Increasing Engagement in Online Learning through Virtual Reality

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Abstract

The research paper discusses the influence of virtual reality videos on learner engagement

levels in on-demand courses. Engagement in on-demand learning translates to the duration of

time when the learners can focus their attention on the course content. In this two-cycle

action research conducted on six participants, virtual reality videos included in on-demand

courses on Collaborative Teamwork and Virtual Collaborative Teamwork were used to a)

increase engagement and b) teach empathy. Research has shown that the use of virtual reality

for video content can increase learners' ability to focus and concentrate on the course content.

The implication for theory is that immersive experience of VR scenarios allows

implementation of social constructivist approach in on-demand content and allows learners to

learn from experiences of others. Experiential learning in on-demand content can be achieved

through VR videos. The implication for practice is that chunking course content and the use

of a variety of approaches in on-demand courses, contributes to maintaining high engagement

levels.

Keywords: engagement, virtual reality, online learning, on-demand, scenario-based learning,

immersive learning.

1.   Introduction

The constantly changing landscape of higher education is growing in demand for online programmes (Lloyd et al., 2012). According to research conducted by Palvia et al., (2018) the number of online enrolments between 2016 and 2018 increased by 30% and is believed to become mainstream by 2025.

There are still many barriers to online learning: "Over 80% of faculty with no experience in online teaching or course development and one-third of all chief academic officers believe that online courses are inferior to face-to-face offerings." (Lloyd et al., 2012, p.2). The overall attitude to online learning among faculty is still negative.

A major drawback in online learning is the level of engagement, as exemplified in studies on MOOC courses conducted by Onah, Sinclair and Boyatt (2014) which showed that engagement was as low as 29% in week one of a course, while the completion rate was 11%. That issue is constantly addressed by educators and relevant instructional strategies are implemented. The major 5 strategies suggested by Hew (2016) are: (1) problem-centric learning with clear expositions, (2) instructor accessibility and passion, (3) active learning, (4) peer interaction, and (5) using helpful course resources. Also as pointed by Roblyer (2006) "the measurable impact on students' learning depends on the way educational technology is used and the conditions under which it is implemented" (Salazar, 2010, p.2). It is crucial to use the right tools and strategies in the right context; technology should enhance learning experience and improve the outcome.

Increasing learner engagement in an online learning environment has been a key point for debates and research for decades, as engagement is strictly related to student retention and successful course completion. There are many variables that contribute to low engagement, the main points being the feeling of isolation (Joyce & Brown, 2009) and the feeling of disconnection, as well as overall low satisfaction related to lack of immediate response

(Slagter Van Tryon & Bishop, 2009). It is argued that for the engagement and satisfaction to be high, online programmes need to mirror on-campus experience (Schaeffer & Konetes, 2010). Immersion seems to be the key to engagement growth. With the use of current technologies, the educationalists attempt to utilize mobile technologies and apply them to increase engagement with the consideration for individual factors, task factors and environmental factors (Carroll et al., 2019). There is a more personalized and learner-centred approach; the learner can make choices, they think critically and become involved in the online learning process.

Gamification has been increasingly used in online learning as means of increasing learner engagement, it is perceived as a key factor to revolutionising online learning and a solution to an enduring issue of low motivation (Zainuddin et al., 2020). One of the most recent emerging technologies used in online education is more widely available Virtual Reality, which is seen as an integral part of gamification. In their successful research conducted in 2018, Coyne et al., described an effective implementation of VR in online team-based learning. The purpose was to measure the level of engagement and as many as 94% of pharmacy students expressed their satisfaction with the activity involving VR and expressed interest in enrolling on a similar course in the future (Coyne et al., 2018). It is evident that integration of innovative technologies into learning design brought a fresh approach to learning that was alluring for the students. The engagement levels increased because of experiencing positive emotions and excitement because of a greater feeling of presence. Virtual reality is a 'promising methods' that could contribute to motivation increase (Mystakidis, 2020).

The goal of the literature review is to analyse the use and effectiveness of virtual reality in various disciplines, including education, and how it can be incorporated to on-demand content to develop an engaging online course.

2. Literature Review

2.1 The use of virtual reality

2.1.1 Basic definition of VR

There are many definitions of virtual reality (VR) and they have been evolving over the years along with the progression of technological inventions. However, for the purposes of this paper, virtual reality can be defined an immersive experience of increased social presence and presence in general in an online world, VR allows a user to see gestures, experience emotions and feel like they are physically present in the actual place they are visiting virtually (Greengard, 2019). In the past decade, the VR experience has become more widely available with the use of affordable VR goggles that can be connected to a PC or used with a mobile phone.

2.1.2 VR timeline

The design and use of VR hardware has been evolving over the decades. In the 1960s VR was used as a multi-sensory stimulator with no interaction, in the 1970s the users were able to see silhouettes and interact with each other, in the 1980s VR provided a simulation of environment with graphic design and VR goggles were made commercially available, in 1990s artificial objects could have been overlaid on reality, which gave rise to augmented reality (Mazyruk & Gervautz, 1999). In the 2000s and 2010s, virtual reality has evolved significantly and has been used in a variety of fields; visualisations in gaming and entertainment, graphic design technological and architectural visualizations, or simulations of surgeries (Portman et al., 2015). With the rapid growth of technological innovation, the use of virtual reality drastically in the decades to come: "According to futurists, virtual reality is set

to become completely realistic by 2030, and most people will be spending a significant amount of their time in virtual spaces." (Easy UX, 2018).

2.1.3 VR in various disciplines

The most common disciplines where virtual reality is used are:

- Marketing.

