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MIXED REALITY IN THE INFORMATION SYSTEMS PEDAGOGY: AN AUTHENTIC LEARNING EXPERIENCE

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Abstract:

Mixed Reality (MR) has brought a significant change in today's world and its significance is continuously evolving in Information Systems (IS) pedagogy. This study expands on the current literature to plan, design, test, and evaluate the use of Microsoft HoloLens, which is an MR device in an IS classroom. This study uses design science guidelines to introduce HoloLens to 20 postgraduate students and 130 undergraduate students in their class. Student responses were both positive and negative highlighting the advantages and disadvantages of the technology, the applications and its interface as presented in this paper. Findings suggest that the use of an authentic learning framework provided effective instructional design guidelines support the acquisition of advanced knowledge.

Keywords: Authentic learning, mixed reality, design science

I. INTRODUCTION

Today, the transformation of the pedagogy caused by technology provides an opportunity to revolutionize learning environments in an authentic context (Kirkley & Kirkley, 2004). Authentic learning is designed to connect students to real-world issues, problems, and applications. Learning experiences in authentic learning reflect the complexities and ambiguities of real life. In an authentic learning environment, learners can gain a deeper sense of discipline (Oldfield and Herrington, 2012). Technology has a significant potential to be an enabler for authentic learning (Lombardi, 2007), and Mixed Reality (MR) is one of the important technology to support today's authentic learning environments.

MR is an emerging technology in which the real world is enhanced by an overlay of computer graphics-based interaction (Milgram & Kishina, 1994). The user can view the real world through a handheld or head-mounted device by coating illustrations on the surrounding environment (Harborth, 2017). Microsoft HoloLens and Google Glass are examples of MR devices. The use of MR in the pedagogy is becoming more and more to be taken as a reflection of today's reality. MR applications are used in various fields like health (Stretton et al., 2018), business (Soliman et al., 2018) and education (Leonard & Fitzgerald, 2018). The educational value of using MR in learning design is to provide an exceptional student experience, by helping them to 'see the unseen'. Through the capacity of MR, it is possible to visualize and interact with complex and abstract concepts (Billinghurst, 2002). Students in the Information Technology field can have a work-integrated learning experience with MR by programming augmented reality applications (Jee et al., 2014, Chong et al., 2009).

This study experiments the use of MR in an Information Systems (IS) classroom by applying design science perspective to understand the power of authentic learning. Design science is a promising research paradigm in IS (Gregor & Hevner, 2013) and the ultimate principle of design science research is that the understanding of a design problem and its solution are developed in the construction of an artifact. Design science guidelines are used to introduce Microsoft HoloLens, an MR device in a post-graduate and an under-graduate classroom at a University in Australia. The design problem for this study is the use of MR in an IS class to understand and learn the technology as part of authentic learning, and to prepare the students for their future work. Thus, the research question addressed in this study is as follows:

Research question: *How do learning activities with the use of Mixed Reality affect the authentic learning of undergraduate and post-graduate students in an Information Systems unit?*

As a solution to the design problem and to answer the research question in this study, Microsoft HoloLens is introduced and evaluated in an IS class. HoloLens is introduced as an artifact in a class activity based on the six steps of design science research (Baskerville et al., 2018). During the trial, Microsoft HoloLens is used to prepare the tutors, to design the task, to orient the students, to collect data and to accumulate the feedback after the use of the artifact in class. The theory of authentic learning was applied to evaluate the results of the student feedback so that the effect of authentic learning using MR is known. The findings of this study shed light on how MR is succeeding in bringing the outside world into the classroom by setting an example for authentic learning.

The remainder of this paper is organized as follows. Section two introduces related work and theoretical foundations on MR, design science, and authentic learning. Section three presents the steps used to introduce HoloLens in class and take the survey. Subsequently, the research method is presented along with the results of the data analysis. In section four, this paper discussed the results in detail by presenting the implications of the results based on authentic learning theory and provide design implications for MR in education. This paper is concluded with a summary of our main findings and contributions.

II.LITERATURE REVIEW

This section presents the related work and the theoretical foundations of three main areas listed as the MR, design science, and authentic learning.

