Doctoral Colloquium-Exploring the Benefits of Using 360 Video Immersion to Enhance Motivation and Engagement in System Modelling Education

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Doctoral Colloquium Paper —Exploring the Benefits of Using 360^0 Video Immersion to Enhance Motivation and Engagement in System Modelling Education

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***Abstract*— This paper describes the use of a 360^0-video case study to enhance experiential learning in an ICT systems analysis class. We hypothesize that the use of a visual case study combined with virtual instructions can lead to learning motivation and enhanced learner engagement. This examination follows the conceptualization phase of a methodology to investigate the practical uses of the intervention deriving in learning engagement. A sample of 24 participants from an Australian University was considered. The findings of the study reveal a positive impact on the measures provoking learning engagement and motivation among the participants.**

Keywords—systems analysis and design, education, immersion, learning motivation and active engagement, experiential learning

I. INTRODUCTION

With the increased availability of virtual reality (VR) and 360^0 video technology, there has been an increased opportunity for providing new dimensions for communication [1]. New learning metaphors in the educational arena for teaching delivery and learning engagement are being exposed by the use of VR [2]. The interest in 3D media, spherical videos and VR applications where visual information and immersive narratives can be navigated and accessed by learners had a significant increase in recent years[3].

The pervasive use of technology in the academic domain is in defining the use of visual abilities as elements in literacy skills within the digital technological domain and education [4]. The use of visual representations supported by technology can provide interactive learning opportunities for an information communication technology (ICT) class [5] and provide visual reinforcement of class content compared to traditional delivery [6]. For example, research has studied the use and application of mixed media visualizations in distance education for paramedics skills with promising results [7] and assistance with spatial learning immersion for architectural design [8]. The use of technology in training and instruction supported by the use of visual information and key representations are essential elements for the development of visual literacy skills in the ICT field [5]. ICT system modelling as many other STEM disciplines faces the challenge of content delivery in a brick and mortar classroom. Traditional learning methods in systems modelling have been challenged due to the students progressive understanding and learning performance of modelling techniques.

One of the main difficulties in teaching system modelling to students is to assist them to understand the modelling planning and semantics (narrative). Some conceptual understanding connected to the use of logical context, steps and procedures is critical and yet is not visible when learning system modelling. In addition, learners must build structured solutions based on narrative examples and problem domains that are not easy to articulate by novice students. This conceptual understanding learning domain can be a challenge for students as they are unable to link the concepts and apply them into appropriate logical models.

The traditional teaching methods allows learners to define various components of the system. However, it does not illustrate the process for capturing modelling requirements [9]. The question that arises is how to provide a 360^0 vivid experience when the learner is removed from the physical reality and is measured by assessing the affordances and benefits provided by the new methodology.

II. BACKGROUND

First year students in ICT classes face a wide range of challenges, one of which is being confronted with a subject they have never encountered in their previous learning. In system modelling, this challenge is intensified as students encounter several concepts, terms and syntax that include developing an intrinsic skill set while learning and practicing modelling. Learners can also be discouraged when dealing with a daunting learning narrative and confusing written commands that must be deciphered before performing modelling actions.

Traditional learning approaches to modelling have been challenged with regards to students' systematic understanding and learning performance of system modelling. When using problems depicted as narratives, learners find it difficult to conceptualize the aim of the problem domain, blocking decision making when modelling. Some of the difficulties of understanding the system itself can lead to disconnection and, therefore, learning disengagement [10].

The rapid development of science and technology has broken into all areas of society, so that in recent times new technology has become one of the fundamental products of modernity and consumption. Video has evolved significantly over the past years

and is continuously expanding in various societal directions with emphasis in the educational ground.

The use of ocular visualization such as VR has expanded the possibilities to present content and deliver learning material for students. For instance, while a written narrative fails to present a concept or a problem domain, a visual representation can improve the communication experience and knowledge facilitation [11]. In this sense, the current impact of how new technologies is systematically affecting how society acquires information, video immersion has changed the way people learn, communicate, interact and work. Video has changed dramatically and has become a significant piece to advance education by permeating our educational institutions to improve learning outcomes, advance skills and increase student retention [12].

Learning tools such as video, text and augmented imagery are key to provide students with an array of elements to facilitate understanding of learning material and processing of information [13]. Digital learning resources assist learners to process information by helping them to create mental representations through the blend of media components presented to them. These components include the use of graphics, image and videos to present information. Research on mixed media learning has illustrated increasingly positive results for students who gain from assets that successfully consolidate words and pictures, instead of those that incorporate words alone [14].

