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Situated Immersive Gaming Environments for Irish Language Learning

Naoise Collins
*Technological University Dublin*

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Situated Immersive Gaming Environments for Irish Language Learning

by

Naoise Collins

Submitted to the School of Arts and Tourism in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

at the

TECHNOLOGICAL UNIVERSITY DUBLIN

January 2021

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Abstract

In this thesis, three cycles of design based research are outlined, implementing a situated immersive virtual reality game for Irish language learning. It was undertaken in order to investigate a potential technological solution to improve the limited number of daily Irish adult speakers in Ireland, 3%. It examines the intersection between game based learning, Irish language learning and virtual reality technology and the methodological approach undertaken follows a design based research paradigm. The research focus is on motivation and anxiety through interaction with a virtual reality game.

It offers several contributions to current literature including: The utilisation of the Second Language (L2) self-system system of motivation within a design based research methodological approach. The study disseminates the results of three cycles of a design based research experiment. It found an increase in vocabulary retention, reduction in anxiety towards Irish and a significant increase in attitudes towards learning Irish. It also highlights learner’s experience of a immersive situated game to learn Irish.

The first case study was conducted with 7 participants from TU Dublin’s game design programme. This was a pilot study which confirmed the questionnaires and game design direction of the thesis moving forward. The results led to a redesign of the game following quantitative and qualitative feedback from participants.

The second case study was conducted with 13 participants from TU Dublin’s Irish language classes. There were no statistically significant results found, however, there was a large reduction in the mean for Irish language anxiety and Irish language self confidence in participants after engaging with the virtual reality game. The results led to a redesign of the game following the quantitative and qualitative feedback from participants.

In the third case study there were 10 participants from Marino Institute of Education. Statistically significant results were found with a 21% increase in vocabulary retention alongside a decrease in Irish language anxiety and an increase in attitudes towards
learning Irish. Focus groups of the participants are explored through thematic analysis in order to corroborate the quantitative data. Participants validated the quantitative analysis and illustrated how the design of the VR game aided their motivation and vocabulary retention.

The thesis concludes by providing a summary of the research questions and the results obtained and gives game design recommendations for future immersive situated games for Irish language learning.
Declaration

I certify that this thesis which I now submit for the award of PhD, is entirely my own work and has not been taken from the work of others, save and to the extent that such work has been cited and acknowledged within the text of my work.

This thesis was prepared according to the regulations for graduate study by research of the Technological University Dublin and has not been submitted in whole or in part for another award in any other third level institution.

The work reported on in this thesis conforms to the principles and requirements of the TU Dublin’s guidelines for ethics in research.

________________________________________________________________________
Naoise Collins                                           Date
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Firstly, I would like to express my sincere gratitude to my advisor Brian Vaughan, Ph.D for the continuous support of my Ph.D study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Ph.D study.

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Glossary

**Flow** The mental state in which a person performing an activity is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity. 63–68, 74, 188–191, 195, 200

**Gaelscoil** Primary schools in Ireland where the language of instruction is Irish. 21, 50

**Gaeltacht** Any region of Ireland where the Irish language is the primary spoken language of the region. 49–51, 99, 102, 103, 119, 183, 184, 186, 199, 210


**Game Based Learning** Games created for learning. 30, 68–70, 86, 87

**Gamification** the application of typical elements of game playing (e.g. point scoring, competition with others, rules of play) to other areas of activity. 22

**Ideal L2 Self** The ideal L2 self is an image of oneself as a proficient L2 speaker. 42, 123, 126, 127, 130, 131, 134, 140, 142, 144–147, 150, 165–167, 171–175, 207–209

**Immersion** Transportation to a virtual environment, a player’s involvement within a virtual environment, technical aspects of an immersive device. 56, 62, 63, 65–68, 79, 81, 115, 121, 138, 156, 159, 188, 195, 212
**Minority Language** A minority language is a language spoken by a minority of the population of a territory. 20, 49, 52, 53, 102, 184, 185

**Motivation** a reason for acting or behaving in a particular way. ii, 20, 22, 23, 26, 27, 37–43, 45, 46, 49, 62, 74, 75, 99, 110, 123, 131, 133, 141, 142, 146, 153, 164, 165, 173, 179, 180, 183, 185, 189–193, 198, 212, 213

**New Speaker** The experience of multilingual individuals who adopt and use a language of which they are not native speakers. 47, 52

**Oculus Rift** Head mounted display for virtual reality. 21, 23, 79, 80, 86, 100, 115, 169, 175, 194, 195

**Ought to L2 Self** Ought-to L2 self is comprised of beliefs a person has about what is expected of us and avoidance of negative outcome. 42, 123, 124, 165, 166

**Presence** Psychological state subjective to each individual’s perception where even though the individual knows an experience is being created by technological factors their senses are tricks into perceiving the environment as real. 64, 79–85, 87, 97, 100, 101, 110, 120, 122, 125, 128, 133, 135, 139, 144, 147, 156, 161, 163, 170, 174, 175, 189, 193–195, 203, 208, 209

**Prototype** Preliminary version of the game from which other forms are developed. 27, 117, 121

**Qualitative** Used to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas. 28, 96, 97, 103, 130, 131, 133, 149, 153, 155, 177, 178, 200, 203, 206–208, 211, 213

**Quantitative** Used to quantify the problem by way of generating numerical data or data that can be transformed into usable statistics. 28, 96, 97, 130, 133, 149, 200, 206–208

**Scaffolding** Support given to a learner throughout the learning process. 119, 120, 140, 141, 149, 150, 162, 164, 165, 190, 191, 197, 203
Simulator Sickness Ailment associated with prolonged VR interaction. Associated with minor feelings of nausea similar to car sickness. 85, 86, 110, 115, 123, 124, 139, 143, 147, 150, 161, 169, 174, 175

Situated meaning is derived through its context. ii, 20–24, 26–28, 46, 47, 61, 76, 78, 90, 108, 110, 111, 122, 130, 149, 151, 162, 165, 174, 179, 180, 187, 193, 195, 197, 203, 207–210, 212, 213, 216

Situated Learning Immersion in a particular social situated over time to gain skilful knowledge along with the ability to engage in the norms and practices of a socio-cultural group known as a community of practice. 22, 27, 28, 33, 34, 40, 61, 77–79, 87, 88, 91, 103, 106, 137, 152, 178, 181, 193, 206

Social Constructivism Human development is socially situated and knowledge is constructed through interaction with others. 22, 35, 69

Unity3D Game development software tool. 21, 23, 24, 31, 80

Video Game An interactive digital engaging system of rules. 21, 180

VIVE Head mounted display for virtual reality. 21, 23, 79, 80, 100, 122, 135, 138, 147, 169, 175
Acronyms

**3D** Three Dimensional. 23, 31, 71–73, 78–80, 156

**AMTB** Attitude Motivation Test Battery Questionnaire. 40

**DBR** Design Based Research. 89–91, 97, 107, 108, 116, 123, 128, 141, 175, 177, 178, 206, 211, 214, 216

**HCI** Human Computer Interaction. 91

**HMD** Head Mounted Display. 79, 80, 194, 195, 202


**NASA TLX** National Aeronautics and Space Administration Task Load Index. 98, 101, 120, 125, 128, 130, 131

**SLA** Second Language Acquisition. 46

**TBLT** Task Based Language Teaching. 44–47, 87, 137, 158, 187


**ZPD** The Zone Of Proximal Development. 35, 165
Chapter 1

Introduction

1.1 Motivation of the Thesis

This thesis examines how immersive situated virtual reality games can be used to teach Irish language skills.

It focuses on the player’s motivation and anxiety as an Irish language learner. It examines their motivation through an investigation of their anxiety in using the language, their language confidence, their attitudes towards learning Irish and their idealised view of themselves as a future Irish language learner. This is investigated through the design of situated immersive virtual reality games to measure its effect on learners.

The Irish language is a minority language within the island of Ireland with only 1.7% of speakers using it daily outside the education system (CSO, 2016). This situation creates a significant challenge for adult Irish language learners who don’t have access to a community of practice (Lave and Wenger, 1991). The latest large scale report on attitudes towards the Irish language funded by Foras na Gaeilge, Darmody and Daly (2015) found that while most people reported to have some knowledge of the language this was likely to be a passive knowledge due to it being a compulsory subject in schools. They found if Irish language learners had more opportunities and motivation to speak Irish, the level of language proficiency is likely to be much higher (Darmody and Daly, 2015). Thus it follows that Irish language
interventions are required which focus on motivating learner’s behaviour and creating opportunities to interact with the language, which in turn may improve language proficiency by focusing on opportunities to interact rather than isolating proficient behaviours over motivation.

Language is a powerful tool which facilitates thought and communication; when a learner is learning a second language they conceptualise their actions and thoughts in a new way (Gee, 2012). To become proficient, a speaker must be able to convey their thoughts accurately to be understood within the wider community of speakers (Gee, 2012). When a learner is recognised as proficient, their new language skills are embedded within the broader context of their new community.

This research involves immersing the learner in a situated environment, where learners interact inside a specific context in this case, a shop, allowing them to use their second language to carry out a number of tasks such as getting groceries and listening to conversations in the Irish language. By completing and engaging with these, the learner may become more proficient, as their experiences become embedded in practical situations and scenarios. This is a similar approach to the total immersion ideology of Gaelscoils, where the learner is immersed in the language and through this immersion becomes proficient.

This thesis uses contemporary technology and game development tools and methods, alongside Virtual Reality (VR) hardware (VIVE, Oculus Rift, Unity3D) to create VR games where the learner is completely immersed in an Irish language setting. This allows them to contextualise their thoughts and actions in Irish through the task-based situated experience the game affords them, in order to learn Irish language vocabulary.

1.2 Central Question and Aims

Games, and in particular VR technology, allows for deeper, meaningful, immersive interaction with a language (Cheng et al., 2017).

"Educators ought to pay closer attention to video games because they offer
designed experiences, in which participants learn through a grammar of doing and being” (Squire, 2006, 7).

A number of educational theories are being considered on a theoretical basis to help serve as an unpinning for design decisions involved with creating the game including social constructivism (Vygotsky, 1962), situated learning (Lave and Wenger, 1991) and task based learning (Willis, 1996). This thesis will design a virtual reality game that helps learners gauge their ability and stage of learning, as well as the material presented to them.

Language learning apps with gamification elements (Duolingo, Rosetta Stone) have become very popular in recent years. Gamification applies typical structures of games to learning activities such as, point scoring or competition as an example (Blohm and Leimeister, 2013). Language learning apps offer a language learning approach that assesses the learner’s language skills and engages the learner’s motivation through positive reward strategies (Settles and Meeder, 2016). Duolingo for example offers daily challenges and badges to reward the player for using the target language. They lack an immersive situated experience to provide challenge and context to the learner to develop their problem-solving skills. In order to address this issue commercial VR language games have begun to be developed that focus on placing the user in an authentic setting where they can apply the target language in a problem solving capacity such as Mondly VR (Mondly.com) and Immerse Me (Immerseme.com). They focus on a situated experience where learners are immersed in specific language focused activities such as ordering food. The learner interacts by attempting to pick the correct dialogue option from a drop down menu of choices. These commercial VR games are limited in the interactions they afford to learners to engage with the environment. There is no support for any minority languages such as Irish. They currently only offer support for global languages such as English and Chinese. Games research has uncovered some of the benefits of using games to teach language including Crystallize (Culbertson et al., 2016) which is a game developed to examine situated learning in an immersive environment along with the effects of collaboration on learning. Academic investigation into VR for language learning is
at a much earlier stage in terms of research (Guo et al., 2017). Early studies have been promising, they have illustrated its potential for language learning in areas such as vocabulary retention (Vazquez et al., 2018). A key issue in the development of theory for games is the knowledge, skillset and cost required to develop a game that incorporates the learning theories from the literature. Research requires games that can be developed in an agile capacity that can be altered when required based on the results of experimental designs.