Mixed Reality (MR)

Today, 'augmented' reality (AR) and 'mixed' reality (MR) are the two technologies that are used interchangeably. MR technologies display virtual objects over the real-world background while AR refers to the overlay of data onto the visible world. To distinguish the difference between the MR device and MR application, Microsoft Hololens is an example of an MR device, while Pokémon Go is an example of an MR application. On a review of IS-related literature, Harborth (2017) provides a detailed and systematic literature review of MR in IS research. It was highlighted that there is a need to be augmented by insights from IS so that the technology itself can be improved. It is also possible to understand human-centered behavior when interacting with technology.

The idea of MR stems from Sutherland (1968) when a head-mounted three-dimensional display was introduced. MR system is defined by Azuma et al., (2001, pp. 34) to have the following properties: "combines real and virtual objects in a real environment; runs interactively, and in real-time; and registers (aligns) real and virtual objects with each other". Milgram (1994) presented a continuum of real-to-virtual environments as given in figure 1 adapted from Forbes. The definition of the three terms are given as

- Virtual reality (VR) immerses users in a fully artificial digital environment.
- Augmented reality (AR) overlays virtual objects in the real-world environment.
- Mixed reality (MR) not just overlays but anchors virtual objects to the real world.

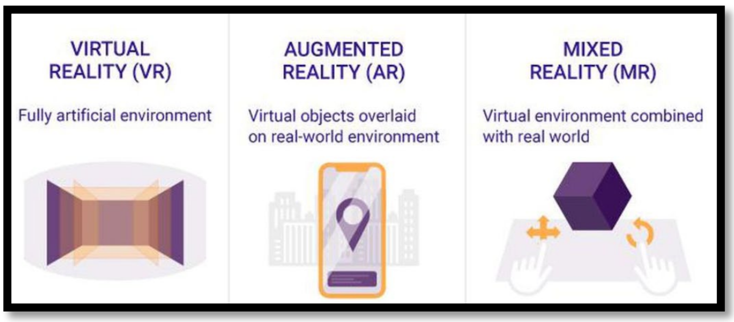


Figure 1. Virtual Reality – Mixed Reality continuum (Adapted from Forbes, 2018)

Visualizing various data both big and small in a real and physical environment is the next promising area in this MR related research. The first promising area in visualizing is a system with immersive analytics features of MR developed by Mahfoud et al., (2018). Przybilla et al., (2018) used design thinking and proposed a human-centric approach for documenting chronic wounds using augmented reality smart glass application. Exploring interactions with the neuropsychologist's avatar in virtual locations using a VR social network (Bernard et al., 2018) and creation of a hybrid augmented experience merging physical and virtual worlds for immersive e-therapy (Gorini et al., 2008), are studied in a health-related area. Given the maturity and availability of MR technology, the adoption of MR applications to support the IS education process is a realistic application scenario within the context of digital disruption. Hence, the aim of this study is to design, trial and evaluate the use of an MR device - Microsoft HoloLens, as a teaching tool in Information Systems (IS) class.

Design Science

Design science is a promising research paradigm in information systems (Gregor & Hevner, 2013). Design science research involves constructing a wide range of socio-technical artifacts, such as new software, processes, algorithms or systems intended to improve or solve an identified problem (Myers & Venable, 2014). Hevner et al. (2004) offered seven guidelines for design science research as presented in table 1. Design science guidelines created from information-systems design theory are given as "a prescriptive theory which integrates normative and descriptive theories into design paths intended to produce more effective information systems." Peffers et al. (2007) extended design theory into a design science research methodology by incorporating the principles, practices, and procedures required to carry out research. They suggested that design science theory as a methodology needs to be consistent with prior literature, provide a nominal process model for doing design science research and provide a mental model for presenting and evaluating design science research (Peffers et al., 2007).

Guideline	Description
Design as an Artifact	Design science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Problem relevance	The objective of design science research is to develop technology-based solutions to important and relevant business problems.
Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Research Contributions	Effective design science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations and/or design methodologies.
Research Rigor	Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Design as a search process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Communication of Research	Design science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Table 1. Design science research from Hevner et al. (2010)

The studies highlight that the essential element of a DSR project should be the design artifact (Hevner & Chatterjee, 2010; Hevner et al., 2004; March & Smith, 1995). In design science, the key question to address is: What is the appropriate balance between making research contributions to science (theory) and technology (artifacts)? To include 'IT, IS and also related people, policies and practices' (Curry et al., 2014) in design science, the concept of 'IT artifact' include 'socio-technical artifacts' (Gregor & Hevner, 2013) and 'cultural properties' (Orlikowski & Iacono, 2001). While we propose the use of design science in experimenting with the use of HoloLens in the class for educational purposes, the nature of design science theory provides a foundation for more systematically specifying its design. Thus, this paper presents an instantiation of solving the problem of using HoloLens in a class by developing a teaching plan and executing the same. This is a definitive example of the computational genre of design science research (Rai, 2017).

