having high-quality devices and access to the Internet to participate in the metaverse immersively and has multi-sensory interactions.

THE MEM USERS

The third theme that emerged from the FGD is regarding the users of the MEM.

The respondents said that their target audience for the MEM they produced was high school students from a Philippine private school because all of the students from the said school have access to different ICT devices and are already used to using ICT devices. However, it was also pointed out that young learners are either easily distracted or bored, thus an MEM designer should consider the attention span of students when planning and developing the material.

> "When you are young, you easily get distracted. Even when there are audio guides, bot, or maps incorporated in the MEM, the student might get distracted (because of the various activities incorporated) thus may not be able to follow the instructions or proceed with the different activities because they may find certain activities boring. This is a challenge for learning materials developers. "

Furthermore, it was revealed during the discussion that Metaverse-based educational materials may be more appropriate for young learners than for adult learners. Adult learners may use it but only up to a certain age, as they might have difficulties understanding and navigating through the MEM interface. The metaverse platform can be overwhelming for adult users, as they, the developers. have also experienced while developing and testing their MEM. One of the developers shared that she experienced motion sickness during the production of their MEM.

> "... for older students or MEM users, they might get overwhelmed by the looks/ arrangement in the platform..."

> "There might be health challenges too. I myself got dizzy while navigating the MEM. I told my group mates that I will take a break for a while. It could be that other students or teachers who are not used to a metaverse environment, like myself, will experience motion sickness."

Cybersickness remains a significant issue, especially when using head-mounted devices essential for accessing the Metaverse. While this study did not employ any head-mounted devices, cybersickness still surfaced as a concern, akin to the findings of Syukur et al. (2022) and Onu et al. (2024). Their research highlighted discomfort and physical strain experienced by users, such as fatigue resulting from prolonged interactions in virtual environments.

CONCLUSION

The data gathered from the FGD resulted in three overarching themes. These are the potential of metaverse-based educational material (MEM) as a teaching and learning tool, requirements for MEM production -- human and non-human resources necessary for MEM development -- and considerations regarding MEM users.

The respondents recognized that MEM can enhance teaching and learning experiences. It can engage both students and teachers through its interactive and dynamic features by offering varied multimedia content and enabling various activities, especially among digital native students. MEM was deemed suitable for synchronous learning as the environment enables collaborative exploration of learning materials.

The requirements for MEM production were classified as human and non-human resources. The human resource called for developers with 21st-century skills, particularly online collaboration and flexibility, which are necessary to address the challenges of MEM production. The non-human resources include a comprehensive concept note to guide production and adequate ICT hardware and software for efficient development.

Considerations regarding MEM users were also emphasized, particularly focusing on young students from private schools as they have access to ICT needed to use MEM. It was also noted that MEN might be more suitable for younger learners due to potential challenges such as motion sickness, which could be experienced by adult users.

This study is limited to the experiences and views of the three students who voluntarily participated in the FGD. This limited sample may affect the richness and diversity of perspectives, as the experiences shared may reflect the specific context of the participants' professional and educational backgrounds. Nevertheless, this study provides insights into the perspectives of online students who underwent the development process of a MEM.

FUTURE CONSIDERATIONS

Moving forward, the experiences and perspectives of the participants yielded the following recommendations for educators or students who plan to use MEM as a tool for teaching and learning.

1. Provision of capacity and capability building for educators and creators of teaching and learning resources, particularly MEM, not only in terms of how-to's of production but on its proper design and utilization for teaching.

2. Provision of resources, especially hardware and software, that MEM creators can use for production and also for students who do not have access to such facilities/equipment.

3. The use of MEM should not be only for private schools and for students who have the means to access the ICT devices needed.

4. Explore the development of age-friendly MEM to address ageism and provide equal opportunities for learners of all age groups to engage with and benefit from MEM in teaching and learning. Additionally, consider exploring alternative hardware or customizing existing hardware to make MEM more accessible and user-friendly for older learners.

5. Continuously evaluate MEM as a teaching and learning tool by gathering insights from various educational stakeholders, starting with students. Understanding their experiences and perspectives on using MEM in their studies can provide valuable information to guide teachers and developers in improving the design, production, and implementation of MEM; and as well as in the development of hardware and software for metaverse.

6. Conduct of research on the effect of metaverse on data privacy especially when there is too much data collection in the metaverse and possible user addictions, its potential harm to physical and mental health, particularly among young learners with limited self-discipline.

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