While research has been carried out in the area of game based learning using Three Dimensional (3D) virtual environments (Preston et al., 2015; Ranalli, 2008; Reinders, 2012), this thesis utilises cutting-edge technology (VIVE, Oculus Rift, Unity3D) and game design methodologies used by leading game development companies that are inherently designed to create immersive, engaging situations and environments as described in the methodology in section 4.2. This thesis utilises contemporary approaches to technology as discussed in section 3.2, and the Irish language see section 2.3. It leverages contemporary Irish language synthesis technologies (Ní Chiaráin and Ní Chasaide, 2016) as part of a situated gaming environment to provide realistic Irish language speech to virtual, non-player characters, as part of an immersive environment, thus facilitating realistic virtual character interaction (see case studies for further information in section 5.1, section 6.1 and section 7.1). This thesis explores the problem space through its central research question and objectives outlined below.

**Can contemporary immersive game based tools and methods be used to develop situated language learning game environments to improve learner’s motivation and anxiety in the Irish language?**

In order for this to be achieved, this thesis has the following objectives:

1. Explore Irish learner’s motivation towards learning Irish including confidence, anxiety, attitudes towards learning and their ability to visualise themselves as a fluent speaker in the future.

2. Investigate if these motivations are affected by engaging with immersive situated virtual reality games.
3. Develop immersive situated game based language learning environments with contemporary game development tools and methodologies e.g. Unity3D and VR.

4. Define usability goals in immersive environments and design decisions to promote an intuitive experience for users.

5. Analyse Irish language vocabulary retention in situated immersive environments.

The work contains published work from the following conferences and journals:

**Conferences**


2. *Shaping Immersive Worlds: Framing Design-Based Research as a Methodology for Investigating the Development of Immersive Virtual Environments for Game-Based Learning, Irish Game-Based Learning Conference, Cork 2019* (Collins et al., 2019a)


4. *Motivation in Situated Immersive Games for Irish Language Learning a DBR Approach, European Conference Game Based Learning, Bristol 2020* (Collins et al., 2020b)
Journals


1.3 Structure of the Thesis

This thesis follows a design based research methodology which is explored in detail in chapter 4. This experimental design involves four main phases which are detailed in section 4.2. Each chapter begins by stating which phase of the design is currently being investigated. The following figure 1-1 details the four phases of the thesis. It derives from the work of (Abdallah and Wegerif, 2014) (see section 4.2).
Preliminary Phase

Preliminary Design Framework

Prototyping Phase
  First Cycle
  Second Cycle
  Third Cycle

Reflective Phase

Figure 1-1: Phases of the Design Based Research Study

The work of this thesis is contained within the following chapters:

Chapter 1: Introduction

This chapter introduces the work contained within the thesis.

Chapter 2: Educational Theory, Motivation and the Irish Language Context

This chapter reviews the literature in order to explore the previous research conducted in terms of motivational theories and the Irish language context. The purpose of this is to highlight where the research conducted is situated within the larger context of the field. A number of educational theories are considered in order to provide a pedagogical rationale for the development of the VR game followed by a discussion
on the definitions and theories of motivation under investigation. A brief history of the Irish language and the pertinent cultural aspects relevant to this research are also examined.

Chapter 3: Games, Game Based Learning and Virtual Reality

This chapter reviews the literature of games and game based learning in order to provide a foundation for the development of the VR learning game. VR technology is then discussed with an explanation of its main features and affordances. It then summarises the literature review of the previous work conducted in the field.

Chapter 4: Design Based Research

This chapter gives an explanation of the methodology utilised. Design based research methodology is highlighted and this is situated in the context of the research in order to highlight how it is being used to develop and examine a VR language learning game to answer the research questions posed. This is followed by a discussion on the mixed methodology of the research design. The experimental design and research instruments of each experiment are considered in conjunction with the ethics of the experimental design.

Chapter 5: First Case Study

This chapter examines the first case study of the thesis. One of the initial steps required in order to answer the research questions was to design a prototype of the intervention. It discusses the prototype design used to test basic functionality and implementation of the design of the VR language game with an evaluation of the questionnaires being proposed for the study.

Chapter 6: Second Case Study

This chapter investigates the second case study of the research design. The aim of the second case study was to investigate how the design of the situated learning experience
affected participants Irish language motivation. The intervention was investigated with a context group of current Irish language learners. Participants were given the opportunity to engage with a VR training exercise to learn the basics of VR. Once they completed the training exercise they engaged with the Irish language VR experience for a twenty minute period.

Chapter 7: Third Case Study

This chapter discusses the third case study of the research design. The aim of the third case study was to improve the design of the situated learning experience based on the results from the previous cycles. It highlights the potential improvements under investigation with a new context group of Irish language learners. In the third case study of the experiment participants were given three opportunities to engage with the experience over a two month period.

Chapter 8: Focus Group Analysis

This chapter discusses the qualitative feedback from participants who interacted with the situated game through focus groups in order to corroborate the quantitative results of the investigation. The qualitative feedback was analysed thematically where eight major themes emerged.

Chapter 9: Conclusion

This chapter concludes the research and summarises the work undertaken within the thesis, detailing the reasons why each aspect of the research was carried out and discusses the research questions that were asked throughout the thesis. Future work in a number of areas related to the work carried out is also considered.
Figure 1-2: Flow Diagram Of The Thesis Structure
Chapter 2

Educational Theory, Motivation and the Irish Language Context

2.1 Introduction

The following two chapters represent the preliminary phase of the thesis. This is where previous knowledge in the area of the intervention was investigated in order to inform the design of the intended intervention. This thesis is an interdisciplinary work interconnected between several fields of research. Game based learning, as a field, is interdisciplinary by its nature with quite a wide discussion about the effects
this has on the area of research (Crookall, 2010). Figure 2-1 gives an example of the multitude of disciplines involved in this thesis along with examples of how they intersect.

Figure 2-1: Diagram Of The Interdisciplinary Nature Of The Study

The creation of new contexts for learning is one of the most exciting applications of technology for education in the 21st century (Prensky, 2003). Games have been of interest to the research community since the 1980s (Malone, 1981). Researchers have examined modifiable 3D virtual worlds such as Second Life as an educational tool (Baker et al., 2009), they have utilised open source tools to create games for specific targeted learning of subject material (Dalton, 2016b) and commercial games such as the Sims have been investigated for its motivational benefits (Ranalli, 2008). Games research has been limited however by the cost of development, the specialised skill set and the human cost of development including art, design, development and testing of these immersive games, thus researchers have used commercial games for theory development to research their application for different uses (Squire, 2004). Free to use game engines like Unity3D and Unreal have dramatically cut the cost of the development of these new contexts. Using contemporary game-based programs
and methodologies it is now possible to develop immersive games capable of targeted learning interventions in an array of subject areas from the teaching of programming (Muratet et al., 2011) to developing a scientific inquiry curriculum (Nelson et al., 2013). This literature review seeks to explore the previous research carried out in this area in order to highlight where the research conducted within this thesis is positioned within the larger context of the field. Therefore, this thesis has divided the literature review into four sections of importance:

1. A number of educational theories are considered in order to provide a pedagogical rationale for the development of the VR game in section 2.2, page 34.

2. A history of the Irish language and the pertinent cultural aspects relevant to this research is outlined in section 2.3, page 48.

3. An examination of games in order to provide a foundation to the development of the VR learning game is outlined in section 3.1, page 56.

4. Finally, virtual reality technology with an explanation into its main features and uses is reviewed in section 3.2, page 80.

This chapter is focused on the educational theories that serve as the pedagogical underpinning for the designed VR game and it discusses the Irish language context in detail.
2.2 Educational theory

The major theories of learning have been broadly defined by four major fields of inquiry: behaviourism (Skinner, 1974), cognitivism (Piaget, 1953), social constructivism (Vygotsky, 1962) and situated cognitive theory (Lave and Wenger, 1991). This thesis focuses on social constructivism and situated cognitive theory as its theoretical paradigm. This section outlines the educational theories that have informed the development of the VR game.

2.2.1 Situated Cognitive Theory

Situated cognitive theory involves immersion in a particular social situation over time to gain skilful knowledge along with the ability to engage in the norms and practices of a socio-cultural group known as a community of practice also referred to as legitimate peripheral participation or situated learning (Lave and Wenger, 1991). Developing a situated VR learning game is a primary aim of this thesis, thus situated cognitive theory serves as a major pedagogical theory in the design of the VR game.

Situated cognitive theory (Lave and Wenger, 1991) has become a major branch of educational theory since the early 1990s. The concept was first introduced by Jean Lave and Etienne Wenger in their seminal paper (Lave and Wenger, 1991). According to Lave and Wenger the concept referred to as communities of practice has four main dimensions:

1. Its members are defined by their understanding of shared meaning that they continually renegotiate with each other.

2. The shared meaning and negotiation bring its members together as a social group.

3. Over time the communal resources developed by the community become a repertoire of knowledge for the community.

4. It is focused on the social engagements needed for learning to take place rather than mental processes (Smith, 2003).
Situated learning views social engagements as critical to the learning process and not a separate cognitive process. Situated designs involve embedding the learner in an experience and believing that the holistic experience of that context is critical to the learning process. Research in the area of situated learning has found that thinking is not just an abstract process, but is firmly connected to our experiences and actual situations (Lave and Wenger, 1991).

“These experiences are stored in the mind/brain not in terms of language but in something like dynamic images tied to perception both of the world and of our own bodies, internal states and feelings” (Gee, 2004, 42).

Situated learning views an individual’s activity as an act of participation in a system of practices that are constantly evolving (Cobb and Bowers, 1999). This thesis views game based learning and VR as a powerful method capable of mirroring these systems of practice. The task-based nature of games involves the player engaging with the system of social practices developed by the designer. (This is discussed in further detail in this section 3.1.2.)

Language plays an important part in a community of practice (Lave and Wenger, 1991). Language acts as a medium to experience shared meaning, understanding, and bridges the personal and societal identity of a member of a community. When speaking, the speaker contextualises their meaning and understanding with words developed by the community over time; if the speaker is recognised, and understood by the listener they become part of a social group of speakers. As a person participates in different communities of practice, experience guides their development and they develop a personal identity alongside linguistic practices which articulates this identity (Eckert, 2006). An Irish speaker saying “chuaigh muid go dtí an siopa” would be recognised as a Connacht native by their use of “chuaigh muid” rather than the standardised method “chuamar” to say we went to the shop. The speaker has developed their use of Irish by immersion in their community and can now be identified through their use of the language as a member of the Connacht community of Irish speakers. Both examples given say the same thing, and both
are recognised as the Irish Language, but the way it is said, in both examples, identify the speaker as belonging to a particular community of speakers within that language. The motivations involved in a person adopting a new language and becoming part of a new community of practice in order to promote their language development are contextualised by the community’s sociolinguistic context and the individual’s personal motivations towards their language development. This thesis examines the use of VR games to contextualise these actions into motivation for their language development while improving their cognitive language skills. The next section examines key aspects of Lev Vygotsky’s constructivist epistemology which is utilised for the game’s pedagogical design.

2.2.2 Social Constructivism

Constructivist epistemology is a theory that believes knowledge is constructed from experience and has personal meaning for the learner (Creswell, 2014). It is closely aligned to situated cognitive theory in so far as it views learning to be a socially embedded experience (Vygotsky, 1962). Social constructivism is a branch of the theory originally developed by Lev Vygotsky, who saw learning as inherently social, believing that ideas are constructed through interaction with others (Vygotsky, 1962). Vygotsky believed language was necessary in order to form knowledge, and that it is through social interaction, using language, that individuals learn (Powell and Kalina, 2001). Many of his theories have been widely adopted and repurposed for educational design, such as in the refinement and development of educational theory (Chaiklin, 2007), the development of teaching strategies (Schreiber and Valle, 2013), (Powell and Kalina, 2001) and for foreign language education (Kinginger, 2002).

His most widely known theory; The Zone Of Promixal Development (ZPD), provides a theoretical underpinning for how learning takes place (Vygotsky, 1962). The ZPD is the range of tasks that a learner can perform with the help and guidance of others but cannot yet perform independently (Vygotsky, 1962). Vygotsky saw human development intrinsically linked to the social environment of the learner, learning is viewed as a two way process of learning from, and creating social environments
These environments are viewed as a collection of the social-cultural-historical factors that people collectively develop which in turn creates what we refer to as society (Vygotsky, 1962). A learner develops their knowledge through a more competent peer who gives the learner the tools necessary for new learning through interaction in the environment (Vygotsky, 1962).

