Integrating eXtended Reality and Digital Printing as a Solution for Personalized and Electronic/Printing Learning Teaching Approaches upon COVID19 Pandemics

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Abstract:
The researched paper presented eXtended reality (XR) as it has revamped the way people experience the physical and the virtual environments, from observation to immersion. XR (AVR) is an umbrella term that encompasses both augmented reality (AR) and virtual reality (VR), among others (360 degrees, Holoride, Holoportation, Holofurnish, Remote Reality, 3D, 4D and beyond). Over COVID 19 each student looking forward to have a path to make the learning content much easier and very attractive, courses teachers/lecturers on the internet even though they explains the course data, students still have someway of misunderstanding, the old PowerPoint also doesn't support them or the digital printed course data without adding any other helping technology. Thus, the author has researched the paper content using the specified methodology to explore the integration between XR technology and digital printing to create opening new ways for the interaction between the physical digital printing and virtual world, which is a very important area for future learning applied upon pandemics or in future education. The theoretical study introduced the XR as it can even provide a new direction for the real world that we are living in by placing virtual objects into the learning scene and the different needed instruments in some cases, system design, the process adding XR, the new direction in XR libraries or even students self-learning and the potential for XR in learning applications and the most important famous worldwide projects near to that approach. As well as the study has emphasizes on the nowadays need to personalize learning especially upon pandemic times like (COVID 19). Whereas the practical study introduces XR/DP experiment learning system example which has been build up for what the integration between both XR and Digital Printing can create to lecturers/learners or even their families. The author continued search the technology acceptance model within a suggested constructs TAM model for the new example system depending five previous researches followed by statistical analysis. The results show the successful of the suggested research model of Technology acceptance Model of XR/DPLS. Finally, the author has recommended the ministry of higher education to start develop the experiment in a large over thinking ideas, to build up system platforms to be valid serving in all learning sectors.

Keywords:
Augmented Reality Applications
Extended Reality
Digital Printing
Mixed Reality
Artificial Intelligence
Online Learning
Emerging Technologies

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Introduction

XR refers to technology-mediated experiences that combine digital and biological realities. Technologies supporting the creation of XR encompasses a wide range of hardware and software, including sensory interfaces, applications, and infrastructures that enable content creation for virtual reality (VR), mixed reality (MR), augmented reality (AR), cinematic reality (CR), 360-degree video, and more. With these tools, users generate new forms of reality by bringing digital objects into the physical world and/or bringing physical world objects into the digital world. XR technologies have applications in all sectors of education and training, from early schooling through to higher education, workforce development, and lifelong learning.

The paper research focused on the use of XR integrated with the digital printing technology for creating environments and experiences that excite, inspire, and engage learners in immersive ways. Of interest are reports of both research studies and applications covering the entire spectrum of immersive platform types, including desktop, mobile, wearable …etc. The paper has demonstrate a potential to help advance research and/or practice in the field of XR from a technical, theoretical/conceptual, empirical, and/or methodological perspective. The paper engages deeply with the implications for the broader XR field arising and the highly need to integrate it with the digital printing technology to form the most convenient electronic and physical learning platform

All of us consider an online learning presenter/instructor and all of us faced a problem in online educating upon COVID 19 , most of students can't follow the learning presenter or even imagine the annotated topic or low achievers gained students . Also we have faces students boring while we gives the lecture even they have a printed material or just an electronic file for the course, and as we all know how the current student differs from the past one. Therefore, For the educational technologies, the author find we've moved away from the time-to-adoption structure of the past and in its place have offered evidence, data, and scenarios that inform what the future might look like and what the educational institutions, learning presenter and learners should go through

Interest in eXtended reality (XR) technologies (such as virtual, augmented, immersive, and mixed reality) has surged. New and more affordable XR technologies, along with voice activation and sophisticated visual display walls, provide promising directions and opportunities to immerse learners or readers in the curriculum, offering deeper and more vivid learning experiences and extending the printing or learning environment itself. Yet effective integration of these technologies into the curriculum will require careful planning and numerous resources. In addition to the technology itself, there are issues such as faculty development, instructional design, learning space integration, as well as governance, policy, and ethics

Research Problem:

The fascinating potential of XR as a relatively new technology in learning students, even with the disability students, merging increasingly digital printing with the XR to face both attendance and online learning requirements upon pandemics like COVID -19.

Objectives:

1. To perform an end user impact technology acceptance model survey to find out how people feel about the XR/DP Learning System in field.
2. To clarify XR/DPSL application for use that fulfills the requirements gathered during the research.
3. To create an effective concept for an XR application with digital printing in attendance/online learning based on the results of the investigation

Research Methodology:

This study based on experimental analysis and descriptive researches in order to describe and apply on XR and printing hybrid technology in online learning field.

In order to achieve the objectives of the research paper and following the used methodology, the author has undertaken the following theoretical and practical study:

Theoretical Study

1. Educational technology

Educational technology plays an important role in students learning and acquiring various cognitive knowledge so that educational technology must be incorporated into future curricula. The application of educational technology enhances skills and cognitive characteristics. With the help of new technology comes an explosion of learning and receiving new information, especially on mobile devices. (Stosic 2015)

Digital Printing in educational books

1/1: The Digital Learning Age (DLA)

All schools and educational institutions have to move towards digital age in all aspects, one of the most important studies was by The European Framework for Digitally-Competent Educational Organizations (DigCompOrg) provides a comprehensive and generic conceptual model for the effective integration of digital technologies by educational institutions (source: Euro Commission ET 2020). DigCompOrg framework identifies 7 core elements and 15 sub-elements that characterize all educational organizations, and the analysis of existing tools presented that the integration of digital technologies across the curriculum in e-learning is an explicit focus of five of the tools analysed which are: Printed planning tool which is a part of a Handbook for planning and implementing e-Learning, Evaluation of teachers' and schools'/ institutions' digital competences and culture, Enables teachers and schools to assess the level of innovation with technology, Structured route for reviewing and improving schools' / institutions' use of technology, in addition to measuring strengths and weaknesses in the use of e-learning system (Kampylis 2015). This integration refers to the use of digital technologies in all school and institutions subjects and for a variety of learning activities. Appropriate digital resources and assistive technologies are needed for such an innovative and effective use across school subjects (source: Conference project paper, Newman and her team 2016)

2. Adaptive technology appears to be well on its way to becoming a major addition to the set of educational technology tools serving the broader educational practice of personalized learning. The use of adaptive technology is still on the upward slope of the bell-shaped adoption curve. However, even at this early stage, the technology can provide institutions with the opportunity to strategically rethink courses and even entire curricula in the context of student learning and success. It is important to distinguish between adaptive technology, personalized learning, and

adaptive learning. The first consists of digital platforms and applications that one can buy or build. Personalized learning is a general teaching and learning practice that seeks to more finely tune the course experience to the individual needs of the learners. Finally, adaptive learning is one form of personalized learning in which adaptive technology plays a major role. Adaptive learning alone does not produce improved learning outcomes (Educause 2020). Digital platforms consists on digital printing as a type of physical hand learning method, on the other hand the connected platform will be the online type of teaching including live video explanations from the teacher/lecturer or the XR technology with/out using all the needed tools to act in learning method (the paper research will present later).

