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Towards A Model to Integrate Metaverse Into Moodle LMS for Better Students' Experiences and Preferences in A Resource Constrained Higher Education Situation in Uganda

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Abstract

Learning Management Systems like Moodle are widely acceptable platforms for online learning. However, they get limitations when it comes to subjects and programmes that require physical presence especially for practical based courses like Engineering. This paper provides some expert insights into this online distance learning, with the goal of helping non-expert university teachers (i.e. those who have little experience with online learning) and within a technologically resource constrained environment to navigate in these challenging times. These conceptual case-based findings, using experience from Uganda Christian University (UCU) point at the design of learning activities with two certain characteristics, the enhancement of synchronous learning technologies and asynchronous ones to mitigate the challenge of system breakdown, passive learning to active learning, and enhancing the types of presence (social, cognitive and facilitatory). The paper both empirical and experiential in nature, offers an enhanced frame work of Moodle LMS with possibility to integrate it with metaverse tools to improve online education. For instance, for Virtual Reality (VR) and augmented reality (AR) enhance engineering practical courses by providing safe, cost effective and immersive learning environments for complex concepts and procedures, reducing the need for expensive physical equipment and improving safety by simulating hazardous scenarios. This proposed model shall be tested and validated at UMI after integrating VR/AR into the platform to enhance immersiveness.

Keywords: synchronous learning, asynchronous learning, metaverse, active learning, reflective learning, resource constrained environment

Introduction

Online learning environment can offer learners opportunities of flexibility, interaction and collaboration distinctly different from traditional face-to-face environments. However, the integration of digital education technologies; synchronous and asynchronous ones, also presents challenges and concerns in relations to students' learning. Such challenges have even been acerbated by Covid-19 pandemic wherein higher education community worldwide have been argued to go online. In Uganda, a particular challenge has been the urgent and unexpected request for previously face-to-face university courses to be taught online through Ministry of Education COVID-19 Online Distance E-learning (ODeL)

emergent guidelines. Online teaching and learning imply a certain pedagogical content knowledge, mainly related to designing and organising for better learning experiences and creating distinctive learning environments, are carried out with the help of digital technologies.

In relation to challenges and uncertainties about technology, studies have accentuated that technology does not offer a complete solution for a transformative education. It is also observed that technologies offers both potentials and limitations, which should be thoroughly considered for a successful implementation of online learning. Yamagata-Lynch (2014) observes that there is room in the instructional technology research community to address strategies for facilitating online synchronous learning that complement asynchronous learning. There are mixed appreciations of synchronous and asynchronous technologies, one major frequently mentioned problem in online distance education is the inadequacy of communication and interaction among users (Cukurbasi Calisir, Sabuncu & Altun, 2022). Moreover, synchronous and asynchronous available applications and platforms are based on 2D web-based environments with limitation for 3D that are characterized by immersion and full engagements. This then leads to emotional and social isolation which is detrimental to motivation for participation (Mitra, 2023). Hence, metaverse has recently merged as a useful platform for various types of online environments and has become more popular in this process with the interaction opportunity it offers to users (López-Belmonte et al, 2022; Mitra, 2023). Whereas this seems to be a new concept in developing digital resource constraints context, this paper explores metaverse's possibility to improve online education in resource constrained environments.

However, prior to design of online learning environments, Alzaghoul (2012) has warned that researchers and practitioners should carefully and critically assess instruction learning theories in order to clearly align technology within pedagogy.

Instruction learning theories

Learning theories are meant to help education instructors understand how people learn. This section reviews the most popular learning theories that have been occasionally used to offer a foundation for designing learning and associated learning outcomes. Among those are behaviorism, instructionism, social constructivism among others. This paper purposefully uses situation awareness theory (Endsley, 1995; Kyakulumbye et. al., 2018; 2019; 2020; Kyakulumbye, 2021) as a lens to examine how metaverse mindset can help to improve the design of Learning Management Systems to elicit engaging, active and meaningful learning. This is because Situational awareness Theory (here abbreviated as SitAwaT) helps to align the core of the development, providing understanding of what is happening around us (Endsley & Garland, 2000). It uses inputs from sensors and humans and provides the ability for metaverse tools to survive in an uncertain environment (with edits from Höyhtyä, 2023).

Situation awareness theory (SitAwaT) as a Learning theory for online education

Just as no single theory has emerged for instruction or learning in general, the same is true for online education (Picciano, 2017). Within the online environment, this section examines the appropriateness of situation awareness theory within an online environment.

In terms of long-distance learning, situation awareness theory (Endsley, 1995; 2000) has been recommended to offer solution to challenges of online learning environment (Albashaireh & Ming, 2018). When collaborating, individuals rely on situation awareness (the gathering, incorporation and utilization of environmental information) to help them combine their unique knowledge and skills and

achieve their goals. When collaborating across distances, situation awareness is mediated by technology (Sonnenwald, Maglaughlin & Whitton, 2004.). There are few guidelines to help system analysts design systems or applications that support the creation and maintenance of situation awareness for teams or groups. It is observed that a framework to guide design decisions to enhance computer-mediated situation awareness during scientific research collaboration is crucial.

Situation awareness is comprised of contextual, task and process, and socio-emotional information (Endsley, 2000). Situation awareness has been defined as continuous extraction of environmental information, integration of this information with previous knowledge to form a coherent mental picture in directing further perception and anticipating future events. Whereas situation awareness has been applicable to hard tasks like military piloting, even common tasks such as driving a car, walking through a building or participating in a meeting also require situation awareness (Endsley, 1995). Regardless of the situation, individuals ‘‘must do more than simply perceive, comprehend and project the state of their environment. They must understand the integrated meaning of what they are perceiving in light of their goals before they can choose a suitable action (Sonnenwald, et al., 2014).’’ It has been noted that incorporating human-oriented situation awareness is a driving factor to facilitate user experiences in online environments (Albashaireh & Ming, 2018; Kyakulumbye, Pather & Jantjies, 2019).

Human-oriented situation awareness is revealed to determine social presence dimensions of social context, online communication and interactivity (Tu & McIsaac, 2002). Researchers have revealed that social presence aspect of situation awareness is the most important perception that occurs in an environment and it is fundamental to person-to-person communication (Kyei-Blankson, Ntuli & Donnelly, 2019). However, within an online environment, the learning situation migrates from traditional face-to-face to use of synchronous and asynchronous learning tools. The favor that the learners attach to the tools determines their perceived value in the learning process in terms of objectiveness/outcome attainment and commensurable to the tuition paid (Panigrahi, Srivastava & Sharma, 2018; Vican, Friedman & Andreasen, 2020).