Interaction with the environment is vital to his theory of learning and is also a key element of games and VR (Squire, 2004). Games give information “just in time” (Gee, 2015b) and they offer context to players where information is received “just in time” to make use of it. They offer do-able challenges that the player can engage with when they are suitably prepared (Gee, 2015b). The player in a game operates just outside their realm of comfort where the game system acts as the facilitator allowing the player to master new learning (Gee, 2015b). Game research refers to this phenomena as the cycle of expertise (Gee, 2015b). Games can also act as the more competent learning peer in this newly created environment. Part of the philosophy of constructivist learning involves the understanding that there is no inherent structure to learning (Vygotsky, 1962). According to Vygotsky (1962) the structure of learning is inferred through context and the tasks learners engage with. This allows for dynamic and interchangeable learning.

Social activity allows the learner to have access to cognitive skills they have not fully developed yet to bridge their personal experience to the cultural-social-historical factors to deepen their understanding (Kinginger, 2002). This process is known as scaffolding, learners first succeed in performing a new function with the assistance of an experienced mentor and then internalize this function so that they can perform it unassisted (Ellis, 2000). This once more aligns with the open design of games where players can have the freedom of agency and choice in how they wish to interact with the game world and the game acts as the mentor guiding the player to an understanding of how the game world functions.

Vygotsky’s work sees the individual as central to knowledge rather than abstract concepts and facts (Vygotsky, 1962). The individual succeeds in learning by adopting the reasoning and key skills valued by their more competent peers and by imitating
them in their interactions within the social environment. The motivational need to want to belong to a particular language community of practice is central for an individual in adopting the reasoning and key skills valued by a new language community (Dörnyei, 1998).

The next section examines motivational theories and how they have been influenced by motivational and social psychologists in order to define the aspects of motivation this thesis examines.

### 2.2.3 The Evolution of Motivational Theories

While much of the theory around motivation is contested among the research community, researchers agree that motivation determines human behaviour by giving it energy and direction (Dörnyei, 1998). This section begins by illustrating a brief history of the development of motivational theories.

Motivation is researched primarily through two lenses:

1. Motivational psychologists examine human behaviour through focusing on internal factors for example drive, arousal and self appraisal.

2. Social psychologists see action as the function of the social context and an individual’s social attitudes exert a direct influence on their behaviour.

Social psychology has been highly influenced by the work of Ajzen and Fishbein who developed the Reasoned Action Theory (Ajzen and Fishbein, 1980). This theory linked behaviour and attitudes, viewing the primary determinant of an action as a person’s intention to perform the particular behaviour. The theory views this intention as a function of two basic factors:

1. The attitude towards the behaviour.

2. The social pressures to perform the behaviour.

This was developed further by Ajzen in his Theory of Planned Behaviour (Ajzen, 1991), this introduced the concept of the “perceived behavioural control”. This is the
perceived ease or difficulty of performing a behaviour primarily focusing on the values and attitudes of the individual and context towards performing this behaviour. The theory of planned behaviour has been applied to studies of the relations among beliefs, attitudes, behavioural intentions and behaviours in a variety of studies including healthcare (Conner and Norman, 2006) and politics (Pavlova and Silbereisenk, 2015).

Motivational psychologists on the other hand view motivation through the lens of expectancy value (Kormos et al., 2011). This sees motivation to perform tasks as the product of two factors:

1. The individual’s expectancy of success in a given task.
2. Value the individual attaches to success in that task.

Motivational psychologists have been influenced primarily by the work of Bernard Weiner and Albert Bandura. Weiner was a motivational psychologist who developed the attribution theory of motivation (Weiner, 1972) as a framework to explain why people do what they do. It theorises the way humans explain their own past successes and failures significantly affect their future achievement behaviour.

Bandura’s theory of self-efficacy (Zimmerman et al., 1992) on the other hand focuses on people’s sense of self-efficacy in a given domain. The theory posits that people with a low sense of self-efficacy in a domain can perceive tasks as personal threats, and focus on the obstacles of achieving a task rather than concentrating on how to perform it successfully. This leads to a higher likelihood of giving up and failing at a task. These beliefs of ones self-efficacy are indirectly related to an actual competence as they are a product of a variety of aspects including other’s opinions, feedback, evaluation, encouragement, past experiences, observing peers and information about appropriate task strategies. More recent work in the field of motivation has tried to merge these two distinct fields by combining the social psychologist viewpoint into motivational theory. One such example is self determination theory (Deci and Ryan, 1985). It is a macro theory of motivation and personality concerned with the motivation behind the choices people make without external influence. The theory sees autonomy as an innate human need,
believing there is a desire to be self-initiating and self-regulating of one’s actions. The theory evolved from studies comparing extrinsic and intrinsic factors of motivation. Intrinsic motivation factors are natural inherent drives to seek out challenges and new possibilities. There are three subtypes of intrinsic motivation (Vallerand, 1997): To learn, towards achievement and to experience stimulation.

Intrinsically motivated action or self-determination is engaging with an activity with a full sense of wanting and choosing the task. Extrinsic motivational factors are concerned with external sources that stimulate action towards a task. Extrinsic motivation is often conflated as the counterpart of intrinsic motivation but this does not have to be the case. Self determination theory divides motivation into four types: (Deci et al., 1991)

1. External regulation is the least self-determined form of extrinsic motivation. It’s motivation through rewards or threats.
2. Introjected regulation are externally imposed rules that one accepts as norms and follows.
3. Identified regulation refers to a person engaging in activity because they highly value and identify with the behaviour, and see its usefulness.
4. Integrated regulation is behaviour fully assimilated with the individual’s other values, needs and identity for example when a person decides to learn a language which is necessary for them to be able to pursue their hobbies or interests.

Self determination theory has been highly influential in the field of language learning, and the next section highlights how these theories have influenced the field. It discusses its leading theorists and explores a theoretical process orientated motivational system in order to conceptualise one’s self as an L2 speaker. L2 refers to the non-native second language of the speaker. L1 refers to the native language of the speaker.
2.2.4 Motivational Theories in Language Learning

Motivation has long been recognised as being an important factor in language learning. The work of R.C. Gardner underpins much of the direction of research for motivation in second language learning. Gardner was a social psychologist working in the bilingual context of Canada. In Canada, French and English are the official languages and have equality of status and equal rights and privileges as to their use. Gardner proposed that there are two main factors that influence L2 performance: aptitude, and motivation in learning. He formulated these factors into his Attitude Motivation Test Battery Questionnaire (AMTB) (Gardner, 1987). Gardner believed that while language aptitude accounted for individual differences in language learning achievement, motivational factors can override the aptitude effect. This effect can be observed when it is demanded by the social situation. When the social setting demands someone to master a specific L2, they usually can regardless of their aptitude (Dörnyei, 1998). As discussed in the previous section on situated learning, the social aspect is vitally important here, more so perhaps than aptitude. Gardner’s work was built on by Dörnyei, who developed his own theory of motivation inspired by Gardner’s work.

Dörnyei’s work involved the development of heuristic questionnaires and scales, data driven metrics, in order to quantify the situated process orientated nature of motivation in language learning.

Figure 2-2 demonstrates his conceptualisation of an L2 learner’s willingness to communicate in the target language. He saw language learning as a complex system of attitudes, beliefs, context and emotional states. Figure 2-2 features thirteen variables and six layers involved in the willingness for an L2 learner to speak in the target language, thus illustrating the depth and complexity of language learning.
While his work on willingness to communicate has been very well received, Dörnyei’s most well-known questionnaire is his motivational self-system questionnaire. Dörnyei’s motivational self-system is a process orientated system of motivation (Dörnyei, 2003) interested in the short and long term motivational changes in L2 language learners. A process orientated viewpoint sees motivation as being able to change from one state to another or revert to a previous state. It’s not a static way of being for an individual but something constant that is always dynamically changing due to contextual and situational factors.

He based his model on Markus and Nurius’s concept of possible selves (Markus and Nurius, 1986). Possible selves represent individual’s ideas of what they might become, what they would like to become, and what they are afraid of becoming.
(Cahill, 2016). Possible selves act as future self-guides, they reflect a dynamic, forward-pointing conception to explain how someone is moved from the present to the future. Motivation in construct involves the desire to reduce the discrepancy between one’s actual self and the projected standards of the ideal/ought selves (Ushioda and Dörnyei, 2009).

Figure 2-3 displays the structural equation model of his self system questionnaire. Each variable demonstrates a key factor in an individual’s motivation for L2 use.

![Structural Equation Model Of Motivational Self System](image)

Figure 2-3: Structural Equation Model Of Motivational Self System (Ushioda and Dörnyei, 2009)

The model (Ushioda and Dörnyei, 2009) has three distinct categories:

1. The Ideal L2 Self, the individual’s imagined ideal future self as a language speaker.
2. The Ought to L2 Self, this is associated with extrinsic motivation and includes the aspects an individual feels they need to meet in order to meet expectations. This includes factors such as family influence or promotional factors in learning the L2.
3. The L2 learning experience, this includes the situational and environmental
aspects of the language learning process as well as one’s subjective learning experience. This includes factors such as the classroom experience or a specific teacher.

In line with these categories is the individual’s self-efficacy and language anxiety (Dörnyei and Csizér, 2012). Dörnyei’s questionnaire sets individual scales for factors such as a learner’s confidence and language anxiety in their ability to try and use the target L2 language. A study by Piniel and Csizér (2013) utilizing Dörnyei’s questionnaire found that self-efficacy and language anxiety are indeed distinct from, but closely linked with, motivational constructs of motivated language learning behaviour and the language learning experience. This highlights the importance of defining language anxiety and confidence as its own unique factor when investigating motivation for L2 language use. These factors are discussed in the context of this study in section 8.2.8.

As discussed earlier in section 2.2.1, sociolinguistics view language learning as context dependant and is a process of meaning making in the individual’s context (Kormos and Csizér, 2008). Dörnyei’s work therefore seeks to illuminate the factors involved in this meaning making process and allows researchers to quantify an individual’s state in this process. In the next section the role of anxiety and self-efficacy to the language learning process is expanded.

### 2.2.5 Anxiety and Self-Efficacy in Language Learning

Anxiety in motivational research has two contrasting concepts: facilitating anxiety and debilitating anxiety.

Facilitating anxiety enhances performance, whereas debilitating anxiety inhibits it (Gaeddert and Dolphin, 1981). Research in the area of test pressure in particular has examined the two agonistic effects of anxiety (Sarason, 1984) alongside the work of psychologists in sport science (Burton and Naylor, 1997).

In the field of linguistics it is generally assumed that facilitating anxiety is connected to less cognitively demanding tasks where language is viewed as a complex
task, thus, anxiety is likely to inhibit the process (MacIntyre et al., 1997). MacIntyre et al. (1997) notes that debilitating anxiety is likely to be detrimental because anxious speakers are less likely to take an active, verbal part in classes or to use their second language in the wider world which creates a vicious cycle of debilitating anxiety for the learner, thus limiting them from access to a community of practice to improve their language skills (see section 2.2.1). The awareness of future communication in the second language can become an area of concern to a highly anxious speaker, in turn inhibiting the learning experience further (Muircheartaigh and Hickey, 2008). Increasing the self-efficacy of a learner can help lower the effect of debilitating anxiety (Razavi et al., 2017) this in turn can increase the amount of effort invested in language learning, which is likely to lead to positive experiences and enhance the learner’s self-efficacy further (Piniel and Csizér, 2013). The learner’s environment can improve their self-efficacy or how much effort they are willing to invest can result in further success reducing their anxiety and improving their self-efficacy (Piniel and Csizér, 2013). This highlights the importance of studying this amalgamation of variables as a whole rather than in isolation which will be a major consideration in the methodology (see section 4.2). In the next section the role of Task Based Language Teaching (TBLT) to the language learning process is examined. TBLT is a well researched teaching strategy for language learning that has had beneficial effects on motivation, self-efficacy and confidence for L2 language learners.