1/2: Personalized learning

The technologies and practices of learning analytics, artificial intelligence (AI), and UX design are developing quickly. These developments are in turn enabling the transformation of learning models (for example, personalize learning paths) and of traditional academic credentialing (for example, the cultivation of micro-credentials). personalized learning, student-focused educational strategies, and learning analytics are currently used mainly for purposes such as preventing students from dropping out, but the most purposely of personalized learning in pandemic time with a different mean, that each student can have a special type of a path of learning between teachers and him through XR technologies. Not all students have the same ability to realize the same information they delivered via electronic learning, they differs in cognativity or they suffer from cognativity impairment. Personalize learning paths serves as a springboard for deeper exploration into the full learning aims

2. Digital Printing for Learning (DPL)

We use the term digital printing or printing on-demand to signify the economics of digital printing instead steer the printing (down to a quantity of one), it can be a production of one book or indoor prints like students own walls in their home or corridors prints and inside libraries at universities.

Book production was one of the first and most decentralized all-in-one solutions continue successful applications of digital printing, book or some parts of data course can be produced anywhere. The current study finds that education book publishers in recent years digital printing has become more are beginning to accept that digital printing, in attractive due to higher machine speeds, workflow combination with offset, can provide a more cost enhancements, and quality improvements in both effective production model. Quality has improved, black and white and color. These improvements costs are coming down, and the break-even between have created a number of segment opportunities. Digital production has increased. These include pre-adoption books, end-of-life books, teacher’s editions, customized inserts for offset books, focus books, workbooks, state and region versioned student textbooks, and special media digital printing is beginning to play a prominent (acetates, posters) role in the life cycle of some education books.

University presses in general face a number of challenges which have grown more acute in recent years. Many university presses hope to break even at best, and most depend on subsidies from their parent institutions and other sources. Key challenges for university presses include decreases in public funding as well as declines in subsidies from universities. Furthermore, growing use of customized course packs and free downloadable electronic books. The demand for shorter turnaround time is an excellent driver for digital printing and gives in counteracting these trends. (Riso 2009)

In addition to the achieving the idea “open book libraries” which they are a PDF’s type files of any type of learning material, should each student print and keep up learning from it.

At the recent ages, digital printing should be positioned as the intermediate host of the link between printed content and applied visual content presented by the XR technology, it is now entering the field of opening new horizons towards prints/e-learning.

A lot of production systems can be supported by digital providers, although Xerox continues to lead the digital book market in system installations, challengers are gaining ground such as HP, Epson and many others

3. Mixed reality

The definition can be provided a classification method called 3iMRClass (author classification) based on three different criteria (immersion, interaction, information):

1. Immersion: learner environment must be processed and interpreted (calculated) in real time. This process is the spatial mapping or spatial understanding. This is the most important point, it allows the learner to be at the center of his experience. It also limits augmented reality classic “mistakes” such as positioning errors or displaying through surfaces (and not on it). Mixed reality gives a

spatial mapping brings an immersive feeling far more important improving in a significant way the user experience.

2. Interactions: Natural learners' interactions must be processed in real time and in an immediate way. Mixed reality will make a way to interact naturally and freely using gestures, gaze or voice
Once the space is mapped (Parveaua 2018), the learners must be able to interact with it. In order to stay on a user-centered experience, he must be able to interact in a way which is as natural as possible (gesture, voice, gaze) without any mediate (no controller)

3. Information: the data managed for mixed reality as virtual object will exist in space and time and their positions will depend on the learner's environment . Virtual object must be registered in space and time and can be placed according to the user position, the environment, or any other objects. Every virtual or physical object must be intractable in real time.

Table (1):Virtual, Augmented and Mixed realities differentiation according the « 3iVClass » classification method

"3iVClass" criteria	Augmented Reality	Virtual Reality	Mixed Reality
Immersion	Augmentation of the real world using virtual annotations	Fully virtual environment.	Spatial mapping in real time allowing data contextualization
Interaction	Mediate interaction with physical object	Mediate interaction with virtual object (using controller [Fig..])	Immediate interaction with virtual and physical objects
Information	Virtual annotation within the real environment. Not time-persistent. Decorrelated from user space	Virtual object registered in 3D space. Non time-persistent. Decorrelated from user space.	Virtual object registered in 3D space. Time persistent. Correlated to the user space.

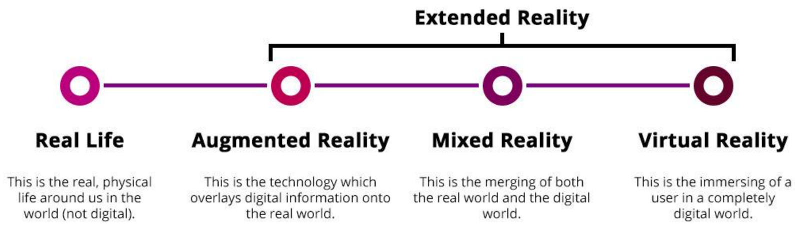


Figure (1): eXtended reality concept

4. Acceptance of XR (AVR) in education

A few factors that may influence the acceptance of AR/VR in education has been identified by Dalim and the team. They have categorized the factors as curriculum, stability of the interaction, self-learning capability, parent's involvement, student's background, platform and social factors. identified six key factors that may influence the acceptance between learners and AR educational tools as listed below (Dalim 2017):

- Curriculum: The technical aspect of the technology must be balanced with the pedagogical aspects of the educational contents
- Stability of the interaction: The reliability of AR application to provide continuous engagement during interaction
- Self-learning capability: The interaction in XR , AR can be done by oneself without the needs for teacher or parental guidance
- Parent's involvement: The participation of the parents at any point or form of the technology usage
- Student's background: The context or conditions of the students
- Platform: Tools or device used to deploy the XR or AR, VR… etc application

5. The partnership between graphic design for XR and Printing

It's important for graphic design to be involved with printing methods and techniques for career purposes. Pepper Communications Ltd (2013) stated that they worked closely with marketers and graphic designers through the United Kingdom for three decades, and they recognized the importance of converting design to effective print, and how it fits into the overall marketing communication mix. American Institute of Graphic Arts (AIGA) founded in 1914 stated that when designers master printing techniques, they will be able to convert their design into high quality print, which is important because the printed material is often the first impression people get of the designer work, so it's essentially to get it right. Also, good print gives the customers confidence in what they do (American Institute of Graphic Arts, 2013).

Additionally, the well trained designer can provide the client with sophisticated solutions that match and satisfy client's needs.

The Environment Scan (Escsn) provided Innovation and Business Skills Australia (IBSA) with a report that examined the key challenges facing the printing and graphic design industry, and considered their impact on workforce development. It concluded that the printing and graphic design industry are going through a significant period of transformation, because of the emergence of digital technology.