The move towards online learning using both synchronous and asynchronous tools

The shift to online learning necessitated by COVID-19 has pushed many educators into the unfamiliar space of online teaching. In these circumstances, educators may fall back on replicating familiar face-to-face (f2f) practices (Henriksen, Creely and Henderson, 2020). Although synchronous video-conferencing provides surface-level replicability of existing f2f synchronous teaching modalities, moving pedagogy from one medium into another is not and has not been a simple translation (idem). Asynchronous learning provides learners with time to reflect between exchanges, enabling high-order thinking (Abosalem, 2016). If asynchronous lessons contain text, audio and video, they offer the learner the ability to convey visual and auditory cues (Borup, West, Thomas & Graham, 2014). However, the fragmented nature of asynchronous interactions can result in a sense of loss among learners (Abosalem, 2016). Researchers have observed that this sense of loss due to limited interaction with the lectures have contributed to online learning’s high attrition rates, estimated to be higher than of face-to-face learning (Tyler-Smith, 2006. Borup, et al, 2014; Abosalem, 2016).

One way to minimize this loss and improve learner’s sense of learning presence is to increase social presence (Borup et al, 2014). Garrison defines social presence as the participants’ ability to be perceived as real in mediated environments (Garrison et al, 1999). Students’ abilities to establish their presence in a face-to-face environment does not equate to their ability to do so in an online environment. For

instance, students with low self-regulation may find it difficult to fully participate in asynchronous online discussions (Wise & Hsiao, 2019). Students who are expert in spontaneous communication may not have the reflective writing skills required for online discussion forums (Muramatsu and Wangmo, 2020). Researchers have observed that a blend between asynchronous text, audio and video tools and synchronous live online presence of the lecturer via tools like ZOOM, Skype and BigBlueButton improves the learners assertive and active learning than they would otherwise be (Chaiko et al, 2020; Muramatsu and Wangmo, 2020; Azlan et al, 2020). From the debates, blending these tools improve social presence and enhances active learning in an online environment while at the same time retaining a high level of flexibility and reflection.

As regards to level of Higher Education and programme of students, researchers reveal that such diverse students have varying appreciation of asynchronous and synchronous text, audio and video tools (O'Byrne & Pytash, 2015). The postgraduate students are revealed to appreciate conversational learning that is offered in real time as it happens within a face-to-face mode while undergraduate students appreciate the self-pacedness of asynchronous pre-recorded lecturers (Fansler, 2006; Colombo, 2019). Moreover, with such mixed appreciations of synchronous and asynchronous technologies, one major frequently mentioned problem in online distance education is the inadequacy of communication and interaction among users (López-Belmonte, Pozo-Sánchez, Carmona-Serrano & Moreno-Guerrero, 2022; Cukurbasi Calisir, Sabuncu & Altun, 2022). Additionally, synchronous and asynchronous available applications and platforms are based on 2D web-based environments with limitation for 3D, which are characterized by immersion and full engagements. This then leads to emotional and social isolation which is detrimental to motivation for participation (Mitra, 2023). Hence, metaverse has recently merged as a useful platform for various types of online environments and has become more popular in this process with the interaction opportunity it offers to users (López-Belmonte et al, 2022; Mitra, 2023). Whereas this seems to be a new concept in developing digital resource constraints context, I delve into metaverse's possibility to improve online education, especially as way to improve communication, social presence, active learning and engagement.

Metaverse-Based Education on online learning

The adoption and use of Internet technologies in both synchronous and asynchronous mode as learning tools has facilitated the adoption of the Metaverse environment (Cukurbasi Calisir, Sabuncu & Altun, 2022). The authors have further observed that the decrease in communication among learners within online distance education and the lack of interaction has made the concept of metaverse more common. Ravenscraft (2023) has observed that that founder/originator of the notion of metaverse, Mark Zuckerberg, that it is the future of the internet or deeply uncomfortable, worse version of zoom. The metaverse, derived from the words "meta" implying 'the building of a virtual reality social platform' and "universe" which is 'space, time and their contents' (Cheng, Chen & Han, 2022), was created by the emergence of a new class of enhanced social interaction beyond entertainment (Cukurbasi Calisir, et a, 2022). Broadly clarifying, Ravenscraft observes that the technologies companies refer to when they talk about "the metaverse" can include virtual reality (VR)—characterized by persistent virtual worlds that continue to exist even when you're not playing—as well as augmented reality (AR) that combines aspects of the digital and physical worlds (Ravenscraft, 2023). However, it doesn't require that those spaces be exclusively accessed via VR or AR. Mentally even when we replace the phrase "the

metaverse" in a sentence with "cyberspace," ninety percent of the time, the meaning won't substantially change (Ravenscraft, 2023).

Metaverse enables multisensory interactions between virtual ecosystems, physical entities and digital twins (Mitra, 2023). Digital twins are digital models of entities, processes, products or services as representation of the physical world (idem). As has been observed, most developing contexts e-learning platform are learning management systems like Moodle, Blackboard, Sakai among others with integrated synchronous and asynchronous 2D based platforms aforementioned. In their paper, "Putting a Second Life 'metaverse' skin on learning management systems," Kemp and Livingstone (2006) note that Second Life, SL, system by Linden Lab is a persistent 3D world, or "metaverse" where users access the online system with a proprietary client and interact with content and other "residents." Unique features include simple tools for constructing 3D objects and scripting tools for interactive content - including connectivity with external web-pages and internet resources (Kemp & Livingstone, 2006). As opined by Dickey (2005), integrating 3D metaverse platforms have several advantages for learning:

- 3D immersive format has significant potential for "facilitating collaborations, community and experiential learning" and highlighting the situated embodied nature of the learning as a particular strength;
- provides a sense of embodiment, yet one in which normal barriers between students and staff can be broken down. Compared to other electronic tools for distance communication, there can be an improved sense of being 'there' in a classroom, rather than of being a disembodied observer;
- the acknowledged power of multi-media to improve delivery of material over purely written means.