2.2.6 Task Based Language Teaching

Situated cognition posits that all knowledge, similar to language, is inextricably bound to the activity and situations in which it is produced (Brown et al., 1989). TBLT provides a framework for language instruction through activity and situations grouped as tasks. John Dewey is well regarded as one of the key theorists involved in developing the task based approach to learning (Dewey, 1916). It was his belief that learning is focused on developing the person rather than on specific information on a subject. Dewey primarily focused on inquiry-based learning (Dewey, 1916). This is where the learner adopts the key skills and reasoning associated with scientific work. There is
no curriculum but rather the learner participates in constructing knowledge through task based challenges. This is a similar line of inquiry to the work of serious game researchers (Lambert, 2016). They view games as task based challenges that the learner actively participates in (see section 3.1.7). Socio-cultural theory discussed in section 2.2.2, provides a theoretical account of tasks on the premise that participants co-construct the activity they engage in when performing a task, this is performed in tandem with their own socio-history and goals which are directed through their motivation as discussed in section 2.2.4. Leading language theorist James P. Lantolf applies this theory to language learning (Lantolf, 2000; Lantolf and Appel, 1994). Language tasks are viewed as work plans by this account and are defined by four criteria (Skehan and Skehan, 1998):

1. Meaning is primary.

2. There is a goal which needs to be worked towards.

3. The activity is outcome-evaluated.

4. There is a real-world relationship.

Learners interpret their tasks through their effort to orientate to the task and establish goals in order to perform it (Ellis, 2000). As the seminal paper by Firth and Wagner (2007) establishes; acquisition cannot and will not occur without use and to understand how language acquisition occurs and develops, one must observe and explicate language in use. TBLT methodology focuses on the use of authentic language asking participants to do meaningful tasks using the target language. The framework developed by Jane Willis (Willis, 1996) identifies a number of purposes for TBLT which aligns with the goal of improving the participant’s attitude and motivation in their ability to become a language speaker including:

1. To give learners experience of spontaneous interaction.

2. To engage learners in using language purposefully and co-operatively.
3. To make learners participate in a complete interaction, not just one-off sentences.

4. To develop learners’ confidence so that they can achieve communicative goals.

Through TBLT learners are able to experience what they can do using their language skills rather than merely having corrected what they can’t. In turn, this helps build motivation, confidence and language knowledge (Preston et al., 2015). TBLT seeks to develop a learner’s language through providing authentic tasks for learners to complete and then using language to solve it. TBLT task design incorporates two key features:

1. A focus on supporting task progression through scaffolding as detailed in section 2.2.2.

2. A language learning specific focus.

The language learning specific focus is facilitated in the way that the task is designed to provide feedback to the learner in terms of their comprehension whilst they progress through the task. Interest in the motivational basis of language learning tasks can be seen as the culmination of the situated approach in L2 motivation research. Second Language Acquisition (SLA) researchers have been attracted to tasks because by focusing on them, they are able to break down the complex and prolonged L2 learning process into discrete segments with well-defined boundaries, thereby creating researchable behavioral units. Thus, from this perspective, tasks constitute the basic building blocks of classroom learning, and accordingly, L2 motivation can be examined in a more situated manner than within a task-based framework (Dörnyei, 2003). Games can be defined as systems of task based immersion (see section 3.1.3). This makes them suited for achieving the goals of TBLT. Games immerse the player in a context where they engage with specific scenarios with well-defined boundaries similar to the focus of TBLT. VR technology augments this further as a participant is immersed in the game adding realism and new meaning to the actions for the participant (Slater, 2009) as referenced in section 3.2. As language learning theory has
moved towards a greater emphasis on the role of interaction in language acquisition, the creation of meaningful contexts for interaction which facilitate language learning must be a key goal in the use of technology (Dalton and Devitt, 2016).

This section explored a learning pedagogy deeply embedded in a situated and contextual viewpoint where language and meaning making is specific to context, an account of the motivational factors involved with language learning has been explored and TBLT is highlighted as a teaching framework to promote motivational language outcomes. The next section explores the Irish language from a historical and sociolinguistic viewpoint in order to highlight the specific context of this work.

2.3 Irish

This section gives an account of research conducted on the attitudes and motivation of Irish language learners. This is followed by an exploration of the history of the Irish language in order to provide the specific historical context of how it has evolved. Finally the sociolinguistic dimension of the language and how it is evolving to incorporate new speakers is examined.

2.3.1 Motivation in Irish Language Learning

The majority of the population of Ireland (89%) are positively disposed to the Irish language according to modern surveys (MORI, 2005). Deeper motivational analysis of the Irish language landscape has found a more complex relationship to modern Irish language attitudes and motivation (O’Rourke and Walsh, 2015). Research into the motivation for Irish language learning in the Irish education system has found several underlying weaknesses in learner’s predisposition towards learning the language. For example, 36% of students had a less favourable attitude to Irish than they had for all other school subjects (Devitt et al., 2018). Gender has been identified as an area with significant motivational differences (Murphy, 2010). Higher integrative and instrumental motivations have been identified among female foreign-language learners at all levels of education. These may be related to more positive internal attitudes,
identity and feelings of agency among females regarding languages or to the more positive attitudes and influence of society and parents towards female foreign language learning (Murphy, 2010). Research in Irish language learning in secondary schools has found that it is common practice among teachers to overemphasise reading and writing at the expense of listening and speaking in Irish classes combined with the widespread practice of teaching Irish through English (Little, 2003).

An extensive report by Ó Laoire (2007) into the teaching practices in Irish secondary schools found that Irish had rarely been used in communicative situations outside the classroom and learners did not have any communicative situations to use as an evaluative method to measure the progress of their communicative ability in the language. He found that learning Irish was seen by learners as memorisation for short-term school based purposeful recall. Students’ perception of Irish was as a static school subject they didn’t perceive it as a living language (Ó Laoire, 2007). The environmental factors and the lack of a communicative social context for language use is highlighted in the report:

“The English language environment and the lack of immediately visible social contexts in which one can communicatively use Irish present constant challenges for teachers and learners alike.” (Ó Laoire, 2007, 17)

School teachers and educators hold a valuable position in their role to revitalise the language where their attitudes and standards are of great significance for future Irish language learners (Harris, 2007). Competence in the Irish language holds valuable cultural capital for access to third level education and securing a civil service or teaching post. While the policy of making Irish mandatory for these jobs has provided an economic incentive for the language, there is an argument that it has further removed the language from a language community and has given priority to learners to achieve in exams in order to attain coveted promotional opportunities and positions (Watson and Phádraig, 2011).

A report into Irish language in primary schools (Department of Education and
Skills, 2007) found that 23% of teachers had unsatisfactory levels of Irish. The standard of teaching and learning was poor or fair in half the classes and only 6% of classes showed evidence of excellent teaching. There was a link found between language and teaching competencies in that teachers with a stronger competence in Irish often displayed better teaching methodologies. Irish should be viewed as more than just a mere school subject in order for the learner to thrive and become part of a community of speakers, this depends on the attitudes and motivations of teachers in a way other subjects don’t. This means that improvements to teachers’ attitudes and motivation are also of greater significance in the case of Irish (Harris, 2007).

The attitudes and motivations in relation to Irish discussed in this section are the result of a complex history in how the Irish language has transformed over the course of the past two hundred years. The influence of the English language in particular has shifted the development of the language. The next section gives a brief history of these developments in order to understand the historical significance of the language and how this has effected attitudes among the Irish population.

### 2.3.2 Irish Language History

The Irish language has a long and complex history. The oldest evidence of Irish in Ireland dates from the 5th and 6th centuries from inscriptions written on Ogham stones (Künzler, 2020). It is a language that faced systemic oppression by English rule since the 14th century when Irish was banned from the court system and for use in commerce by the Statutes of Kilkenny in 1366 (Carnie, 1995).

Irish was a uniform language throughout the period of Old Irish from 600 to 900 A.D. and Middle Irish from 900 to 1200 A.D. (Bretnach et al., 1994), but regional variation became evident in spoken Irish from the twelfth century onwards and this continued throughout the period of Early Modern Irish, 1200 to c.1700 AD (Phaidin, 2008). The language forms identified from this time are divided into the three main regional dialects of Irish found in present day Gaeltacht speech – Munster, Connacht and Ulster (Ó Dochartaigh, 1992).

The introduction of the national schools in the 1830s banned the use of Irish in
the education system (Darmody and Daly, 2015). In the 19th century it became the minority language in Ireland (Darmody and Daly, 2015). This was due to the disproportionate number of native speaking areas, known as the Gaeltacht areas, that were affected by the Great Famine that caused widespread emigration and death by starvation. Before the Great Famine half of the people living in Ireland were Irish speakers but after the famine the number reduced to one in ten (Darmody and Daly, 2015).

Conradh na Gaeilge was set up in 1893 with the aim of restoring the Irish language to its previous dominant position. The organisation was connected to the Irish nationalist movement who were fighting to recognise the Irish identity as separate to the English Empire. This created an image of the Irish identity as a noble peasant class with a pure language without English influence (O’Rourke, 2011). The Irish language has maintained this image of a pure language linked with the past and its Celtic culture with an opposition to English language and culture.

Traditional Gaeltacht speech is a local dialect, showing little influence from English in phonology, syntax and vocabulary and is especially prevalent among speakers born before 1960 (Murchadha, 2012). Gaelscoils have been growing in popularity since the 1980s and have demonstrated considerable success in maintaining a high standard of Irish (Devitt et al., 2018). In recent years there has been an increase in the number of Irish speakers identifying themselves as fluent speakers without a connection to the language community of native speakers (O’Rourke, 2011). The next section considers how this change could be altering the image of the Irish language community.

2.3.3 New Speakers

Most L2 research is focused on achieving native-like mastery of a language however definitions of what it means to be native are ill-defined. Chomsky (1965) defined native speakers as those who are capable of giving valid judgements and of identifying ill-formed grammatical expressions in their languages although they may not be able to explain exactly why they are ill-formed (Saniei, 2011). Definitions of native speakers include the notion that innate proficiency in a language makes the
speaker the “true” language owner (O’Rourke, 2011). Chomsky’s theory replaces real language with an ideal language, sociolinguistics would argue that asocial linguistics is not useful unless use and variation is included in language theory. Innate and authentic speakers are intertwined with origin, they are from somewhere bound to a geographical roots with a defined community (Nic Fhlannchadha and Hickey, 2018).

For Irish this is a problem for the language community (Nic Fhlannchadha and Hickey, 2018). According to the 2016 census, 1.76 million said they could speak Irish but only 73,803 said they spoke it outside the education system daily, 1.7 per cent of the population (CSO, 2016). Of these daily speakers three-quarters of them live outside the Gaeltacht regions (O’Rourke and Walsh, 2015). Ireland has undergone immense historical and social change since the foundation of the state but the imagery and identity of the language has undergone very little cultural change and is still viewed primarily as rooted in the Gaeltacht areas which are idealised in the notion of a traditional Gaeltacht native speaker (O’Rourke and Walsh, 2015). This is not just the case in Ireland as many minority languages across Europe are in a similar position whereby the authority of the language is still defined by a geographical region including Basque, Galician, Welsh, Breton and Catalanian (O’Rourke and Walsh, 2015). As in the case with Irish in many of these regions there are a greater number of speakers living outside of the region identifying themselves as daily speakers who have no ownership or authority in their language (O’Rourke et al., 2015). In rural Galicia there is a clear reverence for the native speaker, where the language has survived in its purest and least contaminated form, defined by its nostalgia for the past and the mythification of rural Galicia (O’Rourke and Ramallo, 2013). James Costa argues the case that legitimacy in a language is destabilised by the death of traditional speakers (Costa, 2015). He argues that not only is it difficult to claim language ownership, but it is difficult in the cases of minority languages to define who counts as a legitimate member of the group. Currently Gaeltacht native speakers are argued to act as gatekeepers to the Irish language with an innately proficient identity, seen as “true” speakers. This static view of language held by learners and speakers alike, limits the learners ability to gain access to the resources of the community in
order to develop their language skills in Irish (Ó Laoire, 2007). Even with over 2300 hours on average of Irish taught in schools each year, students do not perceive the language as a living language but rather as a static school subject (Ó Laoire, 2007). This is an important consideration in light of the discussion in the previous section 2.2.1 about the importance of the social aspect of the learning process. To reflect this understanding of minority language change recent sociolinguistic research is adopting the term “new speaker”. This term new speaker refers to individuals with little or no home or community exposure to a minority language but who instead acquire it through immersion or bilingual educational programs, revitalisation projects or as adult language learners (O’Rourke et al., 2015). These new speakers come with their own attitudes and experiences with the language (O’Rourke et al., 2015).