As the main concept of the XR that it need a very creative and attractive graphic design like the digital printing needs, or any other printing method. They all need designers and developers to collaborative each other in order to establish visual and printing aesthetical designs with the ability to achieve their goals

6. The virtual learning data visualizations tools (VLDVT)

1. desktop (pc,laptop) : Desktop apps that support the more theoretical aspects related to course practice. Such tools can include examples in the form of videos, audio, explanations of techniques, animation, annotation tools. These learning apps offer a user experience which is similar to the one of a more conventional Digital Learning Environment.
2. mobile apps : Apps that can be used with a smartphone. The main difference from the desktop category is the opportunity they provide to capture movement through the movement of the smartphone, also the scanning of the content by QR code or any other method to preview such a mixed reality or for example one AR application content.
3. whole-student interaction : This category of tools includes the motion capture of students' movement in various ways, such as depth cameras, inertial and optical full steps capture systems in case of the operation surgical, or experimental chemistry or physical sciences, etc. The difference of this category from the two categories above is that they aim at providing particular feedback on the various aspects of student's movement (shape, quality, actions and tasks, etc.)
4. augmented, mixed and virtual environments : this category can be seen as an evolution of interaction systems for practice steps since they intent both to visualize within a virtual environment an ideal sample steps for the student to follow, and also to capture the experimental work of the student and provide real time feedback

And we can divide the needed virtual learning technology tools into the following two categories:

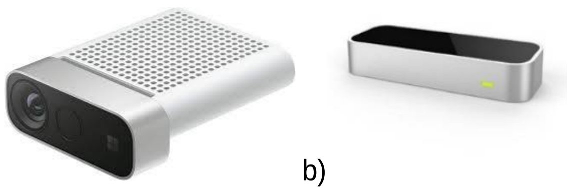
6/1: Virtual Learning Hardware Technologies

One of the challenges faced by VR/AR recently was creating less complex and more affordable hardware, which is a key factor to popularize virtual technologies. Latest hardware developed by the companies is classified into three categories: Smartphones mounted on headsets. Dedicated Head Mounted Displays (HMDs holographic devices such as the Microsoft HoloLens were utilised recently). Mixed Reality glasses.

MR (AR&VR) glasses fig (2) designed to superpose synthetic information on a transparent glass. Glasses can browse and display learning data information over any kind of media display, play sounds, present and take photos and videos, some of glasses also compatible with Alex, Amazon's voice assistant . one of the MR eyewear's most powerful functions may be translating audio into other languages .learners can control the glasses through voice interaction, pressure control, head movement and through a companion app, other glasses have some other functions as UV protection wireless Wi-Fi, noise cancelling .

Figure (2): Popular models of Head Displays for MR in 2020 (sources from: a) Mad Gaze, b) Aryzon 3D MR (AR) cardboard, c) MR Nreal glasses, d) X2 MR ThirdEye glasses, e) vuzix blade, f) XR Norm glasses, g) Microsoft Hololens

For a deeper immersive feeling, external sensors have the potential of capturing gestures and user's position. Examples to this are Leap Motion, Microsoft Kinect, and MYO (Fig3). Leap Motion and Microsoft Kinect are able to capture user's movements, but MYO goes one step further by capturing hand's movement precisely, which is useful to virtually rehabilitation solution and physical therapy MR E- learning with its characteristics which allow pair real-time depth sensor data with AI-driven insights. Can learn and help students and patients how to prevent and mitigate potential patient accidents and injuries in care environments with predictive alerts. While it is used in industrial engineering learning as advanced body tracking to monitor and analyze worker movement and behavior. Design safer, more ergonomic workstations that can mitigate long-term injury risk while improving productivity through task analysis and process optimization. Robotics engineering MR learning can also be enrolled into Kinects' DK depth sensing to automate depalletization and pillarization processes. Streamline repetitive tasks like stripping down a pallet to improve productivity. (Source: Msoft. Azure Kinect DK 2020)



a) b)

Fig (3): Sensors to interact with virtual objects and information (source: a) Leap motion, b) Microsoft Azure Kinect DK)

6/2: Virtual Learning Application Technologies

1. One of these possibilities are Virtual Worlds (VWs) using AR/VR technology, which may be used or adapted to train students in any specific discipline, such as construction, medical education like (MEDIVIS Anatomy X), this new application is a spatial computing learning and training and the teacher/lecturer or the institution can share or create the content using creator tools via the AnatomyX Web Portal. The application supports powerful features like voice support in sharing , remote mode, new and improved avatar visuals, cursor improvements, improved scale handling, bug fixes, for fe/male body anatomy explanation within students training, while there are two types of dealing with MR AnatomyX or the other solution of the company "SurgicalAR", both sudents or trainers can navigate and learn the educational courses using either one of the following technology: AnatomyX for Magic Leap (Source: Magic Leap. 2020)or AnatomyX for Microsoft Hololens, were the artificial intelligence and AR are the base of applied educational materials (source: medivis. Inc 2020)
2. The XR(AR) whiteboards education tool, the new virtual whiteboards technology can be create in the space without need to put it in a place and anyone can share it like (NOMTECH. Inc whiteboard), it is just can be created using the app and can be used anywhere. Fig(4, a) (source: nomtech.Inc 2020)
3. MR Studio platform which provides a fully collaborative, 3D holographic experience using either imported 3D models from CAD/BIM systems or real world 3D scan data like (Arvizio MR Studio Immerse, Inc), platform provides a suite of AR/MR capabilities to optimize and share complex 3D models and point clouds on multiple types of headsets and mobile devicesThe solution also allows documents (e.g. printed plans), images and other project data to be included in the mixed and augmented reality experience without requiring the development of custom application software.also the platform allows all aspects of collaboration, model mark up, model optimization and multi-user presentation to be co-ordinated from XR Director, an easy to use application that manages and coordinates the entire workflow. XR Director is available as a Local Edition for shared experiences at a single site or Enterprise Edition for collaboration across multiple locations, the platform convenient with the complicated learning subjects like in (Energy, Construction, Mining and advanced manufacturing) Engineering (source: arvizio, Inc)
4. MR Molecule builder, at this application experience, students can learn how to build a variety of common organic molecules. It helps students familiarize with the bonding properties of different elements and visualize a 3D molecule from a 2D Lewis Dot Structure, like the (Xennial digital, Inc), fig (4, b)
5. Spatial , at this application experience, lecturer/teacher can create his 3D-realistic avatar (looks human digital bodies) from a single 2D selfie, the avatar can be more than one to enroll students to feel teamwork activity within the sharing content, while the app transform any room into teacher's monitor while using your hands as the mouse to move objects and content. Furthermore s/he can upload 3d models, videos, docs, images, notes, and his own screen. The learning content can be created with/out a need to use eyeglasses, in addition it can be connected to the learning print material (Source: Spatial app 2020). fig (4, c)

Figure (4): a) sample of AR space whiteboard, b) MR Molecule builder , c)Spatial system learning application example

6/3: Core Commonly Used Modes in Applications (CCUMA)

1. Exploration: Allows for individual users to study holographic educational information content independently like in Anatomy cases where key features are locate, isolate and take into piece like dissect
2. Mastery: Allows the learners to test themselves to enable mastery of a system or region where key features are review mode and quiz mode.
3. Sharing: Allows multiple learners to collaborate in the same holographic session within class meeting setting