Marketing has found great benefits of virtual reality in destination marketing and promotion of holiday destination through increasing the feeling of presence, that is said to have a direct connection to emotions and intention to purchase as a result (Yung et al., 2019).

- Architecture

The biggest challenge of architectural design is dealing with complex and dynamic models and VR is said to have a potential of enhancement of current tools through visualisation, navigation and interaction with complex diagrams and structure models (Oberhauser, Sousa, Michel, 2020).

- Medicine

Virtual reality in medicine allows simulations of surgical practices that have a potential of solving many issues in nowadays healthcare system. (Keswani et al., 2020).

- Military

In the military, virtual reality found its best use in aviation and training of new pilots through flight simulations and accomplishment of complex tasks in a safe environment to increase proficiency of candidates (Dalladaku et al., 2020).

- Entertainment

In gaming, virtual reality is used to incorporate layered states of engagement: immersion, embodiment, and presence (Evans & Rzeszewski, 2020).

2.2. The use of virtual reality in education

The benefits of virtual reality have been recognised in education for its immersive qualities and opportunity to experience situations that are part of future work environment. Educational system has changed greatly over decades and there has been a greater focus on student-cantered and practical activities (Kaminska et al., 2019). Confucius' words seem to be key to successful teaching and learning: "Tell me and I will forget, show me and I may remember, involve me and I will understand." The increased feeling of presence in VR may contribute to learners feeling involved in a scenario, and that may ultimately increase their engagement and understanding of the topic (Fabrisa et al., 2019). What causes the feeling of presence is the notion that the environment seen through VR goggles is perceived as real (Freina & Ott, 2015).

This emerging technology has been successfully used in biology, chemistry, physics, psychology, or engineering (Fabrisa et al., 2019). VR help learners to visualise three dimensional concepts (Stepan et al., 2017) or allow them to interact with physical objects and provide instant feedback, for example, in surgical simulations (Maresky et al., 2019). It is worth pointing out that the wide-spread use of VR in education is still a new phenomenon, and it is not sufficient to use VR to achieve a high level of engagement, it must be well integrated in the programme design. Research has shown both positive and negative impact of VR on learning outcomes (Maresky et al., 2019; Makransky et al., 2019). As a new piece of technology, VR can be used to enhance learning activities (Hamilton et al., 2016),

however, it is crucial that the use of VR is fit for purpose to achieve a positive learning outcome (Fabrisa et al., 2016).

3.   Research Methods and Methodologies

3.1 Context and rationale for research

One of the main instructional design goals was to create content that was engaging for the learners. The choice of the topic was directed by keen interest in instructional design of online programmes with the use of latest technologies that could enhance learning processes and could contribute to more effective knowledge acquisition as well as increase in learner engagement levels.

There is a strong link between the use of VR multimedia and learners' ability to emotionally connect with the programme content to fully experience the lesson that is being delivered (Bertrand, 2018). Virtual Reality also allows learners to experience learning with the use of multiple senses (Burdea et al., 2014). The use of cognitive load theory in elearning, allows learners a more effective acquisition of knowledge (Clarke & Mayer, 2008), that contributes to long memory retention (Sweller, 1988; Sweller, 2005). It is important that VR multimedia is used in activities where the main aim is observation, and the focus is on visuals to avoid cognitive overload.

There has been little research conducted on the use of VR in online learning and the effects of VR on learners' capacity to acquire knowledge more effectively (Huang et al., 2010). There is yet much to be explored to discover a full potential of VR in online learning, how it can be best applied in instructional design, what types of learning context it is suitable to be applied in and what types of learners can benefit from exposure to VR.

3.2   Aim of the research and research objectives

The purpose of the research was to evaluate the effectiveness of the use of Virtual Reality in an online learning environment to design a pedagogically valid online programme that learners would find engaging and informative while using latest technologies to enhance learning experience.

Research question:

How effective is VR in engaging learners in an online learning environment?

The downside of distance learning is working in isolation and not having direct contact with a tutor and classmates. The learning experience is impacted in a negative way, if the learners do not interact and exchange ideas, social constructivist element is significant (Croft et al., 2010). Virtual Reality increase the level of emotional connection and create the impression of physical participation in a classroom, the feeling of presence has an impact on emotional responses (Schuernie et al., 2001). Effective learning occurs when a learner experiences positive emotion (Chuah et al., 2011). VR multimedia impact online learners' ability to connect more effectively, experience positive emotion and increase student engagement (Bertrand, 2018). It also has a pivotal role in the increase of student attention and knowledge acquisition (Slavova & Mu, 2018).

The objective of the research was to evaluate the impact of authentic experience in online learning and its positive effects on engagement levels and learning outcomes as a result.

3.3.   Research design

The research approach taken was interpretivism. Interpretivism is based on an interpretive paradigm approach that focuses on an individual and their subjective opinion on a given topic or issue, that is often based on previous experiences (Cohen et al., 2011). Nguyen and Tran

(2015) state: "The interpretive paradigm allows the researchers to view the world through perceptions and experiences of the participants" (p.24). The research data was mainly a qualitative perspective, the aim of which was to understand world's perception of an individual (Bell, 2010). The insights into perceptions and qualitive data showed the reasons behind statistics and allowed analysis on a deeper level. Learning the reasons for low engagement levels in a specific context helped to implement improvements.

3.4   Theoretical perspective

Initial stage of research commenced with beliefs of an individual or a group and their theories known as ontologies. Their belief is their ontology of a concept and different groups of people can have different ontologies about the same concept (Brabazon, 2017). Beliefs are shaped by experience and knowledge that individuals gain throughout their lives and that is their epistemology (Brabazon, 2017). Both ontology and epistemology are connected as every research process that leads to knowledge starts with a belief in a concept or a hypothesis. Ontological perception of concepts is subjected by participants background (Cousin, 2009).