Figure 2-4 illustrates the main thematic conflicts between new speakers and native speakers: Identity, Ownership and Accuracy are all points of contention between the speaker groups. It highlights a polarisation between the speaker groups, where both groups recognise their own legitimacy as a fluent speaker but with different values as to how this is accepted, such as effort and love of the language being valued over accuracy for new speakers.
This highlights the limitations in L2 educational interventions in seeking a native-like mastery of language, in particular in a minority language context. Therefore, language acquisition cannot be tied to the distinction between native and non-native speakers (Saniei, 2011). Ideally, L2 interventions should be redefined and adjusted to authentic situated settings in which second language learners can take part.
2.4 Conclusion

This chapter has explored the educational theories that inform the design of the VR game that will be detailed in future chapters. It began with an account of situated cognitive theory and social constructivist theory. This was followed by an overview of motivation and how theory has evolved in this area. The field of motivation in the context of language learning was specifically investigated, succeeded by an in-depth review of anxiety and self-efficacy in language learning. Task Based Language Teaching was investigated as a framework to implement in the VR game’s design. The educational pedagogy of the research was followed by an exploration of the context of the intervention, Irish language learners. This section examined their motivation in language learning, the sociolinguistic history of the language and how it is evolving in its modern day setting with an exploration of the modern sociolinguistic term: New Speaker. The chapter has highlighted the specific needs of the community being targeted in order to redefine the objectives of the study based on the target group (see section 4.2).

In the next chapter an overview of the challenges researchers face in their search for a game definition is given followed by the history of research in games with a particular focus on how games have been targeted for use in learning interventions. This is followed by an overview of VR technology and how research has developed in this field. In order to investigate a game based learning intervention, it is vital to have a clear understanding of what actually constitutes a game, as well as examining game design concepts and methodologies at the centre of game design philosophy.
Chapter 3

Games, Game Based Learning and Virtual Reality

3.1 Games

3.1.1 Introduction

This thesis views games as a tool to create an immersive situated language learning context for the learner. The engagement required to feel physically and mentally present in their environment is created through the tasks, while the narrative process
of creating meaning for these tasks creates the emotional connection for a player to feel immersed. This is how games are related to the earlier discussion on task based learning (section 2.2.6).

Tasks mediate what the player is doing through the ludological interactions the player engages with in the game (Karhulahti, 2015). The player becomes linked to the in-game protagonist through purpose. This purpose makes things meaningful through the players actions in the game. This link to an in-game protagonist carries a closer identification in VR games where the player is engaging physically in the same actions as the game protagonist. This makes the divide between player and character even thinner. Due to the current limitations of VR this boundary still exists however, as the player recognises their voice is not the voice of their character or how they are able to interact with the virtual world is not as accurate as how they physically interact with real world objects.

Games can be defined as an immersive process, a constantly evolving dialogue between the game’s design and the players that interact with it (Flanagan and Nissenbaum, 2014). Together they create the system that scholars and critics alike are referring to when they talk about games. This system only exists with the player’s interaction with the rules of the game’s design and where these two aspects meet is a crucial element in the creation of the meaning-making process of that system. This system is mediated through the task that the game presents and the player, in turn, interacts with. Understanding this activity presents an inclusive view of the immersive process where action defines the type of gameplay with the meaning of the actions incorporated. Games immerse their audience successfully on a case by case basis, reliant on each game’s specific design intention rather than succeeding and failing in one definitive criteria that applies to all games.

This section begins by defining games as a dynamic process. This is followed by an overview of the current theoretical definitions of games. The theoretical overview of task based immersion is discussed and is proceeded by a definition of immersion and its key concepts. Finally, the two processes utilized in to produce immersion in games are highlighted.
The connection between the player and the game’s design is centered around the in-game purpose. This purpose is the activity a player must act on to be a functioning part of the system. This task positions a player in the environment and offers them forms of embodied and empathetic engagement. In this case, enabling the VR game to immerse the player in a situated learning context created through their engagement with the tasks the game offers.

### 3.1.2 Game Definitions

In order to define a game, researchers examine the crucial components that are necessary to be present for a system to be recognised as a game. These crucial components vary across definitions and tend to be very broad due to the speed of technological and design change in the field, posing a large challenge for the game research community. As technology has advanced enabling deeper and more complex systems, game designers have implemented new design methodologies that has advanced the field rapidly.

Figure 3-1 demonstrates the characteristics Thomas Malone (1981) believes to be central towards making an intrinsically motivating and compelling experience.

He divides games into three main sections:

1. **Challenge** - meaningful, obvious goals and feedback from the systems.

2. **Fantasy** - Allowing the player to inhabit a new role and experience a new context.

3. **Curiosity** - an optimal level of information for the player at the right time.
1. Challenge
   - Goal
     - Personally meaningful goals
     - Obvious or easily generated goals
     - Performance feedback
   - Uncertain outcome
     - Variable difficulty level
     - Multiple level goals
     - Hidden information
   - Toys vs tools
   - Self-esteem

2. Fantasy
   - Intrinsic and extrinsic fantasies
   - Cognitive aspects of fantasies
   - Emotional aspects of fantasies

3. Curiosity
   - Sensory curiosity
   - Cognitive curiosity

Figure 3-1: The Characteristics Of Intrinsically Motivating Instructional Environments (Malone, 1981)

Malone’s work is particularly interesting as its relevance towards modern systems are apparent. Rather than condense the definition of a game into a single variable he views games as a system built to be compelling for the user through a series of aspects common to game systems.

Games operate as a series of dynamic relationships (Tanenbaum, 2015). The most essential of these is the relationship between the game designers and players of the
game (Squire, 2006). Designers create a dynamic ruleset for the player to interact with and in turn the player participates, acting as the locus for the process. This co-dependent relationship is usually encapsulated in the academic discourse when games are discussed as systems. The most widely used definition of a game is

“a system in which players engage in an artificial conflict defined by rules, that results in a quantifiable outcome” (Salen and Zimmerman, 2004, 11).

The statement highlights most of the key terminology required for a game definition but it leaves the field very open to debate around key parts of what a game entails. More specifically, there is a question around what it means for a player to engage with a game. Engagement is central to the human element when we talk about the symbiotic nature of game play (Leino, 2010; Karhulahti, 2015; O’Sullivan, 2019), however, there is often a tendency for game research to ignore the human element (Greitemeyer et al., 2010; Banks, 2015; Hofer et al., 2017). By focusing only on quantifiable measurements researchers aim to create a perfect system, both in game design and in research. This approach fails to account for any difference and the interactions of players in how they play games or how the game is interpreted. It also limits the way we read player-game interactions, a rich and unique source of meaning making potential (see chapter 8 for the qualitative feedback from participants on their interactions in this thesis). Leading game based learning theorists such as Kurt Squire identify engagement with games as key value to recognition of the learning process occurring:

“It is critical that researchers examine what players actually do with games, rather than assuming that there is any one “game itself” as it is meant to be played” (Squire, 2006, 19).

While highlighting the importance of the player to the process, it is still essential that this is viewed as a dialogue where the ruleset’s of games are valued. Activity theorists who investigate games such as Squire (Squire, 2006) or James Gee (Gee, 2015a) are interested in focusing games towards the human element. They focus on the “openness”, “free play” and “self-exploration” of games for its players. This has
been expanded upon by Richard Bartle, who is well known for Bartle’s taxonomy which groups players into four main categories: Socializers, Explorers, Achievers and Killers (Pearce and Artemesia, 2009; Power, 2015; Tanenbaum, 2015). The taxonomy sees games as a system built to facilitate personal player expression but this limits games’ meaning making potential if it only makes subjective sense for each type of player. Games can express meaning through a static interpretation of the systems meanings and as an activity of change (Gee, 2012). Definitions that favour one over the other are imprecise and don’t fully encapsulate the total nature of games (Frasca, 2007).

Jesper Juul attempts to bridge the gap between system and activity by trying to ascribe the player as another feature of the ruleset (Juul, 2010). According to his definition we are either in a win or lose state in each game we play. This definition, while helpful in early game research, does not accurately reflect the deeper narrative impacts of recent titles such as the Last of Us (Naughty Dog, 2013) or God Of War (Studio Santa Monica, 2018) where the narrative of the game does not conform to the player “winning” but rather the goal of these games is to give the player a sense of emotional impact and resonance. Though these games may have an end that in many ways function as a win state it is not its primary, or even most important function, rather it is the conclusion to an accumulation of meaning that has been taking place. Put another way it is the journey and the tasks involved to get there that matters, not the destination or the goal.

Jane McGonigal addresses this issue through her attempt to define games through a more flexible definition. She defines games as sharing four traits: a goal, rules, a feedback system, and voluntary participation (McGonigal, 2011). The idea of voluntary participation was introduced in Huizinga’s Homo Ludens (Huizinga, 2014), where it theorizes about the play experience in physical or virtual spaces. A game without a player is only a computer ruleset but a player who does not approach a game with a wilful and playful mindset is not engaging with the game with the required mindset (Busselle and Bilandzic, 2008). Here a playful mindset means a willingness to interact with a game for what it is. As an example, in a game of poker, its not an
issue with the ruleset of poker if a player refuses to make a bet to progress the game. In essence, a mismatch between the game and player can be the same as a mismatch between parts in any other part of the game’s system.

Ernest Adams defines the context and player of a game as the central component in his definition:

*A game is... "a type of play activity, conducted in the context of pretend reality, in which the participant(s) try to achieve at least one arbitrary, non-trivial goal by acting in accordance with the rules"* (Adams, 2010, 3).

Rather than defining games as static systems with certain components necessary in order to be defined as a game, it is much more useful to define games in terms of a theoretical framework which takes context, the player and the system into account. As previously discussed, context is important in the learning process and within the broader understanding of games, meaning that games naturally lend themselves to situated/contextual learning as discussed in section 2.2.1. Similarly the Adam’s definition sees games as designed experiences that focus on activity and engagement as essential thus making them ideally suitable for situated learning, where players engage in unpredictable situations by acting according to the social practices of the game (Gros, 2007).

Squire argues for games to be framed in terms of designed experiences (Squire, 2006) and should be distinguished from other medium by their ability to offer the player agency over the narrative of the gaming environment and its ruleset. Game designers create the rules for the players’ experience, making the game experience an interaction between the game designer and the player. Therefore, in the virtual world of the game, doing is essential (Gee, 2006). To play a game players must engage in the social practices of the game through action (Gee, 2015b). Games develop ways of; knowing, doing, being, caring, social practices, identities and shared values which combine to lead to expert knowledge (Shaffer et al., 2005). Players are able to inhabit new experiences by playing in a new identity which allows them to re-create themselves to think, act and value themselves like their role (Gee, 2015b).
As discussed by Malone (1981) fantasy is a core element of games that allows for intrinsic motivation. Games offer players the ability to rethink themselves in their new role, as a knight in medieval times such as *Skyrim* (Howard, 2011), for example. These fantasies and new roles don’t need to offer fantastical magical elements but rather allow the player to experience a context they don’t have the opportunity to inhabit in their day-to-day life (Gee, 2015b). This could be the player recreating an everyday activity like going to a shop and getting items in a new role as a language speaker from a minority community. The experience of engaging in this new role allows the learner to engage in unpredictable situations to cultural, linguistic and textual stimuli which is key to truly communicative learning rather than conformity to established patterns of knowledge (Cook, 1997). In the next section the importance of immersion is discussed and how tasks immerse players in a game environment.

### 3.1.3 Task Based Immersion

Game designers aim to create a state for players to enter during gameplay and the goal of games is to immerse the player in this intended state (Hunicke et al., 2004). However, the features that cause this immersion can vary from title to title. While traditional genre types may share mechanical similarities, the way the player engages with it will depend on its meaning making purpose and the player’s ability to access it. For this reason, an aspect of the definition should not just be the activity but the meaning of the activity and the way it resonates with the player (Corneliussen and Rettberg, 2008). Resonance in this case is an aspect of involvement which in game research is usually measured in terms of cognitive transportation (Green et al., 2004). Task based immersion identifies immersion as a process rather than an output where the player actively attempts to engage with their context continually looking for markers to place them in this new environment (Slater, 2009). To illustrate this, the next section gives an overview of the term immersion and how it is utilised within game research.
3.1.4 An Overview of Immersion

Immersion has been key to game research in the last two decades (Calleja, 2011). Immersion is a contested space in game literature similar to the game definitions highlighted above. Immersion can refer to many cognitive roles from transportation to a virtual environment (Sheridan, 1992), to a player’s involvement within a virtual environment (Brown and Cairns, 2004) or the technical aspects of an immersive device (Slater and Wilbur, 1997).