Authentic Learning

Authentic learning is an instructional approach that allows students to explore, debate, and construct concepts and relationships in contexts that involve real-world problems and projects that are relevant to the learner. Authenticity, ownership, the relevance of the learning experience, and active participation were considered as important features in creating situated, learner-centered, collaborative learning environments in problem-based learning. (Nelson, 1999). Authentic-learning can help to design a learning environment with a more motivated and engaged type of learner (Oldfield and Herrington, 2012). Herrington, Reeves, & Oliver, (2010) propose a list of nine key elements that characterize an optimal authentic learning experience. The nine steps are listed as:

1. Provide authentic contexts that reflect the way the knowledge will be used in real life
2. Provide authentic activities
3. Provide access to expert performances and the modeling of processes
4. Provide multiple roles and perspectives
5. Support collaborative construction of knowledge
6. Promote reflection to enable abstractions to be formed
7. Promote articulation to enable tacit knowledge to be made explicit
8. Provide coaching and scaffolding by the teacher at critical times
9. Provide for authentic assessment of learning within the tasks

Guidelines for design and implementation of learning environment suggest that a situated learning environment should provide a physical environment which reflects the way the knowledge will ultimately be used, a design to preserve the complexity of the real-life setting with ‘rich situational affordances’, a large number of resources to enable sustained examination from a number of different perspectives, a design which makes no attempt to fragment or simplify the environment (Herrington & Oliver, 2000). Authentic learning will develop links between previous learning and new learning. There are ten design elements that learning researchers believe represent the ‘essence’ of authentic learning is listed as real-life relevance, an ill-defined problem, sustained investigation, multiple sources and perspectives, collaboration, reflection, an interdisciplinary perspective, integrated assessment, polished products, multiple interpretations and outcomes (Lombardi, 2007). Thus, in this study, the use of HoloLens in IS class is designed to connect what students are taught to real-world issues by following the principle of authentic learning. Learning experiences in authentic learning reflect the complexities and ambiguities of real life which are offered to students in their class and in their follow-up assessment.

Paint

III.METHODOLOGY

For this study, Microsoft HoloLens was introduced to 25 students studying a postgraduate Management Information Systems unit and 180 students studying a graduate unit about Information Systems in Organisations. A total of 150 students attended the study. Six HoloLens devices were used in ten different workshop classes to review the concepts taught. Each workshop consists of 20 students. Four tutors were involved in the orientation of the use of HoloLens in class. Before presenting the details about how the study was conducted, the design science steps used for this study is explained as follows:

1. Design as an Artifact: Microsoft HoloLens is the MR solution used for this study. The use of an MR solution to teach Information Systems and the future of work is an instantiation of the artifact in this study.
2. Problem relevance: The objective of this study is to use an MR solution to enhance teaching information systems and the future of work, with technology. The research question is: “*How do learning activities with the use of Mixed Reality affect the authentic learning of undergraduate and post-graduate students in an Information Systems unit”.*
3. Design Evaluation: The use of HoloLens in class was evaluated by surveying 150 students taking the two units Information Systems in Organisation and Management Information Systems.

4. Research Contributions: This study gives a new way of introducing a design foundation by using a new artifact – Microsoft HoloLens to introduce the concept of MR and evaluate the usability of the students' feedback.
5. Research Rigor - The design of the lesson plan, working on the ethics approval, creation of the tasks for students to experiment on the Hololens, conducting the survey and analyzing the results is the rigorous methods used in both the construction and evaluation of the design artifact.
6. Design as a search process - The search for the effective way of using and testing the new artifact - MR (Microsoft HoloLens) in education was conducted.
7. Communication of Research - The study and the findings were discussed with various organizations, health, education, and information technology department. The study will be presented in conferences and Journals.