The use of video incorporates self-regulated learning, imitation of the instructional video, study time adaptability. The use of and access to materials in a higher capacity offers learners the insights to understand the required task when assistant tools are available [15]. According to Siemens [16] education innovation has experienced three unmistakable ages of advancement (distance education, online learning and blended learning) and now a fourth is developing. This fourth era incorporates versatile technology mixed with adaptive learning and competency assessments. There is also an emphasis on learning interactions and how they can be developed further. Video in training is one component of those associations for instruction and training within education and how it can be advanced further.

The current COVID-19 situation across the globe where brick and mortar education has been impacted by an external force where many educational institutions have closed their doors has impacted millions of learners. This can also be an opportunity to migrate from a face to face interaction to an online interface. The use of VR video for learning can help to deliver a vivid learning experience to learners who have been disconnected from their physical reality. This cost-effective delivery pedagogical shift can improve teaching reliability and fidelity as well as provide learning equality to students for knowledge acquisition. To assist with the new teaching delivery demands the use of technologies such as such as 360 video cameras that are becoming more affordable, portable and accessible make it suitable for the creation of VR contents for educational and teaching delivery purposes [17]. An essential question that arises from the project literature review is how 360^0 visualization tools can be used as a linking modality to improve learning motivation and engagement. After reviewing the current literature, this intervention adopted virtual experiences using a 3600-video aiming to investigate the learning engagement and motivation in a system analysis context compared to a non-immersive experience.

III. Simulation Design

The aim of the simulation was to provide students with visual and auditory feedback to mitigate the problem's students face in relation to understanding the modelling requirements compared to a traditional teaching approach. The use of a virtual scenario provides an ocular description of a case situation within a system real world environment allowing the first stage of conceptualization and better understanding of the requirements compared to a traditional narrative.

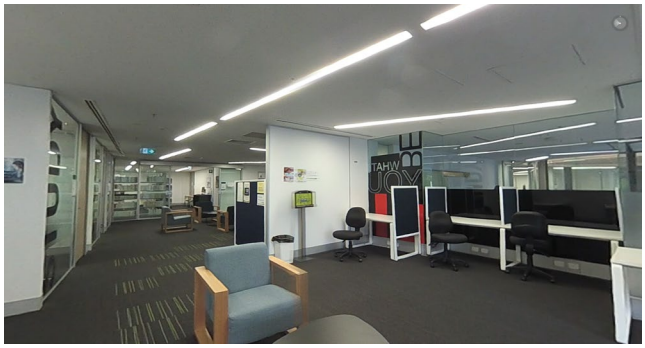

Figure 1: Virtual scenario to be explored for situational recognition

Twenty-four participants were involved in the study and ethics clearance was granted prior to the intervention. The research methodology adopts design-based research (DBR)[18], through which a framework was developed, which outlines four learning phases "4C" proposed by [5]. This "4C" framework recommends a sequence of practical activities that support students with modelling construction by following four steps (conceptualization, connection, construction, consolidation).

This first stage of the intervention refers to the first "C" conceptualization phase which refers to learners visual understanding of the task requirements and situational understanding to provoke learning engagement.

This learning scenario also allows the incorporation of a virtual teaching assistant displayed in a 360-degree setting to support students with task understanding and instructions integration. This assistance can help to reduce the learning timeframes when understanding complex scenarios, hard to understand activities or when performing assessment tasks such questions, assessments exams. The introduction of an educational assistant in a 360 scenario (Fig. 2) within a learning environment maximises learning engagement in an adaptive manner.