Researchers interested in immersion believe that cognitively transporting the player to a virtual space can help to improve the meaningful emotional experience of the system (Diemer et al., 2015). The inverse of this impact is also possible where the emotional involvement of the player, leads to higher immersive ratings than calm emotional states, a consistent finding across the literature (Diemer et al., 2015).

Game designers aim to make content and form that are well integrated. This occurs when the content conforms with the player’s world view with attention being directed at the game’s ruleset (Riva et al., 2004). In order to create an immersive experience within a game world, a game designer must involve the player and draw their attention (Witmer and Singer, 1998). S. Jin’s empirical study concluded that “involvement is positively associated with focused attention and focused attention positively correlated with immersion” (Jin, 2011, 114). Therefore, involvement is a necessary factor for immersing a player within an environment. This aligns with how games and VR technology interact, where, immersing a user in a virtual environment is the purpose of VR technology (see section 3.2.2). The question then becomes, how does this process of involvement take place? Below the process capable of answering this question is examined.

3.1.5 Flow

Flow can be thought of as becoming immersed through an action or task (Shin, 2018). It is usually described as a state of profound enjoyment and concentration experienced during an activity (Csikszentmihalyi, 1990). Csikszentmihalyi, the researcher credited
with the term, identifies flow as a state produced by a fully inhabited action. It is a state of optimal experience, whereby a person is so engaged in activity that self-consciousness disappears, time becomes distorted, and people engage in complex, goal-directed activity not for external rewards, but for simply the exhilaration of doing (Csikszentmihalyi, 1990).

Csikszentmihalyi identified eight possible dimensions of flow (Bachen et al., 2016):

1. Knowing what has to be done moment to moment.

2. Immediate feedback.

3. Intense concentration.


5. Removal of all unnecessary information from consciousness.

6. A sense of control over the action.

7. A distortion of sense of time.

8. An intrinsically rewarding action

An investigation of Csikszentmihalyi’s eight dimensions of flow identifies why it was adopted by the game academic community (Bachen et al., 2016). These dimensions are similar to design principals for game creators and act as cognitive markers for the participant (Michailidis et al., 2018). Flow is a binary experience similar to presence (Csikszentmihalyi, 1990) (see section 3.2.2). You can drop in and out of a flow state, but all of the criteria must be fulfilled to become fully immersed in the task (Michailidis et al., 2018). Flow is the immersive feeling of total involvement in a task (Csikszentmihalyi, 1990). Involvement is the key factor of flow, one does not have to feel involved to feel present, but one must be involved in order to experience the flow state.

Involvement unlike flow is not binary but exists on a scale and different games utilise different types of involvement (Brown and Cairns, 2004). Brown and Cairns
(2004) identified three levels of involvement which they refer to as immersion: engagement, engrossment and total immersion. However, it is worth noting that they argue that total immersion is not always achievable (Michailidis et al., 2018). This concept of total immersion that Brown and Cairns discuss appears to be the same concept as flow.

The first stage of immersion is engagement. It is the lowest level of involvement with a game and must occur first. The player must invest time, effort, and attention. Feedback must then correspond in a manner so that the player can understand what is expected of them. After engagement the player can enter the state of engrossment however, this layer depends on the game’s construction. As illustrated below this intersection depends on how the game features combine to affect the player directly as discussed in section 3.1.6. The final state is the state of flow (Brown and Cairns, 2004). The desire for a flow state is mediated by the type of task required of the player and the mode of the discourse with the text. While several of the factors of involvement may be present in all successful games (Bachen et al., 2016) flow would severely hinder the way some games want to interact with their prospective player such as games created to allow players to empathise and think about their decisions. As an example, a game like *Beat Saber* (Beat Games, 2019) attempts to put the player in a state of flow where they stop feeling the passage of time through exhilarating immersive action they control. *The Walking Dead* (Telltale Games, 2012) on the other hand poses hypothetical situations that the player reflects on through their immersion in the story unfolding. The former adheres to flow theory and utilizes the framework to make the player feel involved to a point where they forget themselves and are completely immersed. *The Walking Dead* demands that the player has a deeper contextual understanding of the game as text. That is, a form of narrative expression with the same width and depth that is expected from film, theatre and literature (Mukherjee, 2015). The player becomes immersed through its emotional impact rather than through fast paced action. The type of reflection in *The Walking Dead* is simply not possible, in the high-octane action of *Beat Saber*.

"When you play a game 10,000 times, the graphics become invisible. It’s
all impulses. It’s not the part of your brain that processes plot, character, story. If you watch a movie, you become the hero — Gilgamesh, Indiana Jones, James Bond, whomever. The kid says, I want to be that. In a game, Mario isn’t a hero. I don’t want to be him; he’s me. Mario is a cursor." (Frasca, 2001, 168)

As this example by Frasca demonstrates the flow state focuses on pure reactive play. However, a story encapsulates and immerses a player in a different form of immersion through its text. Both forms are mediated by the task that the player performs. This highlights the difference between the two branches of how meaning is generated through task interaction in games.

3.1.6 Immersion through Mechanics and Narrative in Games

Game design theory often views the player as an “agent of chaos” in the system (Tanenbaum, 2013). In this paradigm, designers see the player as having the role within their system to be given free reign and to be allowed to act as unrestricted as possible in order to maximise their agency within the game world. Many game researchers suggest that the larger the possible actions available to the player the more immersed they will feel in the environment due to their ability to act unprohibited in the system (Ketelhut et al., 2007). However, while a new player may act as an agent of chaos in the beginning of their play, this is usually in order to understand the rules, systems and the boundaries of what is capable while they are interacting within this new environment (Tanenbaum, 2013). Game designers view a player as someone wanting to become engrossed in their experience and the designer acts with the intention of seeing the player as having “bounded agency” (Tanenbaum, 2011) within the game world. This bounded agency exists as part of the mechanism of context, a boundary that makes the actions of a game meaningful.

A player interacts in the play space of the game through the ruleset’s mechanics (Sicart, 2009). Mechanics interact with game’s rules and the text to create meaningful possibilities (Sicart, 2009). This is where the player is afforded agency to act in the
context of the game. It is through this action where meaning is created. Any action that translates to a direct objective within the ruleset of the game is given meaning for the player. Even an action as basic as waving one’s arms has meaning for the player if it is an objective in the ruleset of the game. Complexity helps to make the translation from a ruleset’s objective to the player’s intended action a richer part of creating meaning (Tanenbaum, 2013). A player’s interactions through the game mechanics therefore become part of the game on the metaphorical not just the input level (Sicart, 2014).

This complexity shifts the relationship between player and text. Immersion in a game world demands a level of identification with what is happening in the context. Beat Saber only needs a simple ludic identification where input equals output for the player to reach a flow state of immersion. However, a story rich game needs an increased level of identification with the protagonist’s goals. In this case immersion demands a more complex type of immersive state in order to create deep meaningful involvement with the game’s text.

As an example, arcade classics such as Pac Man (Namco, 1980) or Donkey Kong (Nintendo, 1981) are built to reward repetition through a deeper mechanical understanding. These games seek to immerse the player through the flow state and through muscle memory of the ruleset’s mechanics as the player seeks mastery of the system (Gee, 2015a). Other games with high replay value include role-playing games such as Skyrim (Bethesda Game Studios, 2011) and Divinity Original Sin (Larian Studios, 2014), these games offer replay value by the range of possible experiences that they offer the player. These experiences are afforded through offering players a range of narrative avenues and solutions to mechanical problems.

Meaning is also created from what the player is able to draw from the task. The difference between shooting an enemy player in Player Unknown Battle Grounds and shooting an enemy in order to survive in the Last of Us (Naughty Dog, 2013) offers different meaning for a player despite the ruleset’s objectively being the same. The qualities of the narrative such as character and setting offer context to the task thus transforming the way it is interpreted. The task itself is the link between the player
and game’s ruleset. Tasks are the focus that decides whether immersion can or cannot take place, but it also controls the type of immersion created. Whether this is flow or the reflective immersion instigated by complex narrative mechanisms both are dictated by the interaction between player and game via the task at hand.

As Brooks states:

“To be immersed is to be involved in the context, not only physically but also mentally and emotionally” (Qin et al., 2009, 112).

Immersion in context is to feel physically, mentally and emotionally involved. The engagement required to feel physically and mentally present is created through the tasks players engage with while the narrative process of creating meaning for these tasks creates the emotional connection for a player to feel immersed. Similarly, the game, as an object designed by game designers, only becomes a functioning system when its tasks are realized by the player. This intersection is an important perspective when viewing, designing and evaluating a game.

This section has discussed games as a process, followed by a discussion on defining games through task based immersion. This led into an explanation of immersion, the flow state and immersion as involvement and how these layers of immersion are created through tasks in games. Finally, the different types of immersion created through involvement with tasks and incorporating meaning from the context and actions of games was discussed. The next section seeks to outline how games can be used in a learning context.

### 3.1.7 Games In A Learning Context

The use of games in a learning context necessitates evidence of its impact within the relevant learning context. It’s a complex task to define what it is we “learn” when engaging with a game. Decades of research into games has evolved the perception of how games effect learning. Figure 3-2 it describes the evolution of pedagogical theory in relation to game based learning artefacts.
They began with a behaviourist (Skinner, 1974) approach to the learning experience which involved controlling the player’s experience and seeking to impart direct learning objectives. These games were drill and practice “edutainment” (Squire, 2003) developed in the 1990s. The main aim of the games developed at this time was to use games as a tool to motivate the new generation of digital natives (Prensky, 2003). The second generation of game based learning artefacts saw the development of games capable of developing and testing new theories and frameworks for how people learn (Gros, 2007). Long held theories about learning such as social constructivism as discussed in section 2.2.2 and individual constructivism (Piaget, 1953) were adopted and the focus of these artefacts was on the learner’s experience rather than their behaviours. In the current third generation of development, theories like legitimate peripheral participation (Lave and Wenger, 1991) as discussed in section 2.2.1, are becoming increasingly influential in game-based learning where the focus has shifted to the setting of the learner rather than the learner themselves. The open ended nature of games allow these theories to be researched and tested with a new degree of rigour (Gros, 2007). These complex, multi-faceted games and theories usually include complex systems along with community and societal aspects of learning, involving multiple variables and deep analysis with a mixed method approach. Games offer rich contexts for learning which has resulted in a rich multi-disciplinarian research
field developing around the role games have in learning. Figure 3-3 displays the Input-Process-Outcome game model for learning games which views learning games in a similar fashion to the Zimmerman and Salen definition as discussed in section 3.1.2.

![Diagram Of The Input-Process-Outcome Game Model (Garris et al., 2002)](image)

They see games for learning as offering the dual inputs of instructional context married with the context of gameplay. The user then processes this information utilising the feedback of the system along with their own behaviour and judgements. Finally they are debriefed on their experience in the game world which leads to learning outcomes. While this is a relatively young discipline compared to others, it has twenty five years of research evidence that game playing has a role to play in learning (De Freitas, 2006). While the multi-disciplinarian approach to research in games for learning is novel, in developing numerous uses for games in learning environments, it has also led to a large fragmentation among the community in the search for common language and definitions due to the varying definitions and approaches to games studies. These difficulties broaden considerably in research aiming to use games for learning purposes. Serious games is the most common term used which refers to games used for reasons other than just entertainment (Susi et al., 2007). This term however is used interchangeably with game based learning environments which refers specifically to games used in a learning context (Susi et al., 2007). Other terms are used by the community such as:
1. DEG - digital educational games (Gheorge et al., 2017)

2. EVE - educational virtual environment (Mikropoulos, 2006)

3. 3DVE - 3D virtual environments (Dalton and Devitt, 2016)

4. Immersive virtual environments (Chang et al., 2012)

5. Simulations (Barab and Dede, 2007)

6. CALL - Computer assisted language learning programs (Lai and Kritsonis, 2006)

All of these terms are used in reference to games for learning. With such varied inter-disciplinarian viewpoints in the research community for games, it is important that work should follow consistent language defined by previous research in the area with more communication between disciplines (Tanenbaum, 2015).