The hypothesis in this research was that the use of virtual reality in online education allowed learners a more authentic experience of VLE and provided an opportunity for instructional designers to introduce active learning activities that increase learner engagement. Participants of the research might have different ontologies on VR. The research findings could be determined by ontological beliefs of the participants, whose backgrounds might be varied. The participants might be sharing common ontologies on the use of virtual reality in education and those ontologies might impact the engagement level in a programme where VR was introduced. The ontologies might change, however, as a result of exposure to new

experience and the participants might form epistemological views as a result of acquiring new knowledge on VR.

3.5   Methodology

The approach taken to conduct the research was a two cycle Action Research conducted on a group of six participants. The same participants partook in both cycles.

Cycle 1: Online course with the use of VR on the topic of Collaborative Teamwork

Cycle 2: Online course with the improved use of VR on the topic of Virtual Collaborative Teamwork

The reason for methodology choice was the need of improvement of practices in online learning and change implementation, introduction of active learning with the use of VR to increase engagement. The purpose of the research that action research would help to achieve was "to arrive at recommendations for good practice that will tackle a problem or enhance the performance of the organization and individuals through changes to the rules and procedures within which they operate" (Denscombe, 2010, p.12).

The action research was guided by McNiff (2002) eight-stage model.

(1)   Revision of current procedures and practices

(2)   Identification of procedure that requires improvement

(3)   Decision how to progress

(4)   Implementation of the procedure

(5)   Monitoring

(6)   Modification

(7)   Evaluation of modified action

(8)   Repetition of the cycle until desired outcomes are achieved

The issue that was being investigated was low engagement level of online students. Virtual reality videos were used to improve engagement levels. The implementation of online courses with the use of VR commenced with needs analysis and a questionnaire on participants' experience and attitude towards VR as well as their previous experience with online courses. The aim of the questionnaire was to analyse participants' perceptions prior to research commencement. Monitoring was conducted via analytics, while modification and evaluation of the course was informed by participant feedback.

The full Action Research cycle set up by Tripp (2003) outlines "reconnaissance, planning, acting, researching action, evaluating action" (Cohen et al., 2011).

Figure 1.1 The full action research cycle.

Source: Tripp, D. 2003. Action Inquiry. Action Research e-Reports 017.

http://www.2.fhs.usyd.edu.au/arow/arer/017.

Tripp's model was blended into McNiff's model and evaluation stage was followed by a reflection on actions taken in the delivery of the course, production of qualitative data for analysis and analysis of data and student's perceptions and experiences of emotions associated with participation in VR videos.

3.6   Methods

The chosen research methods of gathering data were the following:

3.6.1   Survey

There was a post-survey for each cycle of the research conducted in a questionnaire format to determine participants experience with VR. Prior to first cycle, the participants were asked to complete a pre-course survey. As per ethical requirements, the participants were made fully aware of the purpose of the survey (Bell, 2010). The survey was based on four considerations suggested by Sapsford (1999); problem definition, sample selection, design of measurements and concern for participants (Cohen et al., 2011).

3.6.2   Interview

Structured and open-ended question interviews were conducted with participants at the end of each research cycle. Moser and Kelton (1971) defined an interview as a conversation between interviewer and respondent, the purpose of which is to elicit information. The interview allowed the interviewer to determine feelings behind the responses and participants attitude

towards a concept that was being investigated (Bell, 2010). The interview was conducted via video conferencing tool.

4. Research Project Artefact

The artefact was an on-demand short course in human resource management. The course consisted of two lessons, one lesson for each cycle of the research:

Cycle 1: Collaborative Teamwork

Cycle 2: Virtual Collaborative Teamwork

4.1   Secondary research informed artefact needs analysis

According to study conducted by Estes and Wang in 2008, one of the most common workplace issues that affects performance is incivility and lack of respect. According to Estes and Wang (2008) there was little understanding of the phenomenon at the time of the research. Further study conducted by Cho et al. (2016) states that working in an unhealthy workplace leads to emotional exhaustion and low performance levels. Ramzy et al. (2018) state that dysfunctional workplace behaviour may have even more serious implications, that may affect not only on employee performance, but their mental health that may lead to depression or suicidal thoughts.

The work environment is often dictated by group dynamics and conflicts that arise because of poor dynamics. The key to a healthy and collaborative team and a conflict free workplace may be the three key variables of the Team Conflict Dynamics Model; psychological safety, conflict management process and team performance (O'Neill et al., 2017). Psychological

safety allows employees to openly express their ideas and though without the fear of being ridiculed, mocked, or destructively criticised.

Companies make significant investments in training that improve employees' mental health and wellbeing; however, the source of poor mental health can also be the environment itself, therefore there is a clear training need for how to be a better collaborator and a better team player. It is healthy workplace that makes healthy employees.

4.2   Literature informed instructional design of the artefact

The initial efforts to increase engagement in online learning will employ a wide variety of interactions, including virtual reality multimedia, to make a comparison between the level of engagement for each type of interaction. Another reason for introducing a variety of interactions is to trigger active learning in online environment by requiring the learners to interact with the on-demand course (Shan, 2019). Frequent need to interact with the course content and a variety of interactions that include knowledge checks, will require active participation, and may result in increased engagement. The cognitive processes might be more likely to be activated when exposed to different interactions. It is vital though to avoid cognitive overload by focusing on one type of interaction at a time. The course content needs to be 'chunked' into microlearning content to avoid cognitive overload and allow participants to engage with one concept at a time and have a visual mind map of the content and to make meaningful connections between various sections of the course (Zheng, 2018).