Notwithstanding, Ravenscraft (2023) has warned that while some advocates claim such 3D new technologies can enable portable digital assets, this is simply isn't true, and bringing items from one virtual world to another is an enormously complex task that no one company can easily solve. Other limitations are: poor document repository, calls for considerable hardware demands, the minimum technical requirements are beyond the capabilities of typical labs in most schools and colleges – particularly with regards to graphics cards, virtually impaired learners may have negative learning experience among others (Kemp & Livingstone, 2006). This study is aware of such limitations among others especially in resource constrained environments but juxtaposes the research context to examine how available current practices of LMS usage can be improved using the new mindset and philosophy of metaverse.

Research Context and research questions

This paper provides some expert insights into this online distance learning, with the goal of helping non-expert university teachers (i.e. those who have little experience with online learning) and within a technologically resource constrained environment to navigate in these challenging times adopting emerging immersive technologies with metaverse mindset and philosophy. These conceptual case-based findings, using experience from Uganda Christian University (UCU) point at the design of learning activities with two certain characteristics, the enhancement of synchronous learning technologies with asynchronous ones to mitigate the challenge of system breakdown, passive learning to active learning, and enhances the types of presence (social, cognitive and facilitatory).

This course on which this article is based was one of the case studies during delivery of purely online courses (Project Cost Management and Project Risk Management for a Bachelor of Project Planning and Entrepreneurship; Second and Third year respectively). The case study focuses on a fully online course

that was offered in the Advent semester of the 2020 academic year. Fifty students (11 second years and 39 third year students) participated in this study. The research questions that guided the study were as follows:

a) To what extent do students' demographic characteristics influence their experiences and preferences from online learning environments?
b) What are the students experiences and preferences of synchronous and asynchronous online learning environments?
c) To what degree to the students online learning environment experiences (asynchronous and synchronous) affect their perceived learning outcomes and learning value?
d) How can the available LMS platform be improvised with metaverse to improve communication, engagement and active learning among students and instructors?

Conceptual framework

From the above research questions, the following conceptual framework is constructed to guide literature review:

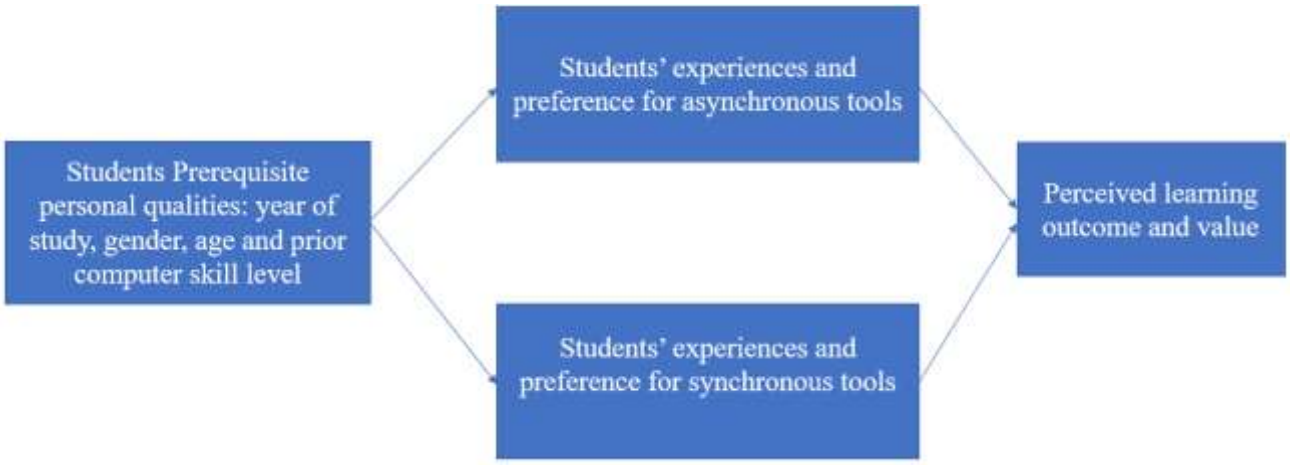

Figure 1: Perceived learning outcomes from perceived social presence in asynchronous and synchronous tools

From the figure, it is hypothesized that students' demographics characteristics influence the perceived social presence in asynchronous and synchronous learning mode; which will ultimately influence their learners' perceived learning outcomes.

Description of the online learning environment using synchronous and asynchronous tools

Under both circumstances, the learning involved both synchronous (in real time) and asynchronous tools (self-paced). Lessons were designed in PowerPoint, Microsoft word and portable digital formats. In all cases, they were pre-recorded to aid asynchronous learning in the first phase. The lessons were pre-recorded using OpenBroadcaster Software (OBS) due to large size of the video, they were compressed using Handbrake, also an Open Source encoding software. Handabrake was used because it compresses the presentation and maintains the presentation quality, yet compressing it by 90%. For instance, a 100 mb presentation is compressed to 10 mb. After making the presentation and compressing it, the video or audio presentation was uploaded to my Youtube Channel, a link was uploaded to my Moodle LMS

course page as a URL. The student would then view the presentation in a self-paced manner, any time, any place any day.

Online learning experience at Uganda Christian University

For synchronous learning, there were three options but for purpose of this paper, two options are presented. These options are: a) Using BigBlueButton (BBB) inbuilt resource within Moodle LMS; b) Zoom for education links shared with the learners via WhatsApp and Moodle LMS as a URL; and c) Using Livestreaming via OBS as streaming software and YouTube Channel. The later is not presented as part of this paper. However, for both cases, assignments were always timed within Moodle Course page LMS. Below are the screen shots/learning interfaces:

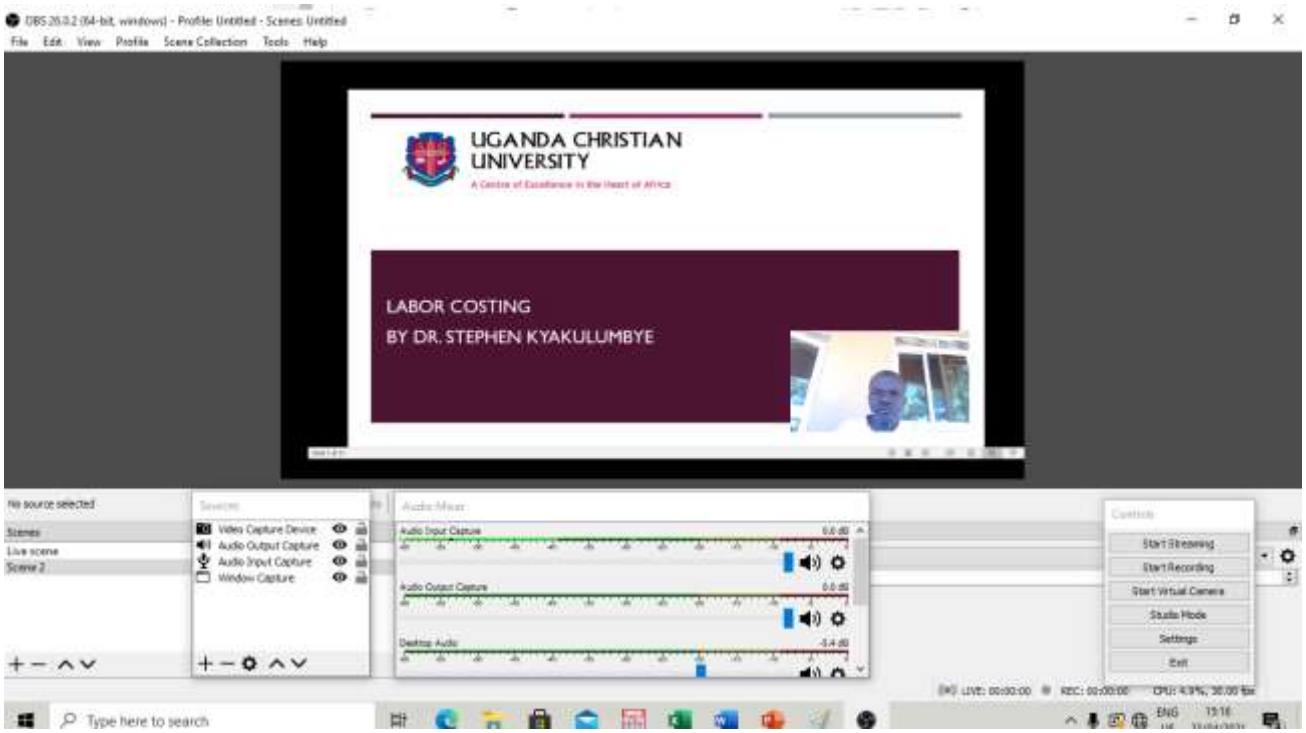

Figure 2: OBS Studio recording and streaming interface during a Labor Costing pre-recording and Livestreaming