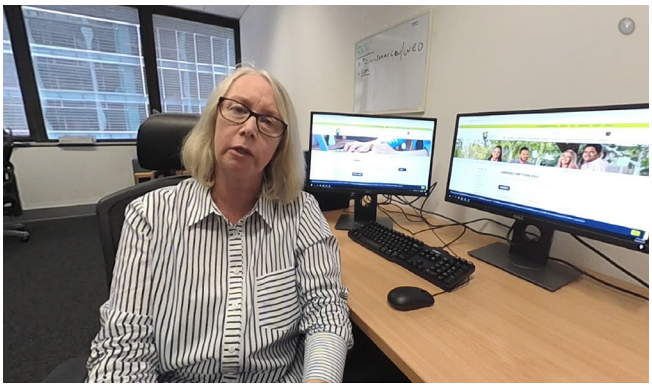

Figure 2: Virtual assistance used for clarification and consultation

Once a learning connection is established, the assistant can provide a virtual experience but with help of the existing learning physical tools represented in an introductory 360^0 video. This can be used as a learning transition for users and trainers to maintain a connection with the simulation in each learning environment. This experience allows learners to concentrate on the tasks as the cognitive load has been reduced by incorporating a vivid perspective deriving in positive attitudes towards the learning process [19]. Connecting the use of virtual technologies in experiential learning and activities improves motivation, engagement and academic performance [17], [20].

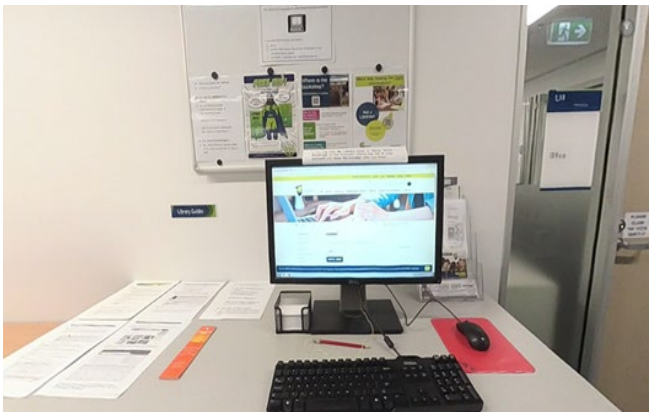

Figure 3: Simulation for training including multimedia tools such as audio, text and video resources.

IV. Results

We investigated the impact of presenting a case study using a 360^0 video to establish a connection between the learning motivation linked to the content and task delivery mode. Results of this experiential learning activity using virtual simulations can be considered more attractive and engaging than the conceptual explanation in a face to face delivery for novice modelling learners (Fig.4). Table I presents the qualitative results and are organized in a tabular form, this includes students' learning satisfaction, experiences and suggestions when learning using 360^0 virtual environments.

Figure 4: Students in a virtual inmmersion using 'Oculus Go' headsets

TABLE I. Participants Comments

Categories	Participants Comments
Participants satisfaction	Learning experience
	Very immersive and engaging
	Very real experience
	Content makes sense
	Great learning tool
Advantages of 360^0 videos	Videos are informative and interactive
	Understanding of the problem and tasks
	Practical method to deliver content
	Interesting way to engage the learning activities
	It makes me come back to the learning task
Suggestions for inprovements	It only considers the foundational modelling part
	More activities can be added for learning stages
	It helps to understand only the basic principles
	Not to depend on the videos only as it looks simpler than reality

V. Discussions

The research experiment focuses on the concepts and conceptualization of the learning task as part of the learning preparation. This preliminary visual activity assist learners with the comprehension of the system modelling problem domain by reducing cognitive processing.

The results highlighted in Table I indicate that most participants described experiences as satisfactory when interacting with the video using VR headsets. This positive learning experience supports the premise that visual immersivity can be engaging and motivating as it supports and facilitates the conceptualization of the problem for system modelling as indicated in [12], [15].

With regards to the advantages, participants reported that this method was easier when learning and understanding the problem domain and notions of system modelling and it is preferred rather than reading a text-based narrative. This

supports the finding by [10],[11] where conceptual understanding can be acquired by reducing cognitive processing.

The feedback from this experiment also included some suggestions for improving the intervention by including more complementary activities and tasks. This aligns well with the process of learning system modelling which requires both the semantics and the syntax to be understood. This step is elaborated in other work by the authors with this paper presented only the first part of the learning intervention.

VI. Conclusions

The study explored the use of 360^0 video to provide an enhancement compared to traditional teaching delivery in ICT system modelling. By re-creating traditional case studies into virtual scenarios students were able to be immersed into the learning material resulting in learning motivation and active engagement as a first step in the conceptualization of system modelling. VR and 360^0 videos provide a learning context that can be navigated by the learner adding a supportive layer which is not accessible using traditional delivery methods. The use of visualization tools such as 360-degree video technology is cost effective, affordable and accessible and provides an integration in educational environments. The feedback from participants encourages the incorporation of additional tools to further develop skill sets in system modelling.

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