The meaningful connections can be made by taking the participant on a journey and designing a course that explains the topic through step-by-step process of scaffolding information. Scaffolding allows the participants to understand their learning journey by gradual increase of their autonomy and ultimately their ability to reach meaningful conclusions through critical analysis of concepts and situations (Salmon, 2013).

Learning content that allows participants to construct their own understanding through critical analysis of a situation, gives them an ability to analyse various other similar situations that they encounter in a practical setting. Designing scenario-based courses allows analysis of practical situations and application of theoretical content of the course, the social context where the learning is likely to occur motivates the learners to engage with the content (Hartley, 2000). Reflective activities on the scenarios promote metacognition, participants have an opportunity to demonstrate understanding of a connection between theoretical content and practical setting, construct new knowledge and possible change pre-existing schemas. Designing scenarios with the use of virtual reality creates a more immersive experience for the learners and allows them to empathise with the characters of the scenario or experience emotions associated with being in a certain scenario. The learners construct knowledge through experiences; therefore, the use of VR allows an implementation of social constructivist approach (Madathil et al., 2017).

4.3 The ADDIE model for instructional design

The design of the artefact was based on the ADDIE instructional design model, analysis design, development, implementation, and evaluation. It is a comprehensive model that allows an in-depth analysis of all stages (Peterson, 2003).

4.3.1 Analysis

The first stage, analysis, may have been the most time-consuming stage of the process as most fundamental decisions were made at that stage. To make the right choices, thorough research was required. Fundamental decisions included the needs analysis of what training is required in work environment to assure healthy functioning workplace and effective collaboration between employees. Afterwards, it was important to identify the persona the

course is being designed for, employee or manager. As much as every employee is responsible for creating a healthy workplace, it is their manager who is facilitating meetings and has the power to control behaviours and take actions when needed. The final step of that stage was to draft an action plan for project progression and completion.

4.3.2   Design

The design stage included identification of learning objectives, identification of learning plan, and identification of both technical resources and academic resources for content writing.

4.3.2.1 Objectives:

The objectives of the course were based on needs analysis, the main areas that needed improvement and steps that needed to be taken to educate learners or increase learners' awareness.

4.3.2.2 Identification of academic resources:

Academic resources and research paper in collaborative teamwork were identified for script production.

4.3.2.3 Identification of technical resources:

Technical resources needed to produce the artefact included:

  a. E-authoring tool. The tool selected was Articulate 360 for its default accessibility settings and ease of use and navigation.
  b. Video editor. The tools selected was Camtasia, it has a variety of features that allow production of e-learning videos and animations and is has a low level of complexity in terms of navigation and ease of use.

    c. VR goggles. The googles selected were VR goggles compatible with smartphones that the participants could use with their phones. These goggles are affordable and straightforward to use.

    d. VR camera. The camera selected for the purpose of recording person to camera VR videos and scenarios was Insta One 180 degree. The benefit of 180 degree in this learning context is that the participants can only see what is relevant to the learning content, however, they can still feel like they are in each scenario. The aim of the VR video is for the participant to empathise with the characters and focus their attention on the interactions between the characters in the VR video.

4.3.3 Development

Storyboard and script: The next step was the production of a storyboard. At the initial stage, the storyboard was a mind map of the concepts that need to be included to meet learning objectives. The mind map was then converted into an outline of the script with initial indication to types of interaction for each part of the script.

On-demand content: In the development stage, the on-demand content was created with the use of software and hardware mentioned above. As the content was produced in a home setting during COVID-19 outbreak, appropriate audio and lightning turned out to be a challenge and impacted the quality of the person to camera videos.

Figure 1.2 Snapshot of an initial version of a storyboard of artefact 1.

4.3.4 Implementation

The research test group consisted of six participants. The participants received a pair of VR goggles and a pre-course questionnaire prior to receiving access to the 35 minute on-demand course on Collaborative Teamwork. The course content in cycle 1 was a mix of interactions that included VR videos, person-to-camera videos, animations, click and reveal interactions and knowledge checks drag and drop activities or open text entry reflective activities.
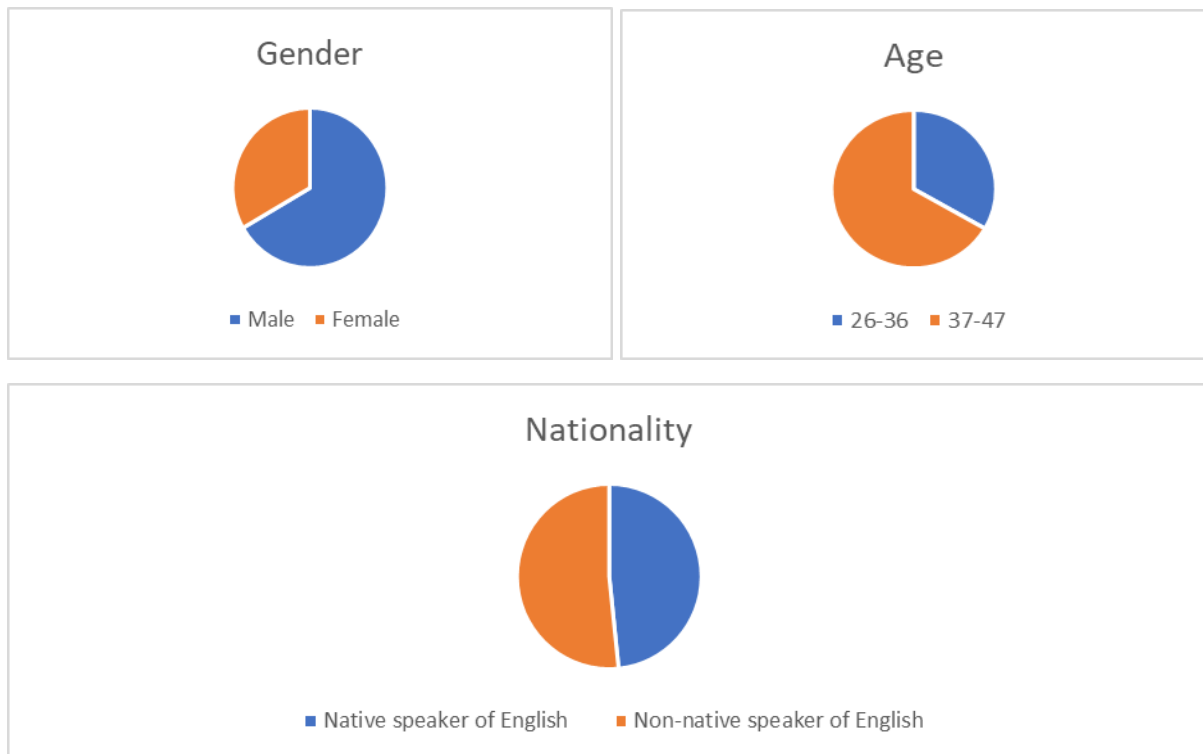
4.3.5 Evaluation