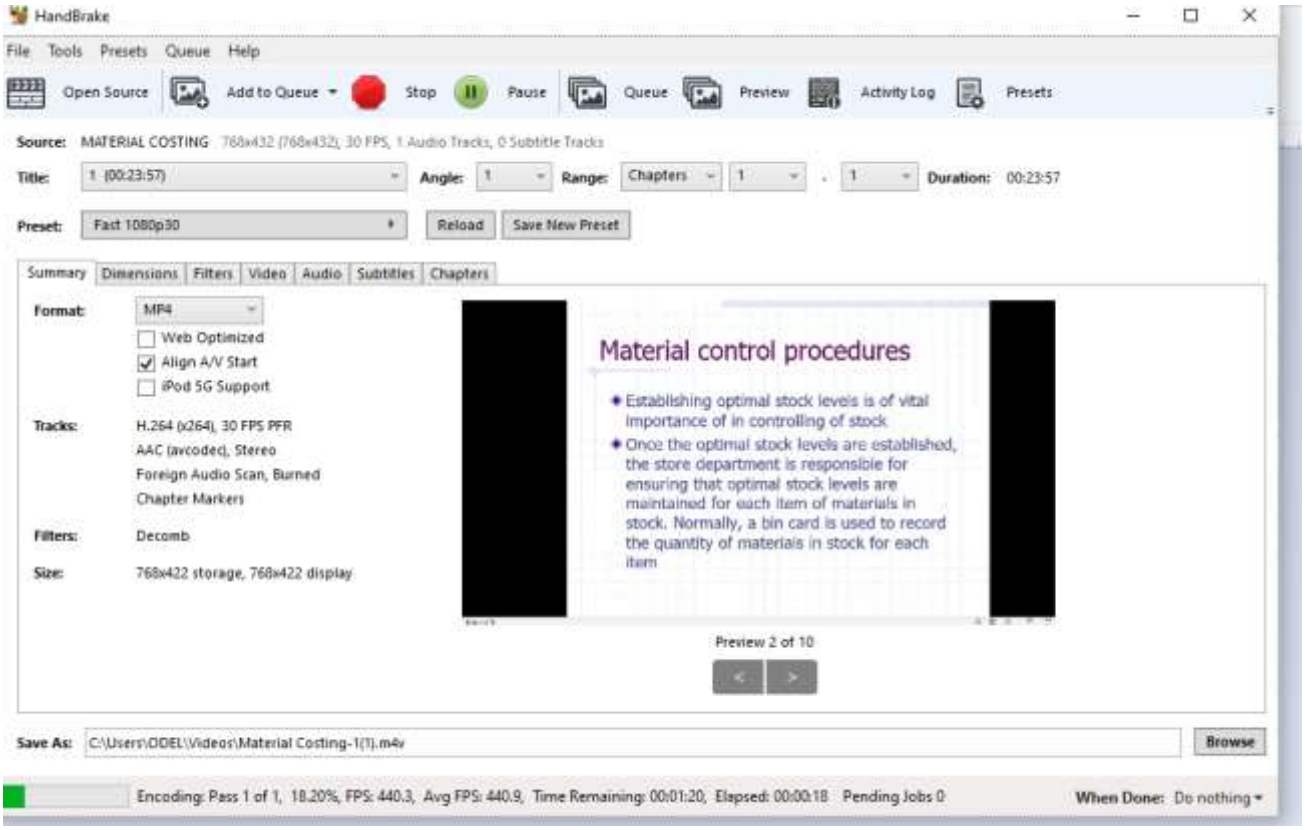

Figure 3: Handbrake during a file compression process

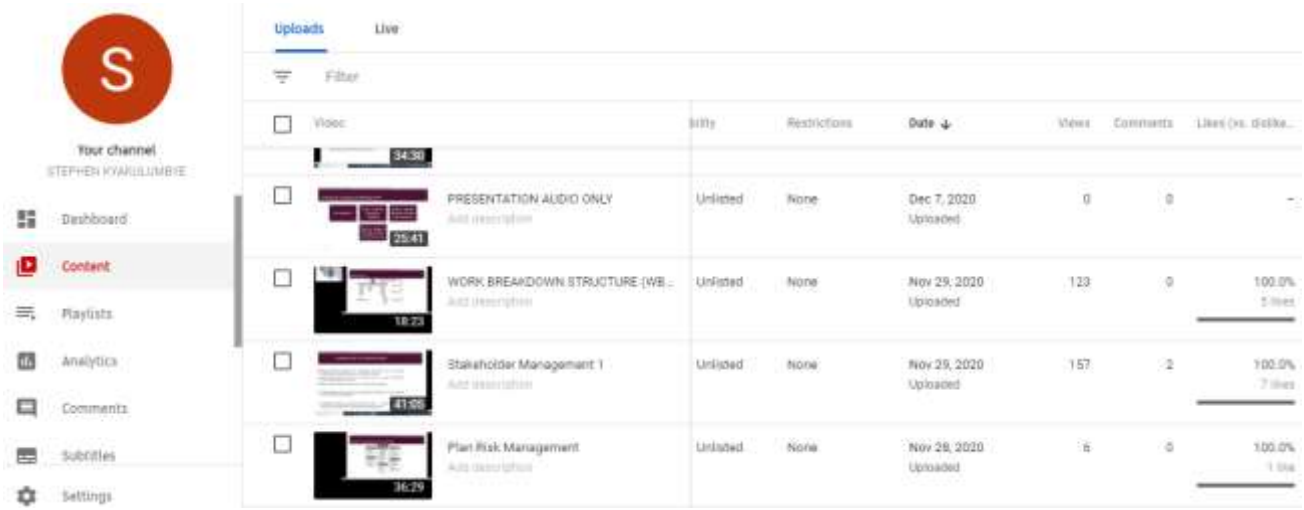

Figure 4: Some of my YouTube Presentations via my channel

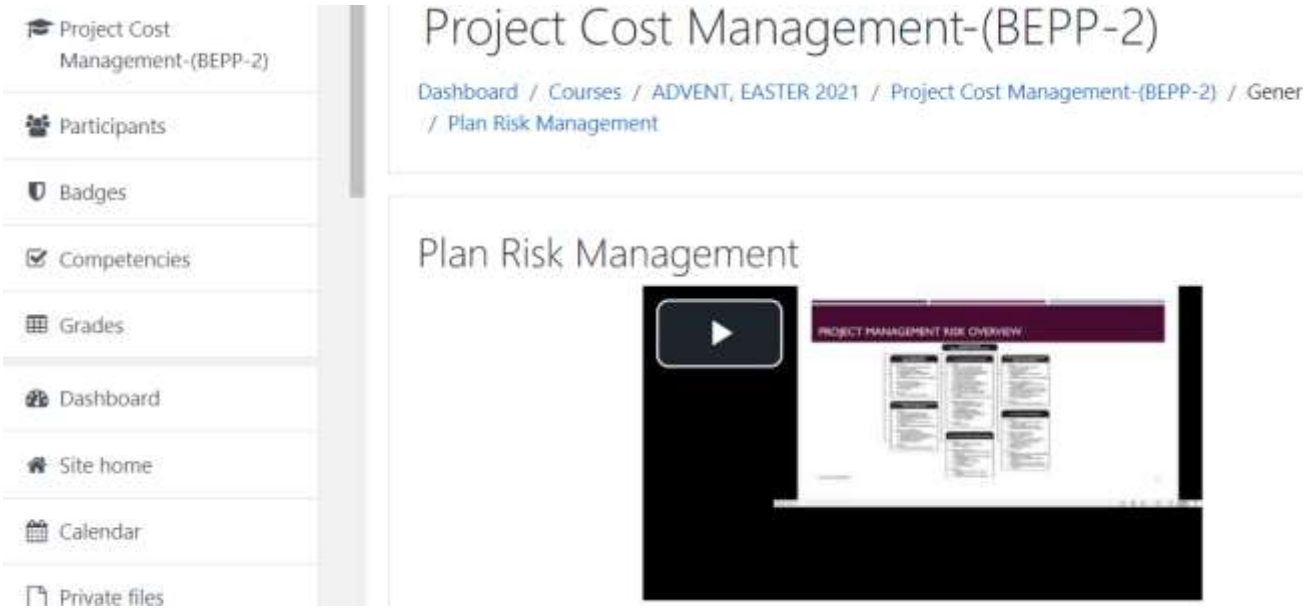

Figure 5: Moodle Course page for Project Cost Management with an imbedded URL from YouTube

Tool developed for assessing online learning experiences

Tool development was guided using situation awareness theory as a guiding theoretical lens. Several authors have used situation awareness theory as a guiding lens for technological interface design and evaluation (Jasser, Ming and Zohdy, 2017; Machado, Maran, Augustin, Wives and de Oliveira, 2017; Machado, Maran, Augustin, Wives and de Oliveira, 2017; Kyakulumbye, 2020). There are other studies that have adopted and adapted some of these constructs among which are: Barbosa and Barbosa, (2019); Muramatsu, Wangmo, (2020); Čižmešij and Bubaš (2020).

From the above online learning interfaces, this study employed a quantitative approach, gathering data at the end of the Semester using a structured questionnaire also shared using Google Forms and analysis of the students LMS online presence. The students' experience, preference and perceived value of both synchronous and asynchronous learning tools was the main focus of gathering data based on their prerequisite personal qualities. The prerequisite personal qualities that formed part of the demographics were as follows:

1. Year of study
2. Gender
3. Age

The questionnaire was constructed on five-likert ordinal scale from Strongly Disagee=1, Disagree=2, Neutral=3, Agree=4 and Strongly Agree=5. The following were items about synchronous and asynchronous learning tools:

1. Which method of learning do you favour/prefer the most?
2. The given objectives are achievable with pre-recorded video lectures.
3. I believe the pre-recorded video lectures are worth the tuition.
4. The pre-recorded video lectures were helpful for learning the material and concepts.
5. The YouTube video lectures links were helpful for learning the material and concepts.
6. I would find it hard to engage with YouTube links because of data scarcity.
7. I would rather remain reading and viewing the pre-recorded videos within Moodle.