Thus, for this study, the design problem is the use of MR technology as an artifact in an IS class to understand and learn the technology. After an initial orientation to MR and the various applications of the technology, students formed groups of four. HoloLens was circulated between each of the group members for them to experience one of the available Apps. Students then discussed the opportunities and capabilities of the immersive tourism HoloTour App and the 3D hologram creation HoloStudio App. HoloTour application gives a view to explore the beauty and history of Rome or to uncover the hidden secrets of Machu Picchu. HoloStudio is a HoloLens app that allows developers to create holograms of your own design and turn them into physical objects with 3D print compatibility. Based on a previously chosen industry or business area for analysis, students were asked to consider how MR and these types of Apps might transform the future and associated opportunities for their chosen industry or business area. At the end of the class, students were asked to participate in a short survey to ascertain their views on the user experience and critique the affordances of the technology. This doubled as a formative learning moment to inform their final assignments which required students to analyze the impact of innovative technologies and the effect of change in their chosen industry/business. At the end of the session, students were asked to rate their experience. Figure 2 gives a snapshot of students using HoloLens.

Figure 2. Use of HoloLens in Class

During this trial study, Microsoft HoloLens was used in the following steps: Prepare the tutors by conducting orientation lesson, design the task by creating questions for students to answer, orient the students by introducing them to the technology, collect data using the survey questionnaire, assess the feedback after the use of the artifact in class. The lesson plan follows the nine steps suggested by Herrington, Reeves, & Oliver, (2010) by providing authentic contexts that reflect the way the HoloLens will be used in real life, authentic activities to use HoloLens and visit Italy as well as design an object like house/car. The use of HoloLens is lab supported collaborative construction of knowledge as a group of 4 students. The process helped students to reflect on abstraction and tacit knowledge to be made explicit by presenting their designed artifact. Teachers had to pay coaching and scaffolding to help students understand the new technology in class and think over their assignments and thus providing an authentic assessment of learning. The lesson plan followed for this study is given below in table 2. The findings from the survey are presented in the next section.

Time	Stage of Lesson	Details
5 minutes	HoloLens orientation	Watch HoloLens Orientation Video and demonstration.
5 minutes	Introduce the task to the class	Discuss the question to solve and how to work in groups.
5 minutes	Group formation	Groups are formed with a maximum of four students in a group.
30 minutes	Initialization with HoloLens	Each student in a group can start using HoloLens and familiarize themselves with using HoloLens and communicating with their team members.
30 minutes	Design with HoloLens	Students choose the question to work on and work towards designing their solution in HoloLens.
30 minutes	Present the solution	Students present their findings with HoloLens.
10 minutes	Survey	Students answer the survey.
5 minutes	Conclusion	The session is concluded with a summary of lessons learned.

Table 2. Lesson Plan used to introduce HoloLens in class

IV. RESULTS

The results of the survey conducted are given in Table 3. The results are presented so that it is evident regarding the feedback from 25 post-graduate students of Management Information Systems unit and 180 undergraduate students of Information Systems in the Organisation unit. From the 205 students, only 20 post-graduate students of Management Information Systems unit and 130 undergraduate students of Information Systems in the Organisation unit which is a total of 150 students participated in the survey. It is evident that 84% of the students felt “It was enjoyable” irrespective of their group. It was quite clear that undergraduate students supported the fact that “This App would make learning more interesting” however, that is the lowest indicated for post-graduate students. It was also found that the post-graduate students agreed to the fact that “This App would help me learn better than normal classroom activities”. Figure 3 presents the variations in the principal components for a clear picture of the interest in the 150 students.

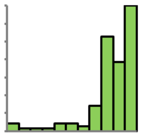
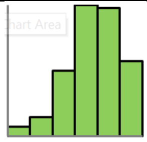
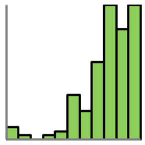
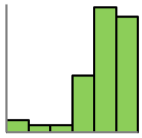
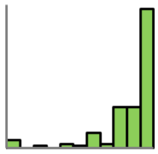
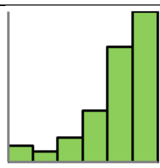
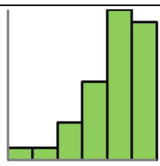
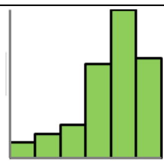
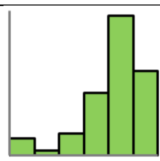
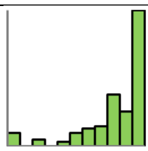
	MIS (20 students)		ISO (130 students)		ISO +MIS (150 Students)		
Measures	Mean	SD	Mean	SD	Mean	SD	Descriptive
It was enjoyable to use.	8.4	1.3	8.4	2.1	8.4	2.1	
It was easy to use	7.5	1.4	7.2	2.3	7.2	2.3	
It worked well	7.9	1.5	8.0	2.0	7.9	2.1	
This App helped me see or visualize the main idea	7.3	1.6	8.4	2.1	8.2	2.3	
This App would make learning more interesting	7.1	2.0	8.9	2.0	8.8	2.1	
This App would help me learn better than normal classroom activities.	8.8	1.2	8.1	2.5	8.0	2.5	
I found it helpful to be able to walk around the object/s.	7.7	1.3	8.1	2.3	7.9	2.4	
It would help me learn/work with others	7.9	1.5	7.6	2.6	7.4	2.6	
I found it helpful to be able to move/place the object/s	7.5	1.4	7.9	2.4	7.7	2.5	
I would like teachers to use this App in the classroom	8.1	1.3	8.3	2.5	8.2	2.5	