Other Features can be used:

- Expand: Slider-Reveal unique spatial relationships and how they all fit together.
- Labels: Easily toggle structure labels on/off for maximum flexibility.
- Orientation: Adjust between upright, prone, and supine views with the touch of a button.
- Capture: Quickly share screenshot images of educational information content in real-word space with friends and colleagues.
- Search: Use free-text to find a particular educational part.
- Reset: Just tap to reorganize all active systems, regions, and parts

7. XR educational benefits

The advantages of XR were classified into two core groups: affective outcomes and learning outcomes. Affective outcomes focus on learner motivation and attitude toward XR integration into classrooms whereas learning outcomes consist of a number of sub-categories such as cognition load, subject performance and higher-order thinking skills (e.g., inquiry learning, creativity). Cultural understanding along with cooperative skills also plays a key role in efficient performance of subject learners. Khoshnevisan and his team work has found through the reviewed studies that vision-based XR is the most used across a majority of the reviewed studies, especially regarding learners' motivation and their subject performance. Not only do the learners feel self-motivated by XR learning experience, but they also share this motivation with their peers or parents during the shared reading time. In terms of learning gains, vision-based XR is also a preferable tool to develop learners' particular skills (Khoshnevisan 2018). cognition load is also an interesting aspect to be placed under scrutiny. While the findings of several studies indicate the aid of AR in reducing cognitive load of the students (Hsu 2017). Due to a number of reviewed studies founded that applying XR enhanced cultural understanding and higher-order thinking skills can be observed. In the study of Liu and his team work interact with both virtual world (e.g., virtual drawings, notes, etc.) and physical world (e.g., trees, prints and artworks on the campus) to promote their active language learning, raise linguistic awareness and exchange cultural aspects. Based on conversation analysis and multimodal analysis, they found out that learner active learning took place through their collaborative negotiation and coordination among team gamers in order to solve the problems together. (Liu 2016)

7/1: Effects of an augmented reality-based educational game on students' learning achievements and attitudes in real-world observations

G-J Hwang and his team, had found for researchers/ teachers who intend to apply the competitive gaming approach to other AR-based in-field activities, a three-step learning design procedure is recommended: (1) Select the activities that require students to explore or make observations in real-world contexts; (2) Prepare a set of questions related to the real-world contexts for the competitive game; and (3) Determine the location and content for each AVR-based events. Other personal factors of the learners, such as learning styles and knowledge levels should be put into consideration when investigating the impacts of the proposed approach. It could also be valuable to analyze and compare the learning patterns of students who learn with the competitive mobile game and the MR based mobile learning approach. (Hwang 2015)

7/2: (Subject) Interactive Learning Systems

((S)ILS)

In this section, the author present the main aspects and characteristics that describe a subject interactive learning system and examine how these characteristics have so far been implemented between the two systems (El Raheb 2019).

7/3: SILS in relation to workflow phases characteristics/Scenarios

In most interactive systems for online education applied parts, the motion/work of an expert/lecturer is captured and being demonstrated as the proper way of executing a move and often as a way of comparing the student's move towards an ideal or professional performance.

During an interactive practical subject learning session, the user (student) is watching a demonstration from an expert/lecturer (virtual teacher). Then, the student is trying to mimic the performance s/he watched, and her/is work are recorded through a motion capture system. As the student's work is then analyzed and compared to the teacher's practical work, if the student has the materials and the elements of the application, while s/he should flows the digital printed PDF. This type of system consists of the following parts: 1) work demonstration through representing a stored prerecorded work captured movement of an expert/lecturer from a database. 2) the student is asked to imitate the ideal work, 3) the student is work captured and the movements/steps is compared with the ideal one in the database, and finally 4) the student is provided with a score value as feedback. Those steps should be in a Toolbox that contains a Toolsets for the lecturer and the students. The toolbox all tools and functions should set real time tasks to the students.

The teaching approaches. In relation to the adoption of a teaching /learning method, described in (Mimetic, Traditional, Reflective, Generative), in the current bibliography for systems that focus in education, the predominant method is the Mimetic. That implies that the students after watching a demonstration of the proper excise, they should try to mimic what they see and take into consideration the feedback from the system that will eventually improve their performance.

Data Processing: What are the exercise aspects that the system evaluates and how?

Within the connecting between the printed course material from the PDF's, and among the teacher/lecturer explanation on online 360 degrees or VR and AR till the evaluation which is a complex aspect involves a variety of parameters (accuracy, timing, shape, speed,etc.) which is hard to combine all at once, most of the systems can be designed for assisting exercise teaching focus on specific aspects providing a score-value. In that case, an initial demonstration of a movement is provided

8. eXtended reality in printed Libraries:

According to The American Library Association and The Chronicle of American Higher Education of universities and colleges (Chronicle 2015) , One of the most intriguing aspects of AR in libraries is the potential for book displays and general presentation. Learners will be able to perceive objects, information, details, and models based on local surroundings.

For example, they could look at a shelf of books and see reviews, synopses, author biographies, and more, without typing a word. Students and book seekers just need to hold up their phone, and look through an app to tell them where exactly the book is on the shelf? On the other hand, The Miami University in Oxford, Ohio developed an AR-based app called ShelvAR that supports librarians to identify books in the wrong place and for inventory (Wolf 2015). Outside of the library, a learner using AR technology could look at the building and be presented with information on upcoming classes and new book releases. AR even has the opportunity to change how we read books—transforming text books into an interactive and more meaningful experience (Massis 2015, Varnum 2019)

9. Previous outstanding projects towards transform education into e – Learning:

1. Up2U or Up To University project: a project within European Union, the project applied the Next Generation Digital Learning Environment (NGDLE) to the students transforming form schools to universities in ecosystem which has been specifically built to deliver personalized, collaborative or experimental learning with no longer the central tool in learning , the project focuses on learning students how to learning into digital environment (Euro. Commission magazine).

2. STORIES project with European Union support and collaboration with University of Bayreuth in Germany: they integrated the latest advances in augmented and virtual reality and digital printing, 3D printing technologies. Stories within any library book will transform to create extended episodes encompassing a network of hotspots and hyperlinks. At the project and in small groups, the students can created their designs using commonly found materials, such as cardboard and paper cups. They then took their creations to the next level by recreating them as a virtual 3D model. Students went even further with their stories by using the VR & AR Authoring Tool of the STORIES

project's platform. Within a CAD tool (Tinkercad.com) easy to use interface, they able to convert their models into digital form, and integrate texts, animation videos and music (source: European Commission, storiesoftomorrow.eu), one of students workshops was Mars Journey storytelling, Dr. Angelos and Dr. Evangelia were the leaders of the workshop, students had building up their illustrations scenes and characters by aiding of a user guide, then writing story and development till the latest finishing process using several technologies including AR, digital printing, CAD tools till book come to the real world. While the android an IOS app (Google Play) Stories Of Tomorrow H2020 - Augmented Reality Viewer for Storytelling Platform is CreativiTICEducation (Stories of Tomorrow project, workshop on storytelling, 2020).