8. Pre-recorded video lectures would offer better organization of content delivered.
9. Pre-recorded video lectures would offer better presentation of content delivered.
10. Pre-recorded video lectures would offer better explanation of content and learning material.
11. Pre-recorded video lectures would offer better class engagement
12. The given objectives are achievable with live ZOOM lectures.
13. The given objectives are achievable with live BBB lectures if it was to be stable
14. I believe the live ZOOM lectures are worth the tuition.
15. The ZOOM lectures were helpful for learning the material and concepts.
16. The BBB lectures were helpful for learning the material and concepts.
17. Zoom lectures would offer better organization of content delivered.
18. BBB lectures would offer better organization of content delivered.
19. Zoom lectures would offer better presentation of content delivered.
20. BBB lectures would offer better presentation of content delivered.
21. Zoom lectures would offer better explanation of content and learning material.
22. BBB lectures would offer better explanation of content and learning material.
23. Zoom lectures would offer better class engagement.
24. BBB lectures would offer better class engagement.

Data Management and Analytics

After collating data via google forms, it was imported into Ms. Excel where it was coded based on the likert scale to convert it into numerical data. This is because when Ms. Excel captures data and it is exported to the data analytics programs, it is exported as string data type. Numerical data type allows statistical analysis techniques to be performed. Since most data was ordinal data from a small conveniently selected sample of 50 students who were part of the online course, non-parametric tests were performed. Specifically, the non-parametric tests were: Analysis of Variance (ANOVA), Mann-whitney test that allows to work with ordinal data for two different groups (Third Year and Second Year students), Kruskal-Wallis test or One Way ANOVA to establish difference between 3 or more groups independent groups (Gender, Age category and Computer Skills Level). All the statistical techniques were performed using SPSS version 24.0.

Results

Year of study and students' preference for mode of online learning

Table 1: Your year of study * Which method of learning do you favor/prefer the most? Crosstabulation

			Which method of learning do you favor/prefer the most?				
			Real Time with BBB	Real Time with ZOOM	Pre-recorded video lectures	Visual Text notes uploaded on Moodle	Total
Your year of	Second	Count	1	2	6	2	11

study	Year	% within Which method of learning do you favor/prefer the most?	14.3%	18.2%	20.7%	66.7%	22.0%
	Third Year	Count	6	9	23	1	39
		% within Which method of learning do you favor/prefer the most?	85.7%	81.8%	79.3%	33.3%	78.0%
Total		Count	7	11	29	3	50
		% within Which method of learning do you favor/prefer the most?	100.0%	100.0%	100.0%	100.0%	100.0%

From the percentages presented, there are differences in opinions about online learning mode among Second and Third students of Bachelor of Project Planning and Entrepreneurship. Both second- and third-year students have more preference for the pre-recorded video lectures (20.7% second years were in preference for pre-recorded video lectures and 79.3% of the Third year had more preference for pre-recorded video lectures). This is followed by Real time virtual lectures with ZOOM with 81.8% of the third year with preference for ZOOM virtual classes and 18.2% of the second years. As regards Real time virtual lectures with BBB and visual text based noted uploaded via Moodle LMS, more second year students (66.7%) had preference for visual text notes than BBB, yet third year students had more preference for BBB real time lecture with (87.5%).

To compute other measures of association, Gamma and Somers' d are both measures of association for ordinal variables. Gamma is symmetrical; Somers' d is asymmetrical. Below are the results:

Table 2: Directional Measures

			Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Somers' d	Symmetric	-.156	.132	-1.148	.251
		Your year of study Dependent	-.123	.105	-1.148	.251
		Which method of learning do you favor/prefer the most? Dependent	-.212	.180	-1.148	.251
a. Not assuming the null hypothesis.						
b. Using the asymptotic standard error assuming the null hypothesis.						

Table 3: Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.343	.291	-1.148	.251
N of Valid Cases		50			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					

From the results of Somers' d and Gamma, there is no relationship between students' year of study and preference for an online learning mode (Somers' d Approx. Sig=0.252 and Gamma Approx. Sig=0.251 respectively above the significance threshold of 0.05 and 95% level of significance).

Gender and students' preference for mode of online learning

Table 4: Your year of study * Which method of learning do you favor/prefer the most? Crosstabulation

Gender				Which method of learning do you favor/prefer the most?				
				Real Time with BBB	Real Time with ZOOM	Pre-recorded video lectures	Visual Text notes uploaded on Moodle	Total
Male	Your year of study	Second Year	Count	0	2	1	1	4
			% within Your year of study	.0%	50.0%	25.0%	25.0%	100.0%
			% within Which method of learning do you favor/prefer the most?	.0%	22.2%	9.1%	100.0%	17.4%
			% of Total	.0%	8.7%	4.3%	4.3%	17.4%
		Third Year	Count	2	7	10	0	19
			% within Your year of study	10.5%	36.8%	52.6%	.0%	100.0%
			% within Which method of learning do you favor/prefer the most?	100.0%	77.8%	90.9%	.0%	82.6%

			% of Total	8.7%	30.4%	43.5%	.0%	82.6%
	Total		Count	2	9	11	1	23
			% within Your year of study	8.7%	39.1%	47.8%	4.3%	100.0%
			% within Which method of learning do you favor/prefer the most?	100.0%	100.0%	100.0%	100.0%	100.0%
			% of Total	8.7%	39.1%	47.8%	4.3%	100.0%
Female	Your year of study	Second Year	Count	1	0	5	1	7
			% within Your year of study	14.3%	.0%	71.4%	14.3%	100.0%
			% within Which method of learning do you favor/prefer the most?	20.0%	.0%	27.8%	50.0%	25.9%
			% of Total	3.7%	.0%	18.5%	3.7%	25.9%
		Third Year	Count	4	2	13	1	20
			% within Your year of study	20.0%	10.0%	65.0%	5.0%	100.0%
			% within Which method of learning do you favor/prefer the most?	80.0%	100.0%	72.2%	50.0%	74.1%
			% of Total	14.8%	7.4%	48.1%	3.7%	74.1%
	Total		Count	5	2	18	2	27
			% within Your year of study	18.5%	7.4%	66.7%	7.4%	100.0%
			% within Which method of learning do you favor/prefer the most?	100.0%	100.0%	100.0%	100.0%	100.0%
			% of Total	18.5%	7.4%	66.7%	7.4%	100.0%

Whereas data reveals that pre-recorded video asynchronous lectures are most preferred by both second and third year BEPP students, 66.7% of the students in this category were females while 47.8% were males. This implies that for both year years, female students had more preference for asynchronous pre-recorded lectures than males. As regards to ZOOM synchronous lectures, 39.1% of males had preference for that mode of learning compared to 7.4% of the females. This implies that male students in had more preference for ZOOM synchronous lectures than females. Yet, for use of BBB as a synchronous virtual lecture, 18.5% of females had preference while 8.7% had preference. This implies that female students prefer BBB while male students preferred ZOOM. As regards to visual text content, 7.4% of female students had preference for this mode while only 4.3% showed preference.