Table 3. Survey questions and the average score

	Component									
	1	2	3	4	5	6	7	8	9	10
It was enjoyable to use.	0.320	0.132	-0.080	0.148	-0.580	0.536	-0.355	-0.282	0.003	-0.147
It was easy to use	0.287	-0.592	-0.407	-0.009	0.061	0.259	0.521	-0.121	0.213	-0.013
It worked well	0.308	-0.415	-0.352	-0.027	0.011	-0.462	-0.565	0.069	-0.264	-0.034
This App helped me see or visualise the main idea	0.318	0.068	0.197	-0.645	-0.278	-0.272	0.009	0.060	0.533	-0.026
This App would make learning more interesting	0.331	0.162	0.083	0.106	-0.426	-0.317	0.519	0.116	-0.529	-0.035
This App would help me learn better than normal classroom activities.	0.316	0.427	-0.219	0.266	0.367	-0.192	0.057	-0.119	0.237	-0.595
I found it helpful to be able to walk around the object/s.	0.314	-0.242	0.469	0.405	0.061	0.144	-0.090	0.620	0.193	-0.063
It would help me learn/work with others	0.318	0.179	-0.028	-0.517	0.403	0.439	-0.038	0.248	-0.422	-0.038
I found it helpful to be able to move/place the object/s	0.316	-0.171	0.565	0.049	0.293	-0.074	-0.022	-0.650	-0.121	0.143
I would like teachers to use this App in the classroom	0.332	0.356	-0.264	0.214	0.116	-0.038	-0.021	0.046	0.186	0.772