Second: The Practical Study

10. eXtended Reality (AR/VR/Video)/Digital Printing Learning System Experiment Implementation (procedures – tools)

Author have chosen to work on System implementation with El Kasr El Ainy medical school/Cairo University members as they are one of the powerful medical education schools in the Middle East and ranked worldwide. A random sample of students were chosen to participate to take their opinion about the XR /Digital Printing eLearning system, while faculty members in other branches of education were invited to take their opinion if they would like to work with a familiar Learning system.

10.1: Data Collection:

Author have chosen to build XR /DPLS on Pelvis bones anatomy of male and female, all data collected from trusted medical encyclopedias include Johns Hopkins Medicine School/ Rochester medical school Health encyclopedia /Open Text Book Canada and revised by Kasr El Ainy Faculty member specialized in Pelvis

10/2: Creating System:

1. A 3D Pelvis anatomy bones were created, miniature definition for each part is formed using medical encyclopedia sources in this regard. All file educating scripts, images, sounds, samples were imported inside the XR /Digital Printing system and an explanation video has been recorded to a faculty member of Pelvis in Al Kasr El Ainy medical school, and it is also were embedded into the educating system. The 3D character for the bone learning scene reference depicting pelvis created and revised with skilled experts in medical bone science and all suggested modifications considered fig (5, a).
2. The functional of cursers, spatial mapping, hand (body) gestures, object movement, and the spatial sound configures upon opening the application.
3. The system has been continue build with XR Application Studio Platform
4. The printed pelvis data course were print on the digital Xerox Versant 2100 Press, to integrate prints into the AR layer fig (5, c), prints made by used Couche gloss-coated paper 200gm.
5. system provides a continuous cycle of interactive data through a sphere of visuals around the learner, XR /Digital printing system places the educator at the centre of a multilevel globe populated with physical and virtual objects used to communicate lesson, parts names of pelvis guide were added, the academic graphical Learner Interface (LI) system designed to allow switch between the interactive AR/Digital printing layer and VR layer by using a button. the VR scene layer fig (5, d) in proximity to the learner for accurate hand gesture registration. Performing a click/air tap by Microsoft HoloLens (or can use any other headset) requires three stages: head movement as a directional pointer, eye tracking as a virtual mouse, and hand gesture control as a trigger. Tracking the operators head positing directs the gaze point controller towards a virtual button in the LI design layout enabling learners to perform hand gestures to trigger functions. The virtual guide layer projects an animated 365 degrees. X-ray mode allowed to learners in three conditional: 3D pelvis graphical interface, VR layer and AR/Digital printing layer, also pelvis parts can break apart in which every part be alone with its' details names fig (5, a). Storytelling and memos technique were embedded as a video link to the video root location on Google drive (or it can be a video link on YouTube) and sound by an expert faculty member. A quiz sample were added with a duration time (can be controlled by the teacher) in order to fulfillment the evaluation of the pelvis bone lesson, fig (5, b).
6. A suggested course learner names were added to the lesson session, in order to let them access it. Fig (5, e)
7. Course name, educating year were setup in addition to course outcomes and objectives.
8.

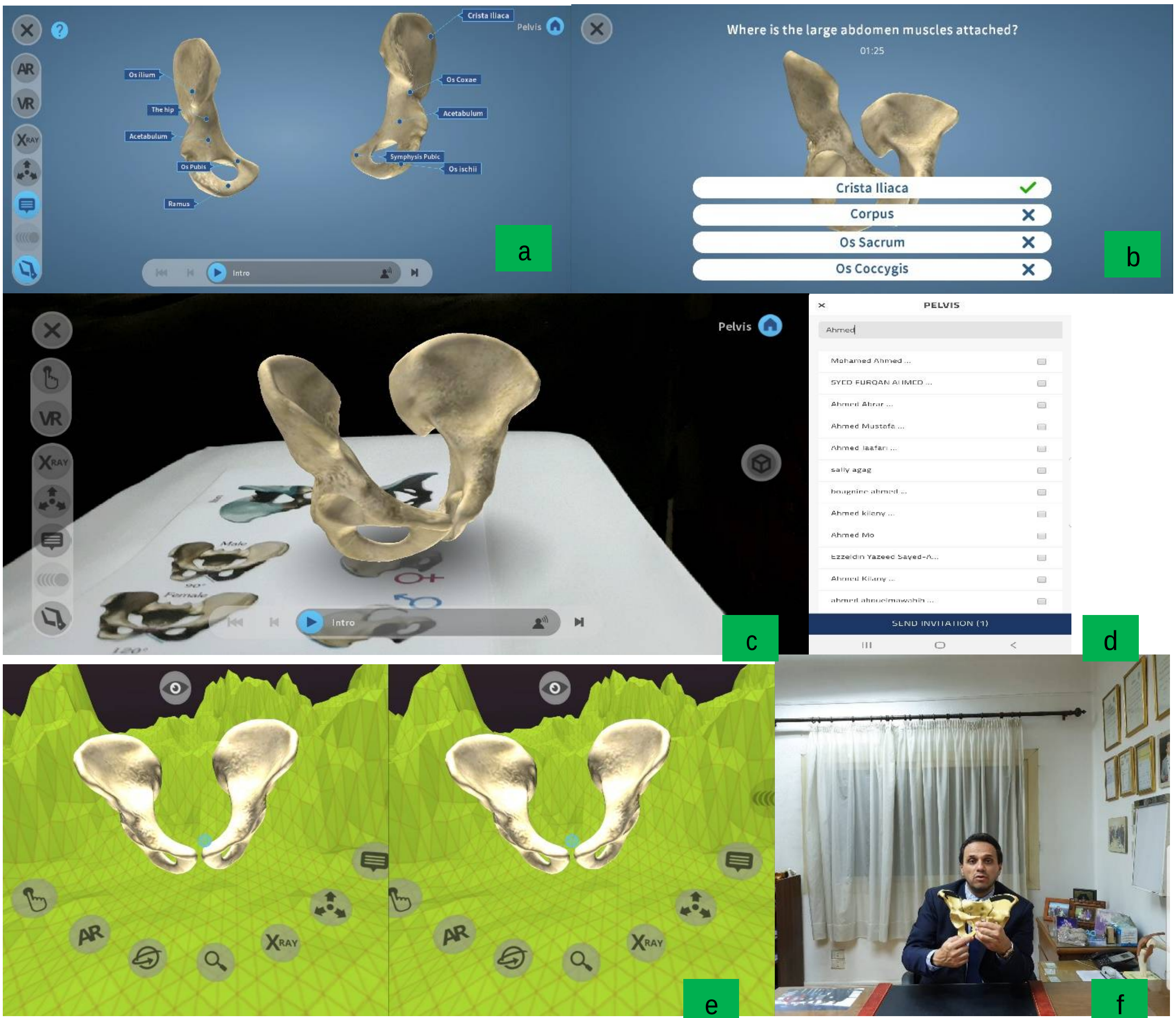


Figure (5): a) Pelvis break apart parts with names, b) Evaluation quiz, c) 3D pelvis in AR layer/Digital printed pelvis , d) 3D pelvis in VR layer, e) Sample of learner names added to the course, f) video of bone faculty member specialization participate (Kasr El Ainy medical school)

10/3: New Technology Acceptance of XR/Digital Printing Learning System (TAM/XRDPLS)

Many researchers have pointed out to the fact that TAM as a standalone model is not sufficient in explaining use and acceptance of technology. Researchers have also explained that constructs Perceived Ease of Use, Perceived Usefulness and Attitude might not sufficiently explain intention and use. This is one of the principal reasons for the development of different versions of TAM like TAM-2, TAM-3, UTAUT (HU 2003, Terzis 2011, MeléNdez 2013, Venkatesh 2000).