From the results, the strength and direction of association is presented using Lambda results:

Table 5: Directional Measures

			Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Lambda	Symmetric	.159	.063	2.211	.027
		Gender Dependent	.304	.120	2.211	.027
		Which method of learning do you favor/prefer the most? Dependent	.000	.000	.[c]	.[c]
	Goodman and Kruskal tau	Gender Dependent	.150	.090		.062[d]
		Which method of learning do you favor/prefer the most? Dependent	.062	.046		.029[d]
a. Not assuming the null hypothesis.						
b. Using the asymptotic standard error assuming the null hypothesis.						
c. Cannot be computed because the asymptotic standard error equals zero.						
d. Based on chi-square approximation						

From the results, method of learning preference dependent variable reveals lambda is 0.304 and that it is statistically significant (p = 0.027).

Discussion of results

This section offers a discussion of results in comparison with the available studies. To a deeper analysis, it identifies from available studies how learning experiences can be enriched using the new concept of metaverse.

Demographic characteristics influence on experiences and preferences for online learning environments

From the results, there are differences in opinions about online learning mode among Second and Third students of Bachelor of Project Planning and Entrepreneurship. Both second- and third-year students have more preference for the pre-recorded video lectures, followed by Real time virtual lectures with ZOOM and least by Real time virtual lectures with BBB and visual text based noted uploaded via Moodle LMS. However, it was revealed that there is no significant relationship between students' year of study and preference for an online learning mode. The results are contrary to other studies that observe that older students in advanced years of study at an institution are more motivated to learn, better at communicating online, and at organizing their learning schedules than lower years of study like first years (Young & McSporran, 2001). In the same study, female students showed better performance than male students did. Hence, both gender, age and year of study factors were related to students' learning outcomes. A similar study by Tinmaz and Lee (2020) resonates with the results of my study revealing that gender has a significant influence on students' online learning experiences.

Metaverse to enhance LMS and improve student online experiences

To improve or enhance LMSs and improve students' learning experiences in an online environment, the Acceleration Studies Foundation declared Metaverse Roadmap in 2006 with 4 types: augmented reality, lifelogging, mirror world and virtual reality. It also includes two axes: augumentation verses simulation and external verses intimate (Mitra, 2023). The diagramatic representation is extracted from the roadmap as presented below:

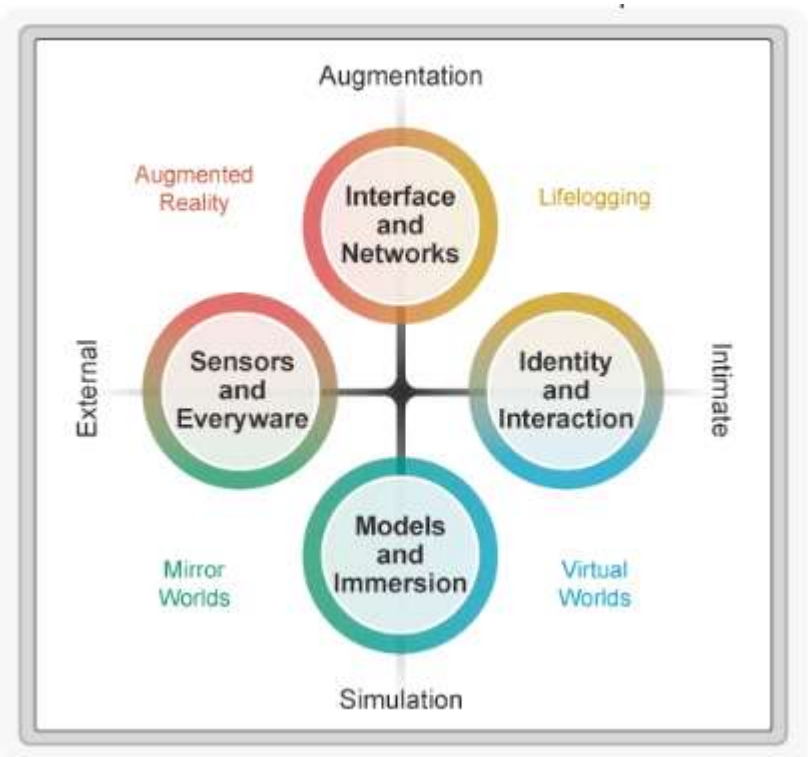

Figure 6: Four types of Metaverse-Source: Smart & Bridges (2006)

Whereas augmentation superimposes digital information on the existing physical world that we perceive, simulation includes techniques to manipulate models of the physical world and creates interactions and experiences in the virtual or simulated world (Mitra, 2023). External technologies are focused outwardly, towards

the world at large; in the Metaverse context, this means technologies that provide information about and control of the world around the user. Intimate technologies are focused inwardly, on the identity and actions of the individual or object; in the Metaverse context, this means technologies where the user (or semi-intelligent object) has agency in the environment, either through the use of an avatar/digital profile or through direct appearance as an actor in the system (Smart et. al., 2007). For details of these metaverse types, Mitra (2023) paper and Smart et al (2007) roadmap can be consulted.

However, the roadmap warns that the four are already well into early emergence, yet the conditions under which each will fully develop, in particular contexts, are far from clear (Smart, Cascio, Paffendorf, Bridges, Hummel, Hursthouse & Moss, 2007). Notwithstanding, integrating metaverse or designing Moodle LMS with metaverse mindset has potential to mirror web-based classrooms with in-world learning spaces and interactive objects (Kemp & Livingstone, 2006). From Kemp and Livingstone (2006), the authors observe that both learners and instructors showed interest and positive learning experiences when using metaverse applications that were integrated into the LMSs.

Reconstruction of the Conceptual framework based on Metaverse

From the foregoing results and associated discussions, this paper recommends a reconstruction of the online learning conceptual framework to cater to a metaverse environment that could support active, engaging and meaningful learning. However, its actual implementation is subject to further research and scrutiny in a given context.