Figure 3. Principal Components

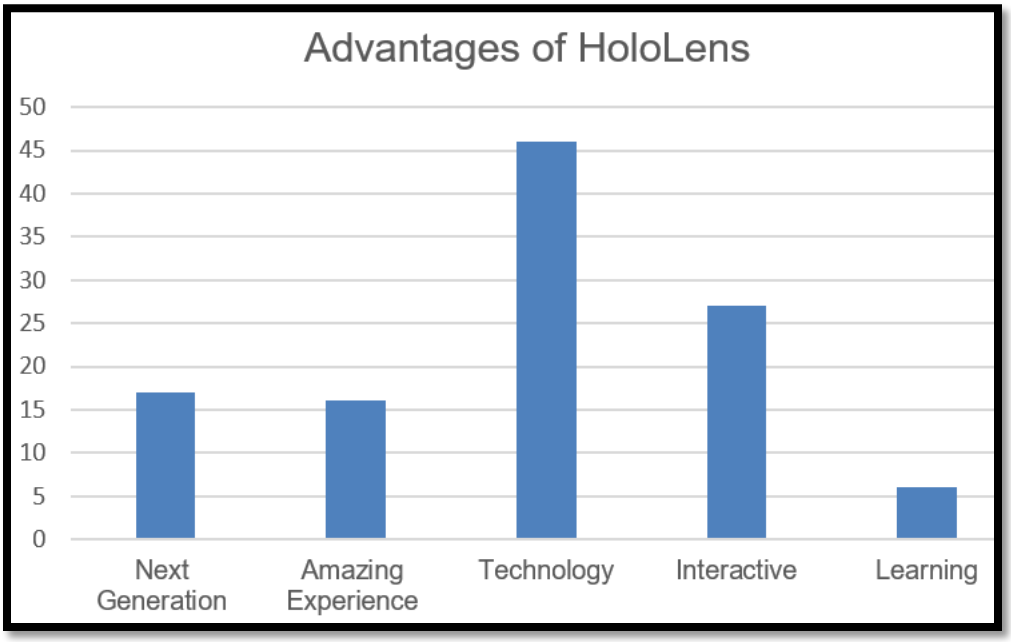


Figure 4. What was the best thing about the app

The qualitative questions were further analyzed to understand the student's opinion. The first question was "What was the best thing about the app", to which 125 students answered. The feedback for the question about the best thing about the app was classified into five groups based on content analysis. It was classified into "next generation", "amazing experience", "technology", "interactive" and "learning" and is plotted as figure 4. As given in the graph, technology with respect to the verbal and visual scored the highest. A few quotes about technology are listed as:

> *"it was very interactive and visualizing, certain things helps to remember it better"*
>
> *"able to see all details without needing of a keyboard"*
>
> *"it was very realistic-the sound was too"*
>
> *"visual while learning"*
>
> *"the visualization apps were amazing quality, the tour of Rome was good as it walked me through and talked to me"*

Although there was a little overlap between technology and interaction, the interactive perspective scored second. A few examples of interactive comments are listed as:

> *"being able to interact with holo objects"*

“immersive + help interact with the lesson”

“interactive and engaging”

“it was very interactive and made learning fun”

“The level of interactions that was made possible in the different locations”

A few quotations about next-generation technology as well as the amazing technology is listed here.

Next-generation Technology:

“insanely interactive, coolest things in the world”

“interactive and hands-on approach, something live never seen before so feels like the face front of technology”

“It felt new, exciting, innovative, engaging and responsive”

“what made the augmented reality worthwhile was how well it integrated with my environment and how easy it was to use”

Amazing Technology:

“in holo-tour it was cool to be able to view a typical street setting and the daily activities of locals in a town”

“learning is much more interesting”

“You can be in Italy without paying”

“The fact that the information was blown up in front of me”

“to be able to see the real world combined with the apps, objects, and interfaces”

Finally, the same number of students answered the question: “What was the worst thing about the App?”. It was found that the majority of the students felt it difficult to use. Their feedback can be quoted as:

“a bit heavy and a bit uncalibrated”

“adjusting the camera for the individual”

“adjustment gestures”

“brightness”

“difficulty selecting choices”

“distracting”

“eye strain”

“hard to control”

Thus, the results obtained from 150 students who used HoloLens in class are given in this section. The next section will discuss the findings and propose the future.

V.DISCUSSION

It was evident from this study that MR is an emerging technology that can be used in education to support and challenge students to explore new possibilities in their future of work. HoloLens is a clear example of today’s digital disruption. From the way students see the unseen it is a clear demonstration of how they experience transformative technology. The use of HoloLens and its applications in class enables learning with the essence of entertainment and engagement. HoloLens and MR technology itself disrupt the business and society by fostering experiential and entrepreneurial learning which is evidenced in this experiment. This study also shows how to build students' capability to approach emerging technologies with a sense of dynamic and progressive change. The students' feedback about the technology was very positive. For them, this technology is the "*next-gen digital native dependency*"- quoted by one student. MR in class promoted experimentation and an entrepreneurial approach into the learning experience which also evidenced students' capability, resilience, and agility.

Information Systems research on the use of MR technologies for education is really in its infancy and is still emerging (Melatti and Johnsen 2017). The new version of Microsoft HoloLens that was released in February 2019 worked with companies like PTC Vuforia solutions, Philips and Bentley to give transformative MR experiences for industrial customers. For tomorrow, experts estimate that the market for MR will increase to 162 billion dollars in 2020. On the whole, the test and trial like this study is a good example of a different set of affordances. The early research in this area is overwhelmingly positive about its effects on both learning and motivation (Bernard et al., 2018; Leonard & Fitzgerald 2018). This research by using MR in the classroom suggests that while the novelty value of the technology cannot be overlooked, there is also evidence that the motivational effects of the technology are due to the intellectual easing effects that they can provide.