An important causal relationship for E-Learning and E- Assessment were studied using several studies by Imtiaz and his teamwork (Imtiaz 2014), the first causal was about E-Learning acceptance which included the following elements: Perceived Ease Of Use (PEOU), Perceived Usefulness (PU), Behavioral Intention (BI), Attitude (AT), Computer Self Efficacy (CSE), Use (U), FC (Facilitating Condition), Subjective Norm (SN). The second causal was about E- Assessment which included the following elements: Perceived Ease Of Use (PEOU), Perceived Usefulness (PU), Behavioral Intention (BI), Attitude (AT), Computer Self Efficacy (CSE), FC (Facilitating Condition), PP (Perceived Playfulness), SI (Social Influence), GE (Goal Expectancy), C (Content)

Imtiaz study' has discussed very clear that most of the technology acceptance research has been in the area of e-learning while in e-assessment very few. So the author has been focused on the e-Learning acceptance of XR/DPLS than the e- Assessment.

10/3/1: Evaluation Procedures

Participation in this study was voluntary, all teachers and students trained on the system and they become aware knowing how to use it (most of them were familiarity with it), students mean age about 18 to 26 and teachers ages between 30 and 52. All of them owned laptops and the mean of using it and internet over 12 years. Total number is 70 . Students (n= 35), teachers (n 35). Teachers and students were from different faculties and not only from the medical schools were chosen to cover multiple subjects as well, in order to take their acceptance if a similar system in their specialization has been built.

The seven constructs were added in suggested model fig(6), putted into 33 question to be survey by the sample volunteers' community.

Tools: the used tools were Likert measurement scale concept and IBM SPSS Statistics Program, 5 points Likert scale set as follow: (Strongly Agree =5, Agree =4, Neutrally =3, Disagree =2, Strongly Disagree =1)

Evaluation followed by an in-depth analysis discussion to identify both successful features and areas for improvement.

10/3/2: KMO Bartlett's Test Analysis. it is necessary to test the adequacy of data. In this research, KMO Testing and Bartlett Testing are employed to validate whether the data are suitable for principal component analysis process. The result is shown in Table (2). As suggested by commonly used KMO measures, it is concluded that the collected data are appropriate for principal component analysis. Furthermore, total of data variance is 86 % and this is a sufficient value.

Table (2): KMO and Bartlett Testing.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.930
Bartlett's Test of Sphericity X^2 (CHI Square)	831.744406
df	28
Sig.	.000
Total Variance Explained (% of Variance)	86.64
(Cumulative %)	86.64

10/3/3: TAM Constructs and Items of XR/DPLS:

- Perceived Ease Of Use (PEOU): the degree to which a person believes that using a particular system would be free of effort (Sabaté 2015)
- Perceived Usefulness (PU): the degree to which a person believes that using a particular system would enhance their job performance (Sabaté 2015)
- Behavioral Intention (BI): theorized as the primary predictor of actual usage behavior
- Attitude (ATT): the degree of person's positive or negative feeling about performing the target behavior (Fathema 2015)
- Computer Self Efficacy (CSE): defined as an individual judgment of efficacy across multiple computer (Anormaliza 2016)
- Future System Use (FSU)
- FC (Facilitating Condition)
- Subjective Norm (SN): the degree to which a person perceives the demands of the "important" or referent others on that individual to use technology (Teo 2009)

Table (3): The suggested TAM Constructs and Items of XR/DPLS

Measurements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std. Dev.
PEOU1: It is easy to operate the XR/Digital printing system	35.7 % 25	48.6% 34	10% 7	5.7% 4	0	4.14	.822
PEOU2: The interaction with the XR /Digital printing system is clear and understandable	35.7% 35	47.1% 33	12.9% 9	4.3% 3	0	4.14	.804
PEOU3: The XR/Digital printing system is flexible to interact with without help	34.3% 24	47.1% 33	14.3% 10	2.9% 2	1.4% 1	4.10	.854
PEOU4: It would be easy to be competent in the use of XR/Digital printing system	32.9% 23	45.7% 32	15.7% 11	4.3% 3	1.4% 1	4.04	.892
PU1: In the courses you teach with the support of XR/Digital printing system, your performance improves	40% 28	38.6% 27	17.1% 12	2.9% 2	1.4% 1	4.13	.900
PU2: In the courses i teach with the help of XR/Digital printing system, the system useful for teaching	30% 21	51.4% 36	11.4% 8	7.1% 5	0	4.04	.842
PU3: It is convenient in teaching, the use of XR/Digital printing system	34.3% 24	47.1% 33	14.3% 10	2.9% 2	1.4% 1	4.10	.854
PU4: I am satisfied with the	40%	38.6%	14.3%	4.3%	2.9%	4.09	.989

different evaluation options offered by the XR/Digital printing system	28	27	10	3	2		
BI1: I will use the XR/Digital printing system in all the subjects I teach and that allow to use this resource	34.3% 24	47.1% 33	15.7% 11	1.4% 1	1.4% 1	4.11	.826
BI2: Happy and don't feel hesitated to try the new emerged technology	28.6% 20	44.3% 31	21.4% 15	5.7% 4	0	3.96	.859
BI3: I will modify the teaching activities of my subjects to take advantage of the capabilities of XR/Digital printing system	31.4% 22	50% 35	14.3% 10	2.9% 2	1.4% 1	4.07	.840
BI4: I will encourage my students and my own participation in XR/Digital printing system, offering an activity based on participation in the forum of the subject	34.3% 24	41.4% 29	18.6% 13	4.3% 3	1.4% 1	4.03	.916
ATT1: I like more to grade tasks with XR/Digital printing system than manually	31.4% 22	48.6% 34	14.3% 10	2.9% 2	2.9% 2	4.03	.916
ATT2: I felt I was in the XR/Digital printing system and so immersed	37.1% 26	40% 28	17.1% 12	4.3% 3	1.4% 1	4.07	.922
ATT3: The XR/Digital printing system has made that my stress due to tasks checking decrease because it does the work for me immediately	34.3% 24	42.9% 30	17.1% 12	4.3% 3	1.4% 1	4.04	.908
ATT4: I like to use the new system	35.7% 25	40% 28	17.1% 12	4.3% 3	2.9% 2	4.01	.985
CSE1: I can complete the tasks of teaching in the XR/Digital printing system if I had never used a computer system like this before	35.7% 25	40% 28	18.6% 13	5.7% 4	0	4.06	.883
CSE2: Thanks to my qualities and resources, I can overcome unforeseen situations about the operation of XR/Digital printing system	34.3% 24	47.1% 33	14.3% 10	4.3% 3	0	4.11	.808
CSE3: I can complete learning tasks in the XR/Digital printing system if I only have user manuals as a reference or guide	31.4% 22	44.3% 31	20% 14	2.9% 2	1.4% 1	4.01	.876
CSE4: If I am in a difficult situation in operating XR/Digital printing system, I usually know what I should do	44.3% 31	37.1% 26	11.4% 8	4.3% 3	2.9% 2	4.16	.987
CSE5: Additional training in handling electronic-print learning improvement my computer self-efficacy and thus managing XR/Digital printing system	32.9% 23	41.4% 29	20% 14	4.3% 3	1.4% 1	4.00	.917
FU1: In terms of weekly hours, I tend to use the XR/Digital printing system the needed time to manage the activities I propose in my subjects	30% 21	51.4% 36	11.4% 8	7.1% 5	0	4.04	.842