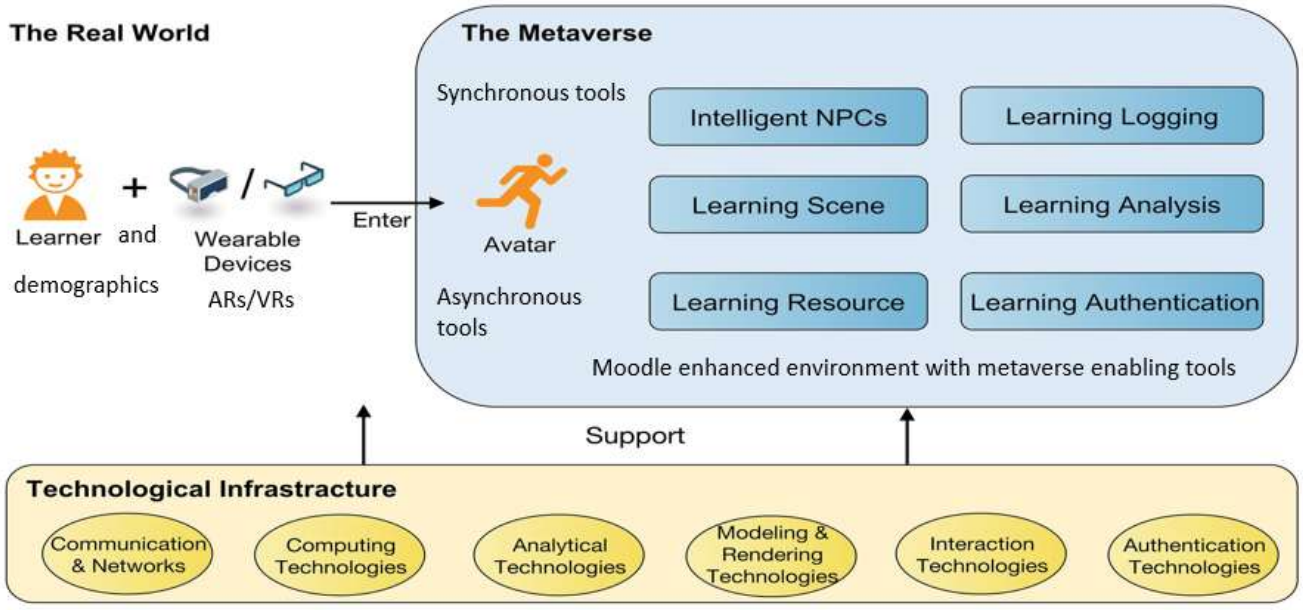

Figure 7: An enhanced frame work of the metaverse in online education: Adopted and modified from Zhang, Chen, Hu & Wang (2022)

Within a given context, a learner enters a learning environment with enhanced wearable devices like Augmented and Virtual Reality tools. Because of enhancement with such tools, the learner is more or less like an Avatar (An avatar in a virtual world is a 3-dimensional character which represents a real person in the virtual world.) to interact with the asynchronous and synchronous tools integrated in a given learning management system like Moodle. However, the environment should be supported with more other tools like Intelligent Non-playable character (NPCs): a character in a computer game that is not controlled by someone

playing the game, learning scenes, learning resources. To monitor the effective learning outcomes, there should be integration of learning logging, learning analytics and learning authentication. However, the real world and the metaverse world should be enabled with technology infrastructure: communication and networks, computing technologies, analytical technologies, modeling, rendering technologies, interaction technologies and authentication technologies.

Key policy framework to enhance online learning experiences

To have such a robust metaverse enhanced learning environment, Graham et al (2012) institution policy framework offers pointers to improve online learning experiences of learners in resource constrained environments and these are in dimensions of Strategy, Structure and Support:

Table 6: Institutional Policy Framework matrix

Policy	Description	Policy dimensions	Sample policy sub questions
Strategy	The policy must spell out how Online Learning (OL) makes the university attain its strategic goals (Niemiec and Otte 2009).	Overall design of BL, forms of advocacy, degree of implementation, purposes of BL.	1. Does the policy put in place a task force to identify challenges and opportunities? 2. Are the objectives of BL aligned with the overall strategic mission and vision of the university?
Structures	The policy prescribes the acquisition and putting in place of online teaching infrastructure.	a)Technology b)Pedagogical/ administrative framework c)governance models d) Scheduling structures e) Evaluation .	a) What are the guidelines and specifications of the infrastructure? b) How are intellectual property rights of data to be safeguarded? c) What is the criteria for determining online seat-time? e) What are the quality standards for evaluating the BL Program? f) How are students to be evaluated? g) How is systematic evaluation of student satisfaction to be conducted?
Support	Provide pedagogical and technological training for online teaching staff.	Implementation and maintenance of the OL design, incorporating technical support, pedagogical support, and faculty	a) What are the guidelines for professional development? b) What are the guidelines for providing incentives for staff?

		incentives.	

Adopted from Graham et al (2012)

The table above shows the three sub dimensions of policy namely strategy, structure and support in the first column, followed by their description in the second column, the dimensions catered for under each and in the last column are some sample questions asked in regard to the policy under question.

- **Strategy** is comprised of issues relating to the overall design of online learning, such as definition of BL, forms of advocacy, degree of implementation, purposes of online learning, and policies surrounding it.
- **Structure** includes issues relating to the technological, pedagogical, and administrative framework facilitating the online learning environment, including governance, models, scheduling structures, and evaluation.
- **Support** involves issues relating to the manner in which an institution facilitates the implementation and maintenance of its online learning design, incorporating technical support, pedagogical support, and faculty incentives.

Conclusion and area of further research

The roadmap warns that the four types of metaverse are already well into early emergence, yet the conditions under which each will fully develop, in particular contexts, are far from clear (Smart, Cascio, Paffendorf, Bridges, Hummel, Hursthouse & Moss, 2007). To the developing country context within resource constrained environments, those forms an area of further research to ensure that the available technology infrastructure can support the proposed types of metaverse to be integrated into the LMS for purpose of improving the learning experiences and engagement of students, instructors and peers. This can be through augmentation, simulation and prototyping to ensure fit into given contexts.

To the developing country context within resource constrained environments, there is need for further researcher to test the proposed framework within such policy contexts. Moreover, it is an area of further research to ensure that the available technology infrastructure can support the proposed types of metaverse to be integrated into the LMS for purpose of improving the learning experiences and engagement of students, instructors and peers; and finally enhance physical space presence using Augmented and Virtual Reality tools through participatory research approaches through augmentation, simulation and prototyping to ensure fit into given contexts. The proposed model in this paper shall be tested and validated at UMI after integrating VR/AR into the platform to enhance immersiveness.

Declarations

The author declares that he has no conflict of interest.

Data Availability Statement

The data shall be available at a reasonable time when requested for.

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