After completing the course, the participants shared their feedback in a post-course questionnaire and attended a live interview. Detailed finding will be described in the next section. Overall, some participants had technical issues with the goggles in cycle 1 and as a result did not use the goggles for the full duration of the videos. However, the participants admitted that wearing the VR goggles limited distractions and increased their ability to focus. Most participants suggested using a higher ratio of VR videos in the following cycles.

5. Research Findings

5.1 Participant profile

Total number of research participants	6 participants

Gender — Male, Female

Age — 26-36, 37-47

Nationality — Native speaker of English, Non-native speaker of English

The research participants were six professionals working across various areas. All participants were required to work online. All six participants had a positive attitude towards the use of technology in education and agreed that it could enhance the learning process, what suggested that they were open to the use of new technology. Some of the benefits of the use of technology in education that the participants mentioned were addressing learner needs and preferences (Participant Five), as well as moving away from rigid timetables and allowing more flexibility in an on-demand format (Participant Six). The participants had varied experience with online learning and VR. However, all participants have attended online courses in the past, therefore have a basic understanding of online learning platforms and formats of delivery.

5.2 Prior experience with online courses

As virtual reality was used in an online, on-demand context, it was important to determine participants' prior experiences with online learning and overall attitudes towards online

learning environment. Prior experience may determine motivation level and overall attitude to complete similar type of courses.

	P1	P2	P2	P4	P4	P6
Prior experience with online learning	yes	Yes	Yes	yes	yes	yes
Type of prior online learning format	live online	live online and on-demand	live online and on-demand	live online and on-demand	on-demand	on-demand
Satisfaction with prior online learning	average	excellent	Good	average	good	good
Attitude towards online learning	mixed	Mixed	Mixed	negative	positive	positive

Participant One had a rather negative experience with live online classes delivered because of COVID-19 outbreak. Participant One felt that online classes could be effective, if they were specifically designed for online delivery. Participant Two felt that social interaction was better in 'live' class. Both Participant Two and Six felt that online classes allow a better flexibility compared to traditional deliveries. Participant Four found online courses 'distracting' and 'dispersive', they felt they learned best when working on a group project. Participant Three saw flexibility of access as a benefit, however, felt that on-demand content was more suitable for shorter courses. As some participants had negative experiences in the past or were strongly opinionated about a particular idea, it was more challenging to change their schemas. Those participants would already have a negative attitude towards on-demand courses and that would impact their motivation levels. Prior experience with the use of VR was also a factor in achieving desired outcomes. Participants who have not used VR were more likely to experience frustration associated with the use of new technology.

5.3 Prior experience with VR

	P1	P2	P3	P4	P5	P6
Prior experience with VR	yes	No	Yes	No	No	no
Prior experience of VR in education	no	No	No	No	No	no

None of the participants have experienced the use of VR in education. However, prior to taking the course, all participants agreed that virtual reality has a potential and should be research further. While the use of virtual reality in education specifically could enhance the learning process. That would depend on the quality of content and the profile of the learner. Participant One has indicated that in their opinion, VR in education might be more appealing to young males interested in gaming. Participant Three saw a potential in VR and believed that it could make learners feel less isolated in an online setting. The overall attitude towards VR was positive and the novelty of the tool may have been an additional motivating factor for the participants who had poor prior experience with online learning.

5.4 Interest in the topic

As much as prior experience with delivery modes and technology are important factors, engagement levels also depend on participants interest in the topic. The more relevant the topic to professional practice, the higher the level of intrinsic motivation, the higher engagement.

Discussion	P1	P2	P3	P4	P5	P6
Relevance of collaborative teamwork to professional practice.	Worked as part of a team but preferred to work independently.	Worked as part of a team and preferred teamwork to	Worked independently for 80% of the time. Preferred teamwork.	Worked as part of a team as a team lead. Preferred teamwork	Worked independently for vast majority of the time. Preferred to	Worked as part of a team in a managerial role. Preferred

		independent work.		to independent work.	work independently.	teamwork to independent work.
Self-assessment of teamworking skills. From 'very good' to 'very bad'.	Good	Good	Good	Good	Good	Good

Participants who worked as part of a team may have found the course more relevant, particularly the participants in managerial roles. The participants with keen interest in teamwork may have been interested in the topic, however, may have not found the topic relevant to their professional practice. Their level of interest may have been impacted as a result. The final group of participants who preferred individual work were most likely to disengage and loose interest in the course as it was not aligned with their preferences. At the same time, the participants with least experience in teamwork may have benefitted from being exposed to various perspectives on effective team collaboration, their preferences may have been a result of prior negative teamwork experience.