FU2: I frequently connect to participate in interactive activities (forums) I have proposed in the XR/Digital printing system	45.7% 32	40% 28	11.4% 8	2.9% 2	 0	4.29	.783
FU3: I can join the XR/Digital printing system to interact with the course I teach at least once a day	34.3% 24	41.4% 29	15.7% 11	8.6% 6	 0	4.01	.925
FU4: I intend to use similar applications like this new system	35.7% 25	48.6% 34	10% 7	5.7% 4	 0	4.14	.822
FC1: The educating organization have time and money to implement such this added value new system upon pandemics	34.3% 24	44.3% 31	15.7% 11	4.3% 3	1.4% 1	4.06	.899
FC2: The educating organization have the ability to train their professors and other colleagues	31.4% 22	50% 35	14% 10	2.9% 3	1.4% 1	4.07	.840
FC3: The educating organization can support the technical support needed for the new technology as one of the most immersed system solution	32.9% 23	50% 35	14.3% 10	2.9% 2	 0	4.13	.760
FC4: The educating organization can support digital skills training, information available, and administrative support	31.4% 22	50% 35	12.9% 9	5.4% 4	 0	4.07	.822
SN1: Accepting the decision of using the new system	32.9% 26	41.4% 29	18.6% 13	5.7% 4	1.4% 1	3.99	.940
SN2: The government gives priority now to the development of XR-printing system upon pandemic and i support the generalization use	32.9% 23	50% 35	12.9% 9	2.9% 2	1.4% 1	4.10	.837
SN3: it is important to go through such this new system in future learning	34.3% 24	44.3% 31	15.7% 11	4.3% 3	1.4% 1	4.06	.899
SN4: learners and families would like to add this new system to the current learning system upon pandemics and after it	37.1% 26	44.3% 31	12.9% 9	4.3% 3	1.4% 1	4.11	.894

16/3/3/1: TAM Constructs Questionnaire Analysis: The pervious table shows the result of each construct questionnaire by numbers and percentage, as well as the mean and standard deviation values for each question. Table shows that mean were above measure 4 (as defined in Likart measurement scale), which means that the result of every question is agree, except two question were on measure 3, which means that it is only neutral. Standard deviation were on the acceptable levels without refers to very high levels.

10/3/4: The study suggests the following hypotheses Paths:

H1: PU positively influences ATT
H2: PEOU positively influences ATT
H3: PEOU positively influences PU
H4: SN positively influences ATT
H5: SN positively influences PU
H6: SN positively influences PEOU
H7: FC positively influences ATT
H8: FC positively influences PEOU
H9: BI positively influences PEOU
H10: ATT positively influences BI
H11: CSE positively influences PU
H12: CSE positively influences PEOU
H13: BI positively influences FSU

10/3/4/1: Path Analysis. The aim of path analysis is to evaluate the veracity and reliability of the hypothetical model and measure the strength of the causal relationship between variables. The author examined the structural equation model by testing the hypothesized relationships between various factors, as shown in Fig. (6) and Table (4).

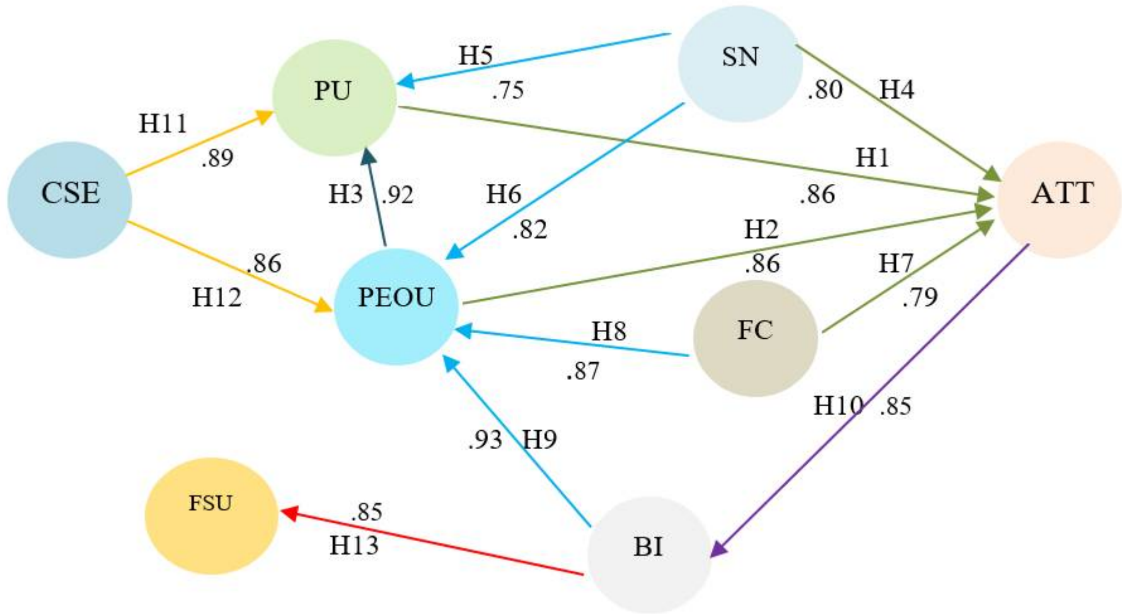


Figure (6): Suggested research model of Technology Acceptance Model based on the following previous studies (Teo 2009, Anormaliza 2016, Fathema 2015, Sabaté 2015, Imtiaz 2014)