The experiments and results of this study according to design science theory, hardly deny the importance of the concept of the IT artifact and the importance of the IT design in implementing Microsoft HoloLens as a MR trial in Information Systems class. This study helps to highlight the possibility of situations where the IT artifact (HoloLens) and its design (Holograms) are promising. The IT artifact in this case the HoloLens and the applications like HoloTour and HoloStudio are already designed and built and therefore already available for this project. This shifts the focus away from the design of the technological artifact and towards the design of the information artifact and the social artifact. Design science research that focuses on the development of artifacts involves two primary activities to improve and understand the behavior of aspects of Information Systems: (1) the creation of new knowledge through design of novel or innovative artifacts (things or processes) and (2) the analysis of the artifact's use and/or performance with reflection and abstraction. In this study, the creation of new knowledge through the design of novel or innovative artifacts is the use of the HoloLens artifact in class for educational purposes. It helps students to not only understand the new technology, the interaction with the technology but also how the technology will be applied in their future of work. Thus, it helps the students to analyze the HoloLens as the artifact and its use and/or performance with reflection and abstraction.

Authentic collaborative MR learning activities were designed, developed and implemented for a unit in Information Systems. This study thus provided an authentic context that reflects the way the knowledge will be used in real life by introducing authentic activities by using HoloLens. The students and lecturers took access to expert performances and the modeling of the processes as they used HoloTour and HoloStudio to collaboratively construct knowledge. The study promoted reflection to enable abstractions to be formed and to enable tacit knowledge to be made explicit by using the device for their learning purpose. Teachers were coaching and scaffolding the students at critical times and integrated authentic assessment of learning within the tasks. The effect of iterative designs of content and instructional process of authentic MR learning used in this study evidence the students' feedback using the survey. It is evident from the results that the students were eager to use innovative technology in their class as they prepare for their future of work. In their survey, they expanded that the activities using MR helped them to understand the course content in detail. It was evident that the use of MR in class for learning will help the student in their everyday life, both professional and personal. The use of HoloLens in class was an unfamiliar situation in which they had to solve problems, adapt to their own behaviors and make decisions regarding the use of new technology. It was a typical example of authentic learning where students had to utilize and manipulate the knowledge they already have in drawing upon their skills to guide their choices and to help them determine their next steps within the content of the novel situation. Thus, it will help to equip students with these essential life skills, to show the connection between learning and real-life and to give students the problem-solving abilities that they require for life beyond school.

One of the main limitations of this study is the cost of HoloLens. The current version of HoloLens cost USD4500.00. Hence, we ended up using 6 HoloLens in workshop classes. This project also won a financial assistant from school to buy 4 new HoloLens to work towards programming and developing applications. Secondly. The applications are also expensive and so, we used freely available applications like "HoloTour". In the future, we aim to develop applications for the next phase of the study as it not only helps us to use it but also involves students specializing in programming to develop the application. Although we’ve seen much progress in the basic enabling technologies, they still primarily prevent the deployment of many MR applications. In the next phase of the study, there is a need to introduce Hololens to students in various fields like business, health, and communication. This will help us to understand the way students from different domains can present the case.

VI.CONCLUSION

This study presents the trial and findings of the evaluation of using Microsoft HoloLens as a teaching tool in the Information Systems (IS) class. The findings of this study shed light on how MR is succeeding in bringing the outside world into the classroom by making learning collaborative and interactive.

The new learning experience with MR, provide students with the opportunity to exercise authentic, critical and creative inquiry which was demonstrated by students’ comments on both opportunities and limitations of the technology. The student also demonstrated that authentic experiential learning led to professional practice thinking about their potential future. The students also brought their learning experience with HoloLens in their final assessment. For example, one assessment presented how to use HoloLens in the watch repair industry. A quote from their assessment states that “HoloLens, the virtual reality headset will allow watchmakers to solve the most intricate of problems as well as giving them a more unique solution of which they may not have previously thought”. Another set of students proposed a personal trainer with HoloLens. A quote from their assessment states that “with the development of HoloLens, the whole system of personal training could change. HoloLens could give a whole new look into personal training, as it would benefit both the trainer and the trainee”. These are all classic examples of authentic learning.

Next-generation learning spaces encapsulate the affordances of both physical and virtual spaces and yet many assessment tasks are still designed as if students occupied only one of these spaces. Teachers will need to design more authentic, meaningful tasks that will engage students in using the full range of their capabilities and available resources, both physical and virtual. Students come together physically to engage in the social construction of their knowledge and use the virtual spaces to broaden the social dimension of their learning environment. We can hence prepare our students for the disruptive innovation, evolving workforce, and lifetime success by using MR in the Information Systems pedagogy as an authentic learning experience.

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