5.5 Cycle 1: Collaborative Teamwork course

In cycle 1 the participants completed a 35 minute on-demand course on Collaborative Teamwork. The course consisted of a variety of interactions that included person to camera videos, VR scenarios, animations, click and reveal text interactions and reflection focused knowledge checks. The ratio of VR content versus other interaction was low in this cycle. VR scenario presented a workplace conflict. The aim of the video scenarios was to teach empathy and present conflict from different perspectives, while the purpose of VR was to enhance that experience.
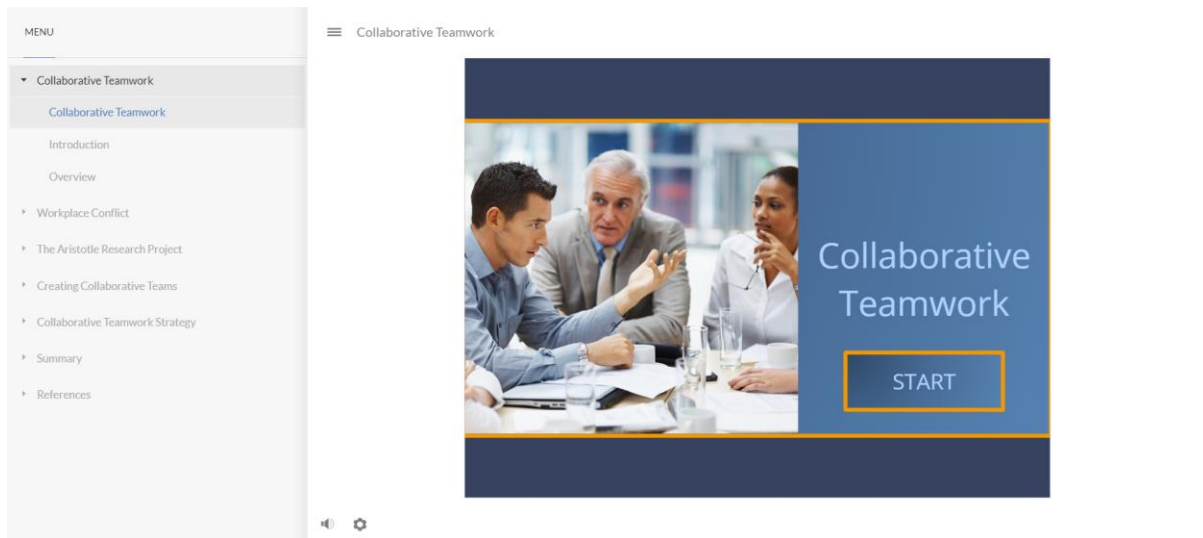
Figure 1.3 Snapshot of artefact 1.

5.5.1 Cycle 1 findings

Discussion	P1	P2	P3	P4	P5	P6
Positive Aspects of VR	Uniqueness of the choice of interaction. The use of VR goggles increased the ability to focus on the scenario.	VR helped to understand different perspectives of the characters' points of view through immersive experience. Increased ability to empathise with the characters.	Found the scenarios engaging. Novelty of the interaction.	The choice of the scenario. Increased ability to focus.	Increased feeling of presence and increased engagement.	Immersive experience by being 'closer' to the characters. Increased ability to focus on the content.
Negative Aspects of VR	Technical issues with using the Googles and issues with a split screen. The necessity of using the goggles only for selected interactions.	Technical issues with using the Googles and difficulties with finding appropriate mobile application.	Technical issues with using the Googles and inability to see a full screen.	Difficulties with splitting the screen and enabling VR mode. The set-up time and time to adjust the goggles.	VR picture quality affected the overall experience.	Discomfort associated with not being aware of real surroundings.

| Recommendations | Higher ratio of VR video content and less text content.

Guidance on the use of VR goggles. | Separation of VR video content from other content.

More video content and less text content.

More instructions on how to use VR. | More VR video content.

More scenarios. | More video content in VR mode.

Assistance with enabling a split screen. | Shorter course content.

Less theoretical content.

More video content and less knowledge checks. | The use of VR for content that includes 3D simulations or geographical content.

Using headphones enhances the experience.

More click and reveal text interactions. |
|---|---|---|---|---|---|---|

5.5.2 Positive impact on engagement

The use of VR limited external distractions and increased the ability to focus as a result. The increased ability to focus and concentrate might have had a direct impact on the level of engagement. Increased ability to focus attention on the learning content may have improved the ability to process information more effectively. VR used for scenario content allowed an increased feeling of presence and immersion, those may have also contributed to the ability to focus and increased engagement. VR also allowed Participant Two to empathise with the characters and experience emotions associated with the content of the scenario. Experiencing emotions may have also been a factor in increased engagement levels.

5.5.3 Issues for consideration

All participants experienced technical difficulties with the use of VR, even participants who indicated that they have prior experience with the use of VR. The VR mode needed to be enabled on learner's mobile device either on the device directly or via application, that depended on the device they were using. The learners would have had a better experience with an instant technical support or instructions suitable for the device they were using,

which would not be a scalable solution for many participants using a variety of VR goggles and mobile phones.

5.5.4 Actions on improvements

Prior to the course completion, the participants received a more detailed instructions on how to use VR goggles and were offered technical support via email or chat. Cycle 2 content had more straightforward and commonly used navigation options in a format of a video playlist with a menu. The entire content was recorded in a VR format to provide an option to participate in a more immersive learning environment. The course was shorter in duration, there was less theoretical content and more video scenarios. The videos were short in duration to allowed for microlearning and grouping of related content (Zheng, 2018). The scenarios were followed by reflections on issues to allow autonomous thinking and individual knowledge creation (Madathil et al., 2017).