Table (4): Variables Correlations

Hypothesized path	Correlation coefficient value	Result of hypotheses
H1: PU → ATT	$.861^{***}$	Supported and very strong
H2: PEOU → ATT	$.869^{***}$	Supported and very strong
H3: PEOU → PU	$.920^{***}$	Supported and very strong
H4: SN → ATT	$.807^{***}$	Supported and very strong
H5: SN → PU	$.757^{***}$	Supported and very strong
H6: SN → PEOU	$.824^{***}$	Supported and very strong
H7: FC → ATT	$.791^{***}$	Supported and very strong
H8: FC → PEOU	$.870^{***}$	Supported and very strong
H9: BI → PEOU	$.930^{***}$	Supported and very strong
H10: ATT → BI	$.857^{***}$	Supported and very strong
H11: CSE → PU	$.891^{***}$	Supported and very strong
H12: CSE → PEOU	$.867^{***}$	Supported and very strong
H13: BI → FSU	$.857^{***}$	Supported and very strong

$*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

10/3/5: Correlation Analysis: Considering the above correlations, XR/DPLS behavioral intention construct of actual usage was the very significant variable, in influencing perceive ease of use to use XR/DPLS, S followed by perceive ease of use construct were also identified as very significant to perceived usefulness. According to the total effect estimates**,** other hypothesized path correlations (H1, H2, H4, H5, H6, H7, H8, H10, H11, H12, H13) were all very strong in influences and supports each other as in the above correlations, that's referring to a very high relationship of the

suggested constructs, as shown in Fig. (6) and Table (4).
The analysis showed that the suggested model were very suitable that would help the universities to apply the system

Table (5): Reliability statistics bu Alpha Cronbach’s coefficient, sum of mean and std. dev.

0	Items	F1	F2	F3	F4	F5	F6	F7	F8	Sum of Mean	Sum of Std. Dev.	Alpha Cronbach's coefficient
Perceived Ease Of Use	PEOU1	.68								4.10	.729	.981
	PEOU2	.78										.981
	PEOU3	.79										.981
	PEOU4	.75										.982
Perceived Usefulness	PU1		.82							4.08	.801	.982
	PU2		.73									.981
	PU3		.90									.981
	PU4		.77									.982
Behavioral Intention	BI1			.74						4.04	.752	.981
	BI2			.78								.981
	BI3			.76								.981
	BI4			.76								.981
Attitude	ATT1				.71					4.03	.828	.981
	ATT2				.79							.982
	ATT3				.78							.981
	ATT4				.87							.981
Computer Self Efficacy	CSE1					.73				4.06	.781	.982
	CSE2					.78						.981
	CSE3					.89						.981
	CSE4					.57						.982
	CSE5					.89						.981
Future System Use	FSU1						.67			4.12	.699	.981
	FSU2						.69					.982
	FSU3						.65					.982
	FSU4						.75					.981
Facilitating Condition	FC1							.58		4.08	.673	.982
	FC2							.67				.981
	FC3							.65				.982
	FC4							.74				.982
Subjective Norm	SN1								.59	4.06	.725	.982
	SN2								.66			.982
	SN3								.67			.982
	SN4								.74			.982
												Total .982
Cumulative %		74.9	80.3	76.59	78.76	77.2	68.94	66.0	66.2			
Variance %		53.2	64.3	56.6	68.6	61.1	48.9	45.4	52.7			

10/3/6: Reliability Analysis. In order to analyze the effectiveness of the original data, the first step of the experiment is to conduct data standardization. In this step we calculate the mean and standard deviation of each question result and also the mean for each category. The results are shown in Table (5). From the table we can see that the mean of all factors is greater than 4, and sum of mean which suggests that the assumptive factors were typical.

Afterwards we further employ Cronbach’s alpha coefficient to show the convergent validity and internal reliability of the factors, which are listed in Table (3). From Table (5) we can find that the total Cronbach’s alpha coefficient is 0.982 and the coefficients of each factor are greater than 0.7 (The minimum acceptable reliability value of alpha cronbach (Hong 2010)). The total Cronbach’s alpha coefficient is highly acceptable (>0.9), and the coefficients of each factor are also highly acceptable (>0.9). As a result the author conclude that the data are reliable measures for their factors.

The sum of mean average refer to more than 4 as referred above in Likert measurement scale concept, which refers that all the constructs evaluation stands in between agree and strongly agree.

11. Conclusion of Findings and recommendations:

This study found that Behavioral Intention and perceived ease of use are the chief determinants of user attitudes to start using XR/DPLS. This may suggest that users regard the level of behavioral intention as the most significant factor which implies that modify teaching activities and using of the new technology will be paid much attention by the university lecturers/teachers and students. Considering the importance and the significance of perceive ease of use it is deserved to conduct further investigation to study the relationship between it with other factors. it is reasonable to argue that PEOU easy, clear and understandable of the system, correlations shows that PEOU also have strongly influenced Perceived Usefulness which refers to lecturers/teachers believes that using the new system would enhance their job performance, and this a very good step towards start applying XR/DPLS, reliability testing was very high, most of samples answers find the system is an online technologies AR/VR 3D learning characters can easily integrates with printed media as well as embedded videos, scripts of the course data and other learning evaluation methods like quizzes, all inside one system

XR/DPLS have the ability to interact with both physical and virtual objects which are registered in time and according to the learner's environment. Within several use cases and a weighting system, i can clearly identify the benefits of such a classification, enabling us to easily establish a reliable definition method for each of these realities or future similar paradigms. Furthermore, its simplicity, this method is accessible to any person, with or without expertise, who wants to create a good learner experience or simply classify existing ones like classical graphic user interfaces or even devices like computer screens.

XR classification easily extendable. For instance, it could add a fourth criterion based on the acoustic perception detailing how the sound could be used to enhance the immersion

EuroCommission Framework for Digitally-Competent Educational Organizations represented different approaches. The findings reveal a number of general considerations that include a focus on leadership and governance practices; emphasis on digital infrastructure and resources, acknowledgment of teachers' role and the need for capacity building; the need for integration of digital technologies across the curriculum; and the need for cross-fertilization and peer-learning for the development and implementation of self-assessment tool. And can be taken as a guide available to implement in Egypt, Africa and Middle East.

Also, the study refer that digital printing not only the way that can students study from a book, but it can be a banner on a wall, or in university corridors or in libraries, it have several ways of presenting prints data to students, and it can support the new system with several ideas suitable for the educational type and time upon pandemics or any other time. Furthermore, the integration between both digital printing and XR can start a new generation of universities libraries and turns it to work within a XR /DPLS.

Teachers preferred the system for the ability to easily customize course materials, the interactivity with paper, the personalization via supplementary content and the recommendation engine for content creation. Students liked the interactivity with other electronic learning resources, the ease in making an-notations and the system's support of students learning together. Furthermore, as the printed books were lighter, their carrying load was significantly reduced. These focus group studies confirmed the effectiveness and value of our integrated prints learning system with the electronic one.

Finally, The author clarify within the study that the proposed extended TAM model has several practical and theoretical implications for researchers and engineers to develop such popular XR/DPLS. This study provided some in-depth analysis of popularity of XR/DPLS in Egypt and then can be applied into development of learning field. It is argued that such this successful systems should exert significant efforts to deliver enjoyable in an easily accessible way as well as to provide excellent social interaction experience to encourage learners to share their fun. And this is will be very helpful to teachers that they will make learning much than a learn method, learners and their families have the way to love learning itself. It has more than a system working in pandemics only, it should be applied in the future within attendance learning days as well.

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