Figure 3-4 is a framework developed by (Reinhardt and Sykes, 2014) to examine games for learning in research and practice. This framework divides games for learning into three sections as they are commonly divided by game-based learning research:

1. Game-Enhanced - Using commercial games for learning purposes.

2. Game-Based - Utilising specifically designed learning games for learning.

3. Game-Informed - Using game principals outside of contexts perceived as a game.
A lot of research has been focused on game-enhanced techniques: using commercial games such as *The Sims* (Ranalli, 2008) or *Civilisation* (Squire, 2004) to illicit learning through carefully tailored lessons in the game with a period of debriefing after the gaming session (Crookall, 2010). This research has been highly influential and necessary to lead theory development. It’s limited however by the capabilities of the games being used to test these theories. Commercial games are built with a different focus than that of game-based learning artefacts. Simplistic explanations of complex information and misinformation has been a common complaint among researchers (De Freitas, 2006). Due to the high cost of the development of commercial quality games with complex systems and believable 3D graphics, game-enhanced research serves a very useful purpose in helping to provide theory and proofs of the capabilities of games where the budgets don’t currently exist to develop learning games from the ground up. One approach taken in order to develop game-based learning systems are Open Sims which have been incorporated into the research community (Baker et al., 2009). They are capable of complex modifications and visualising 3D graphics along with the added capability of creating multi-user environments to allow the measurement of
social learning in virtual contexts. *Second Life*, the most popular Open Sim program, in particular has led to a wealth of research on their capabilities (Baker et al., 2009; De Freitas, 2006; Reinders, 2012). The ability to design natural and specific interactions along with the ability to create realistic 3D environments in these applications is limited. Due to these factors; researchers have been constricted by the artefacts and tools available to research the potential of games as sites of learning. Research in the field must also contend with experimental design methodologies that are positivist in nature. These types of design are unable to cater for the specific groups the design intervention is trying to target and instead ask for more global answers to research questions (see section 4.2.2).

In the commercial world of games, small development teams of 1 to 10 people have emerged with low developmental cost “indie” games which have had mainstream wide appeal (Egenfeldt-Nielsen et al., 2008).

*Braid* (Blow, 2009) a 2009 low-budget game is usually attributed with the creation of the “indie” scene. The game-based learning environment is yet to find a similar breakthrough with a lack of game-based artefacts designed specifically with learning intentions in mind that have hit mainstream appeal. The challenge here is great; game-based learning not only has to satisfy the usability and expectations created by mainstream games, but they also must demonstrate a clear link and evidence to the new learning possibilities of the medium (Egenfeldt-Nielsen, 2006). The most successful work in this field to date has been done by military organisations looking to create realistic training scenarios, “*America’s Army*” was developed and used specifically for this purpose (Susi et al., 2007). This game was originally created in order to teach basic training for army recruits but also achieved commercial success. Many traditional classroom subject areas such as language learning or the sciences lag far behind these developments (Gee, 2015b). Game researchers designing games for learning must be equipped with a methodology that allows them to work in consultation with their target users to iterate their designed artefacts, changing their design intentions and developing their theory and knowledge through a multitude of research methods in order to expand the current state of the art in the field (see
section 4.2 for more on design based research as a paradigm to solve these issues).

3.1.8 Games as a Learning Environment

It can be argued that games have several advantages when utilised for a learning experience due to a number of factors exclusive to them as a medium. Primarily games offer agency to the player over their contextual environment (Adams, 2010). Agency is the ability a game player has to manipulate variables in their environment (Adams, 2010). This fosters personal meaning making for the player as they interact with the environment giving them personal ownership over the experience (Squire, 2003). As discussed earlier in section 2.2.2 games give information “just in time” (Gee, 2015b). They give context to players where information is received “just in time” to make use of it, allowing the player in a game to operate just outside their realm of comfort where the game system acts as the facilitator allowing the player to master new learning. Through repetition players gain mastery of certain skills. Players then rethink their understanding and mastery of skills when the game presents them with new challenges allowing them to increase their understanding. This cycle of mastery and new learning is believed to be a major aspect of the motivating nature of games and also relates to the theory of flow developed by Csikszentmihalyi as discussed in section 3.1.5. Motivation in games is key to learning, as discussed in section 2.2.4, according to Robert Gardner and Wallace Lambert leading researchers in the area of motivation, the motivational reasons a person has to learn the language of another community is the primary force responsible for intercultural communication and affiliation (Dörnyei, 2003). Games allow players to participate in new experiences in otherwise inaccessible roles. The imaginary micro-world of a game (Squire, 2004) is a context where the player can take on a new meanings through the roles they inhabit in the game environment (as discussed in section 3.1.6). The player can act, think and talk as the role they inhabit. It makes it possible for players to participate in communities of practice with others through engaging with the game world’s new context and develop new ways of thinking that organise those practices as new understanding (Shaffer et al., 2005). It is a layered process where the learner
constructs a new personal identity over time by making use of cultural narratives as resources to create “figured worlds” (Neville, 2010). There is evidence to suggest that games have the ability to affect behaviour and a person’s identity and representation of themselves (Yee and Bailenson, 2007). One such example of this is the proteus effect (Yee and Bailenson, 2007). The proteus effect is when an individual’s behaviour conforms to their digital self-representation independent of how they are perceived in the real world. Yee and Bailenson found that when players were exposed to more attractive avatars they showed more willingness to approach opposite-gendered strangers in real life after less than 1 minute of exposure to their avatar in the game world. This research shows that a person perception of themselves in their avatar can have an effect on the decisions they choose to make in game. This suggests that games may be able to effect one’s motivation by changing one’s perception of oneself. The next section explores the impact of learning games and how this can be defined.

3.1.9 The Impact Of Learning Games

The impact of newly developed learning games is a key issue on the agenda for games for education. The design of games for learning is second order design (Salen and Zimmerman, 2004). This means that the designer does not have direct control over its players but rather they build contexts that the player interacts with (Salen and Zimmerman, 2004). The designer seeks to build an environment that the player can freely and intuitively interact with and learn from thus multiple iterations of the design is essential to understand how the player interacts in the game. The game contains the rules and structures that guide the participant through the world and the designer builds these systems. It only becomes an experience however when the human participant is involved by interacting with the ruleset of the game (Squire, 2006). The human participant has agency (Gee, 2015b) within the game’s structure of rules. For learning objectives to be met, the world-view of the game must build on the world-view and understanding of the participant. Game designers must take the world-view and understanding of the specific target context group into account during the design phase. They must also assess their impact during the design
phase to help foster design decisions that create a successful intervention. There is a growing consensus that impact must be assessed during the creation phase of a designed context for learning (Connolly et al., 2012). Specifically in the area of language learning it is vital that learning games have defined the impact they intend to pursue. The next section explores the recent successes of language learning games commercially alongside the research developments of these interventions in terms of the impact they intend to evoke in their learners.

### 3.1.10 Language Learning Games

There has been recent successes with gamified language learning apps and games in the commercial world (Settles and Meeder, 2016). The most popular programme Duolingo has hit mainstream appeal with a self reported user base of 150 million active users (Settles and Meeder, 2016). They cater to 27 different languages including Irish. The application’s main focus is personalised learning and motivating user’s language learning acquisition through gamified elements (Settles and Meeder, 2016; Streeter, 2015). However critics feel that mainstream commercial programs like Duolingo lack a contextual element to its learning process (Gheorge et al., 2017). Users are not situated in the daily learning activities. They lack real or imaginary environments to problem solve in and explore linguistic meaning through concrete experiences. Rosetta Stone is another popular learning application similar to Duolingo that uses pictures rather than text so users can associate meaning of words to visual stimuli. This approach still lacks any physical or cultural context necessary for problem solving to take place (Culbertson et al., 2016).
Figure 3-5: Examples of situated learning digital games in research

In Figure 3-5 an overview of popular research based learning games is demonstrated. As this demonstrates there has been significant work done developing several games with the explicit purpose of exploring situated learning. This is in response to mainstream second language research that, in the main sees language learning in an individual and mechanistic way that does not account for the interactional and sociolinguistic dimensions (Firth and Wagner, 2007).

Tingo is a game similar in structure to Duolingo where users engage in daily activities in order to acquire language learning skills with a customizable personalised dictionary (Gheorge et al., 2017). The game roots its learning in real contextualised
environments and they highlight the game’s use in creating personal experiences for the player. They found limitations with the cost of developing different scenarios along with problems with the repetition involved for users trying to learn more than one language using the same experiences due to the customisable features (Gheorge et al., 2017). The study also has no evidence of how effective the game is for learning. Crystallize is a game developed to examine situated learning in an immersive environment along with the effects of collaboration on learning (Culbertson et al., 2016). The game allows users to engage in a 3D environment to build sentences from words in order to gain information from computer controlled characters. The game uses text chat in order to allow players to communicate with one another. This chat was analysed to measure interactions and learning outcomes from the game. They found a marginally significant difference in the learning outcomes of players who interacted with the game. Task interdependence was found to positively impact the objective and subjective language learning outcomes. This study found limitations in how the experience was designed. Learners were only taught how to say things without any instruction on situated use for when and where they should say them. As displayed above the contemporary focus for language learning games is a situated approach to design interventions. It illustrates the utility in using games for language learning. While these games have been useful in leading the research in this area thus far there is a lack of research exploring the unexplored advantages virtual reality offers language learning in terms of design and theory development with currently only a few small scale research studies exploring its language benefits focusing on vocabulary retention (Vazquez et al., 2018) and a cultural exploration (Cheng et al., 2017). The next section will discuss virtual reality in detail and the benefits this technology may potentially hold for language learning.
3.2 Virtual Reality

3.2.1 Introduction

Virtual reality offers a greater sense of immersion compared to traditional games (Witmer et al., 2005). This sense of immersion has been linked to a deeper sense of engagement within game worlds (Chang et al., 2012) (as discussed in section 3.1.4). VR offers benefits to situated learning experiences because of its ability to make players feel like they are in a believable context in the game world. It offers the ability for learning to take place by carrying out physical activities known as kinaesthetic learning that other game systems can’t offer to the same degree through its input devices which allows the players to learn through interaction (Vazquez et al., 2018). The following section will give an overview of VR technology in order to highlight the use of the technology and the current research being conducted in the field.

3.2.2 Overview Of VR Technology

Virtual reality is easier to define by its goal rather than by a description of the qualities it can contain. The aim of virtual reality is to evoke a sense of presence in the user using the immersive aspects of the system (Slater and Wilbur, 1997). Slater and Wilbur define immersion as an objective description of the aspects of a system such as field of view and display resolution (Schuemie et al., 2001). Virtual reality has wide range of tools available in order to achieve this affordance of making the user feel present in the simulated environment (Slater, 2004). These tools are usually grouped by the different immersive qualities they possess. Head Mounted Display (HMD) refers to any device the user wears on their head in order to be immersed, this includes commercial products such as the Oculus Rift and the VIVE (Buttussi and Chittaro, 2017). CAVE is a projection based VR system where the user is surrounded by stereoscopic computer-generated images in a cubicle. An electromagnetic tracking system along with a sensor attached to the patient’s glasses is used to give perspective (Krijn et al., 2004). 3D environments using computer graphics in research to explore
the immersive effects of games and simulations sometimes refer to themselves as virtual reality environments (Dalton, 2016a). It is for this reason that tools that improve the immersive aspects of 3D environments such as HMD’s and CAVE systems are usually classified as immersive virtual reality (Freina and Ott, 2019). While virtual reality has recently become popular in a commercial environment, research work on the immersive aspects of systems has been ongoing for the past 50 years (Cummings and Bailenson, 2016). In an academic context, this research stretches back to the early 1960s (Freina and Ott, 2019) with a revival of interest in the 1990s (Slater and Wilbur, 1997). The current generation of VR technology has renewed interest and promise in the field. The VIVE and Oculus Rift along with the Microsoft range of VR headsets have revolutionised the cost and the portability of the technology which has led to a third phase of interest in the field (Castelvecchi, 2016). This phase of activity is particularly promising as the software to develop immersive worlds and contexts has become realisable with the low barrier to entry and high performing 3D game engines such as Unity3D and Unreal.