5.6 Cycle 2: Virtual Collaborative Teamwork course

Total number of research participants	4 participants

Nationality

■ Native speaker of English ■ Non-native speaker of English
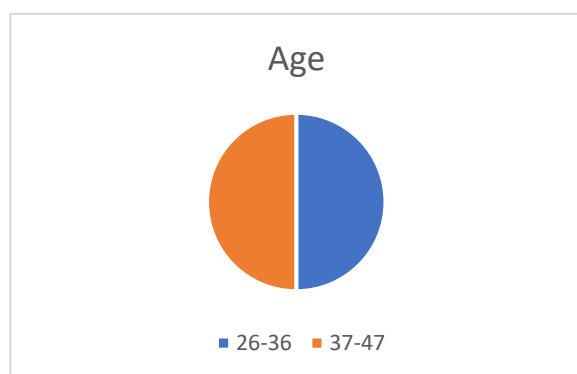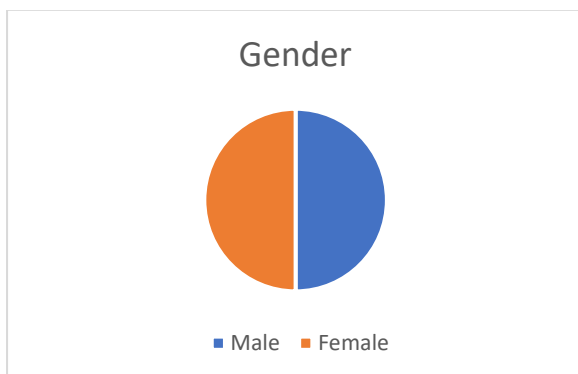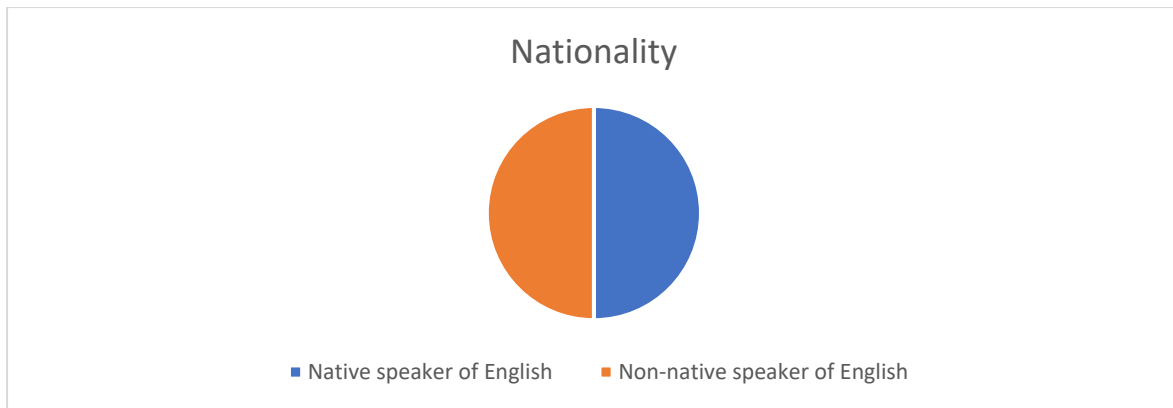
Four out of six participants continued in cycle 2 and completed a 19-minute course on Virtual Collaborative Teamwork presented in a VR video playlist format. The purpose of the course was to increase awareness of good practices that enhance virtual collaboration, reflect on practices presented in a scenario and design strategies for inclusive and effective virtual collaborative environment. The purpose of VR in the person to camera content was to increase engagement by increasing the feeling of immersion and decreasing the feeling of online isolation (Joyce & Brown, 2009). The purpose of VR in the scenario content was to increase the feeling of presence and teach empathy towards individual characters presented in the scenarios.
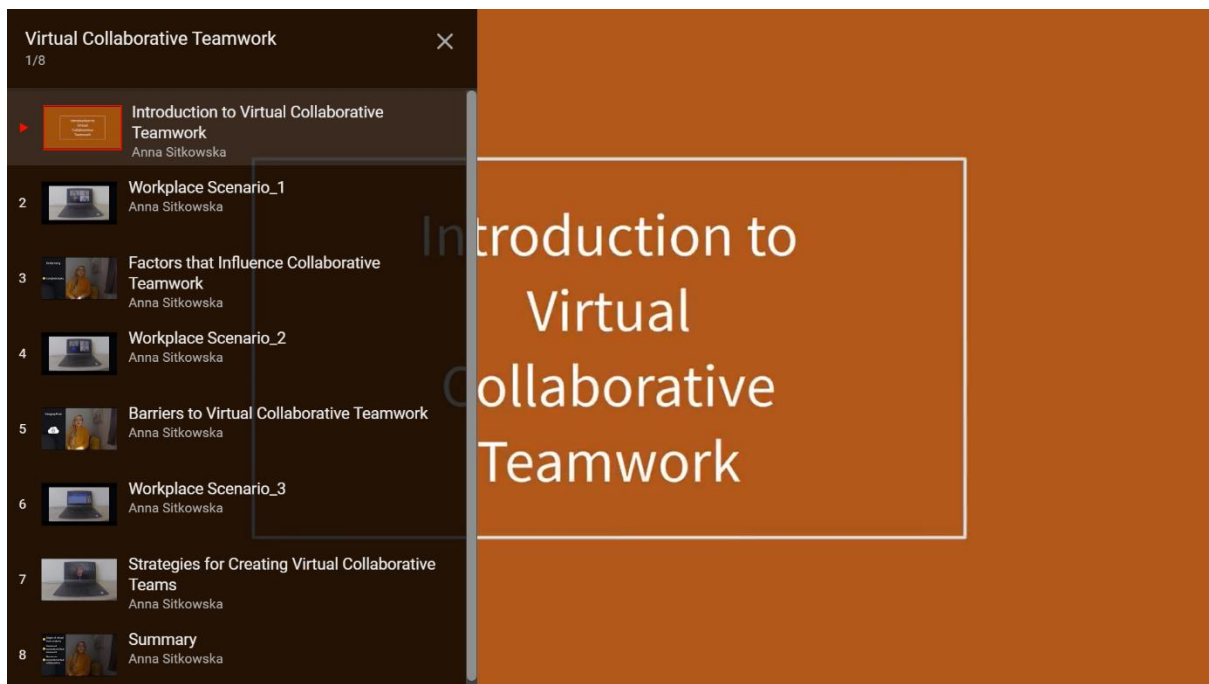
Figure 1.4 Snapshot of artefact 2.

5.6.1 Cycle 2 findings

Discussion	P3	P4	P5	P6
Positive Aspects of VR	Enjoyed the experience. There were no technical issues in the second cycle. Greater feeling of immersion. Lesser feeling of distance. Improved ability to focus on the scenarios.	The experience was very good. The course was more engaging with the use of VR goggles. The use of VR goggles increased the feeling of presence and the content was relatable. Happy with the instructions on the use of VR. Limited external distractions. Very high impact on the ability to focus.	Good VR experience. Decrease in distractions because of using VR goggles.	Good experience. There were no technical issues in the second cycle. Found the experience extremely engaging. Liked being engrossed in the situation. Found the course engaging and the content of high quality the use of VR increased the ability to focus.
Negative Aspects of VR	Sore eyes towards the end of the course.	Found the goggles a bit bulky and uncomfortable to wear for an extended period.	Slight discomfort at the end of the course because of wearing goggles for too long.	Not being aware of surroundings while wearing goggles.

Recommendations	Removing text section from the person to camera VR video content. The participant found the text distracting.	More variety of approaches in the video content.	Adding multiple choice questions as part of the VR course. Shorter course content and shorter time for reflection activities. Using a wider range of interaction types.	Using VR for content that focuses on visuals and visualizations.

5.6.2 Positive impact on engagement

Provision of detailed instructions on the use of VR and resolution of technical issues improved participants' experience significantly and allowed a greater feeling of immersion and presence. To assure positive and desired outcomes, instructions need to be specific for the context and the technical abilities of the participants. Remote support constitutes a challenge; however, it can be provided with the use of video walkthrough or written instruction enhanced with screenshots. Similarly, to the first cycle, the use of VR increased participants' ability to focus on the content, and even helped them to be 'engrossed' in the scenarios (Participant Six). Increased attention equals increased engagement levels.

5.6.3 Issues for consideration

There was still an issues of hardware limitations; quality of picture, size of googles and impact on eyesight for those who were wearing glasses. Chunking content and allowing learners to engage in alternative activities, for example knowledge checks, might have reduced the VR fatigue. The potential for using VR googles is great and the experience might have been more realistic and more powerful, if the recording was made in 360 degree, as opposed to 180 and if the recording was made in an actual classroom or an auditorium during a lecture. There is a lot of potential of VR for visualisations of models or surroundings that

require analysis, which was not relevant for this topic as VR was used to increase the feeling of presence and the feeling of empathy towards scenario characters.

5.6.4 Suggestions on improvement

The participants had individual preferences for content presentation and delivery. What one participant saw as a distraction and an obstacle to their learning, the other participant perceived as beneficial and helpful in content comprehension. For example, key points and concepts that were included in the VR person to camera video, variety of interactions or duration of the course. The reason for the conflicting comments might have been participants' varied perception of cognitive load resulting from varied level of experience (Zheng, 2018).

6. Discussion and Conclusion

There are many variables that assure increased engagement in online learning. Motivation and engagement motives can be different for every student as per Self-Determination Theory (Ryan & Deci, 2017). Selecting a group of students who have common needs or common goals might be a solution to that issue. The learners should also have interest in the topic as that may impact their engagement level, while the use of VR can enhance their experience. The implication for practice is to assure success of the use of VR, it is important to assume that the learners need technical support and provide detailed instructions on step-by-step VR mode enablement. Frustration related with inability to use VR can result in lower engagement level. The frustration can be also caused due to VR fatigue resulted from prolonged use. The research has shown that chunking content and introducing a variety of approaches and interactions can help to increase and maintain high engagement level throughout the course.

VR can be used in a variety of topics to enhance learning experience, content that is being taught determines suitability for the use of VR. For example, in medical demonstrations of surgeries, visualisation of internal organs, visualisation of architectural or engineering constructions, or a variety of scenarios. It would be also worth to do research on the effectiveness of VR in hybrid mode of delivery to assure a higher level of immersion of online learners. The research has shown that the closer the content to real life experiences, the more interesting to the learner. Using realia and authentic material in course creation may increase motivation and engagement levels. Using VR to produce an authentic course content in an authentic setting would be an invaluable experience for the learner, and the recommendation from this research is to explore that concept further.

Curriculum designers need to carefully consider the learning context prior to the design and development of their courses. The course design and choice of delivery methods need to be fit for purpose. As any other learning tool, VR can be either a success or a failure depending on the way it has been implemented. Also, learners have varied preferences and learn differently, therefore, the impact of VR on learning may vary depending on a learner and learner profile. Overall, the curriculum design choices should be pedagogy-led and technology-enhanced.

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