The Sensorama was prototyped and developed in 1962 and is a machine that is credited as one of the first immersive technologies (Freina and Ott, 2019). It engaged multiple senses with three dimensional full colour film sounds, smells and the feeling of motion. The first head mounted display was nicknamed “The Sword of Damocles” as it was so large it had to be bolted to the ceiling (Cummings and Bailenson, 2016). As the capabilities of immersive technologies has improved over the years research involving its implementation and usage in different fields has also been progressing (Gaggioli et al., 2016; Connolly et al., 2011). Immersive virtual reality has been examined in clinical change for over 20 years. In the early 90s different researchers used VR to counter anxiety disorders including fears of flying and acrophobia (Wiederhold et al., 2016). There were limits to the research at the time however due to the cost of the technology, costing over 100000 dollars for a machine (Castelvecchi, 2016). Cheaper, more readily available headsets means that the technology is more easily used in research projects, and more research and focus on the effects and utility of VR itself is under investigation, especially in the area of presence.
3.2.3 Presence

Presence is a theoretical concept under much debate in the literature with no one unifying description of its definition. There is consensus that it is a subjective experience linked to “a sense of being there” (Mikropoulos, 2006; Riva et al., 2004; IJsselsteijn et al., 2000; Cummings and Bailenson, 2016). Lombard and Ditton defined six conceptualisations for the use of the term presence.

1. Social richness - the extent the medium is perceived as sociable or personal when it interacts with other people.

2. Realism - The extent the medium can seem perceptually and socially realistic.

3. Transportation - The “sense of being there”.

4. Immersion - The amount your senses feel engaged by the experience.

5. Social actor - the realism of representations of people in the medium.

6. Medium as a social actor - How much the medium is seen as a social actor (Schuemie et al., 2001).

These six conceptualisations were separated into two different categories: physical and social.

- Physical elements consist of elements contributing to the sense of being physically located somewhere.

- Social elements refers to the elements that contribute to the feeling of actually communicating with someone (IJsselsteijn et al., 2000).

Slater and Wilbur link presence to the user’s psychology. They ask, how much does the individual experience the virtual setting as a place they are consciously present? (Cummings and Bailenson, 2016) This psychological model was then further expanded upon by Wirth. He described presence as a binary experience where self-location and perceived actions are connected to a mediated spatial environment and mental
capacities are bound by the mediated environment instead of reality (Cummings and Bailenson, 2016). In addition, the user needs to perceive themselves in the virtual environment and draw upon spatial cues in order to suspend belief and accept the imaginary world as reality (Chang et al., 2012). This process of accepting the imaginary world is a perceptually occurring process where a user can drop in and out of a feeling of presence in a virtual environment during an experience for a variety of different reasons: feeling distracted, ability to interact with the content, the match between sensors and display, the extent and fidelity of sensory information along with the users prior perceptual, cognitive and motor abilities (IJsselsteijn et al., 2000). In the socio-cultural viewpoint action defines social understanding, therefore they would view presence as a process that occurs when the environment behaves in a way that adheres to cultural expectations of the participant. This is then interpreted that same way by everyone experiencing the environment (Schumie et al., 2001).

As referred to earlier (section 2.2.1) a situated learning environment should conform to a users expectations and presence allows for these expectations to align. From a design perspective the intended VR intervention will need a measurement in order to investigate if it is succeeding in immersing the player in the experience through their assessment of their level of presence in the environment. It is therefore important to find an accurate measure of the experience of presence for research in order to investigate its effects. The next section details the work to date on finding a valid measurement tool for presence.

### 3.2.4 Measures Of Presence

In order to get an accurate measure of presence a large number of factors that contribute to the feeling of being in a virtual environment have been identified. These factors include:

1. The extent and fidelity of the sensory information. This is derived from Steuer’s notion of vividness and is the extent to which the technology can provide a sensorially rich mediated environment (Steuer, 1992).
2. The match between the sensors and display. This is the mapping of the user’s motor actions and the effects of their actions.

3. Content factors. This is the ability to interact with the content presented to us (Sheridan, 1992).

4. User characteristics. This includes the users prior perceptual, cognitive and motor abilities (IJsselsteijn et al., 2000).

5. Distractions that draw the user’s attention away to the real world diminish the user’s sense of presence (Slater and Wilbur, 1997).

Witmer and Singer believe any measure of presence should be reliable by being dependent on the characteristics under consideration alone and it should be validated by assessing what it intends to measure and accurately measuring it (Witmer and Singer, 1998). Currently there is no accepted singular assessment of presence. This is perhaps due to a lack of consensus in the community of an accepted definition for presence and the factors involved in the process. This has resulted in a fragmentation in the measures being proposed to measure the phenomenon. The most popular method of measuring presence is post-test questionnaires due to the fact that they don’t interrupt the experience and are easy to administer (Slater, 2009; Witmer et al., 2005; Gaggioli et al., 2016). Slater et al developed a post-test with three questions on the Likert scales (Usoh et al., 2000). The questions included their “sense of being there”, were there times when the computer generated world became the dominant reality, if they remembered the computer generated world as “something they seen” or “somewhere they visited”. Witmer and Singer developed a questionnaire which is the most popular determinate of presence to date. It involves asking questions on four of the categories of determinants discussed above: control factors, sensory factors, distraction factors and realism factors (Witmer and Singer, 1998).

The post-test questionnaire method has been criticised for various reasons. It is limited as it doesn’t provide a measure of any variations in presence throughout the test (Slater, 2009). Lombard and Ditton describe presence as “perceptual illusion of
non-mediation” (Riva et al., 2007). An experience where the physical environment disappears from the user’s awareness. It is a continuous response of the human’s sensory, cognitive and affective systems interpreting their environment. Post-test questionnaires are limited therefore to asking for an account from the user where they describe their experience from memory. This means the questionnaire does not accurately measure their continuous responses. The post-test also causes the subject to recount their experience as a whole and assess it together rather than displaying the range of times over the course of the experience where the subject felt present and dropped out of a feeling of presence.

Continuous presence assessment has been utilised and uses a slider whereby the subject continuously slides the measurement device during their experience (IJsselsteijn et al., 2000). This has been mainly used for non-interactive media however, because using the slider can cause distraction for the subject taking them out of their experience. Users having a clear understanding of the language involved in a post-test questionnaire is also a limitation. In a study by (Bouchard et al., 2008) 50 people were placed in a VR environment and were asked to rate their understanding of the items on several questionnaires that assessed presence. It found that 72 per cent of items were significantly more difficult to understand assessing presence than the control items the study drew from a different questionnaire, the highly reputable Beck Depression Inventory. This makes it difficult for the post-test questionnaires to be entirely accurate as subjects don’t fully understand what is being asked of them without a deep knowledge of the area. Objective measures have also been utilised involving the observer’s responses to stimuli within the environment. For example if an object is coming at the user do they duck to avoid it? The objective measure being assessed would have to be tailored specifically for the experience the user is intended to have. This measure is limited as it cannot be used as a measurement of presence across a range of experiences.

Physiological measures have also been investigated including galvanic skin response (Wiederhold et al., 1998). Galvanic skin response is a change in the electrical resistance of the skin caused by emotional stress and is measurable with a sensitive
galvanometer. These kinds of measures usually focus on eliciting an emotional response from the subject. In the literature on VR exposure therapy there has been a consistently reported correlation between presence and emotional experience (Diemer et al., 2015) however as stated by Slater (2003) emotions should not be confounded with presence. A reciprocal relationship does not mean they are the same (Bouchard et al., 2008). While research into the effects of presence lead theory development in relation to the field of virtual reality, presence can be limited due to the technical limitations of current VR devices. In the next section simulator sickness is discussed a common side effect related to interaction with current VR devices.

### 3.2.5 Simulator Sickness

Simulator sickness is a common aliment associated with prolonged VR interaction. It is associated with minor feelings of nausea similar to car sickness (Witmer and Singer, 1998). This issue is of key concern to virtual reality researchers as feelings of nausea lead to a lack of presence in their environment alongside ethical safety concerns. It can also potentially confound data, limit the effectiveness of training, and influence participant dropout rates (Brooks et al., 2010). Currently there is much debate in the literature about the direct causes of the ailment (Riccio and Stoffregen, 1991; Gallagher and Ferrè, 2018). The leading theory is the Sensory Conflict Theory, proposed by Reason and Brand (Gallagher and Ferrè, 2018). It believes that simulator sickness develops through a conflict between the sensory systems; the signals from visual, vestibular and non-vestibular proprioceptors differing from one another and causing them to alter expectations based on previous experience resulting in feelings of nausea.

Riccio and Stoffregen developed the Postural Instability Theory in response to this (Riccio and Stoffregen, 1991). They hypothesise that the symptoms of simulator sickness may be experienced when one has been exposed to long-lasting postural instability and doesn’t know how to adjust to this situation and maintain proper balance. This is similar to a traveller trying to get their "sea legs" while on a ship (Duzmanska et al., 2018).
Research in the area in the 1990s developed the simulator sickness Questionnaire published by Kennedy et al. (1993) which is still widely used today as unambiguous physiological indicators of simulator sickness have yet to be discovered. This questionnaire was validated through military training simulators testing for motion sickness. It is used to test the subjective severity of the simulator sickness symptoms.

The current VR technology in usage such as the Oculus Rift is compliant with the European medical device directive 93/42/ECC. Meaning the device is deemed suitable for consumer usage with experts in the field seeing simulator sickness as a relatively harmless side effect. Specific precautions can be taken into account in order to minimise the effects of simulator sickness as detailed by Brooks et al. (2010). These procedures are put in place during VR research experiments to safeguard participants who may experience any feelings of nausea or sickness. These procedures include: sessions being monitored and guided by the researcher and having sick bags, towels, and water available for all participants. The effects of simulator sickness must be minimised in order to create a successful design and intervention and thus must be tested for during the development of a VR intervention.

This section has discussed VR technology with an overview of its history of development, followed by a discussion into presence (the key objective of VR technology.) Research into the measurements of presence have been outlined followed by an overview of simulator sickness. Virtual reality technology is an interesting area of research which may offer many undiscovered learning benefits for language learners. The view formed in this thesis, is that the technology extends the research possibilities in the game based learning field rather than being an exclusive separate field. This relates to the Girvan definition of VR (Girvan, 2018). She views VR systems as a way to provide new methods to experience games and limit our perception of a world outside the game world by involving our senses to an ever increasing extent, enhancing our sense of immersion in the game. The final section of this chapter seeks to conclude by giving an overview of what has been discussed and summarises how this literature review has guided the theoretical development of the research design and the research questions under investigation.
3.3 Conclusion

Through this review of the literature the direction of the work has been clarified and a series of smaller research questions have been developed in order to answer the central research question. In a VR game a user experiences presence in the virtual environment when self-location and perceived actions are connected to a mediated spatial environment and mental capacities are bound by the mediated environment instead of reality (Cummings and Bailenson, 2016). When the virtual reality experience is accepted as a real place this allows the user to experience their new context which assigns new meaning to their interactions.

From a constructivist perspective language facilitates meaning making (Piaget, 1953) (Vygotsky, 1962). TBLT enables for learners to engage with language through analysable tasks in order to develop their language skills and motivation. This aligns with game systems which seek to provide an immersive experience through the players engagement with in-game tasks. Games provide scaffolding opportunities and allow players to engage with tasks in environments and contexts they otherwise could not. VR technology allows the participant to experience presence in this new context thus further expanding their contextual understanding of their environment. VR studies have begun to illustrate its potential for language learning in the areas such as vocabulary retention (Vazquez et al., 2018) and cultural awareness (Cheng et al., 2017).

In this literature review situated learning theory was initially explored followed by a discussion on the social constructivist theories which underpin the creation of the games designed to investigate the research questions (discussed in detail in the case study chapters 5, 6, 7). This was followed by an investigation into motivational theories, which progressed into an exploration of specific language learning motivational theories. The specific context of the Irish language community from a sociolinguistic and historical viewpoint was defined alongside previous research on the motivational attitudes of the community. A definition was proposed for games for the purposes of the intervention and a detailed review of previous research in the
field of game based learning was given. Virtual reality technology was defined for the purpose of the research and the various aspects of the field alongside a history of the research carried out in the area was explored.

Due to the theoretical concepts of situated learning and motivational theories proposed by the literature and due to the systematic nature of games which allows for an endless number of possible design decisions a mixed methods methodology is best suited for the research. In the next chapter the methodology is presented. A design based research approach is undertaken to answer the questions posed by this thesis.
Chapter 4

Design Based Research

4.1 Introduction

This chapter outlines the preliminary design framework of the thesis. In this phase the methodologies underpinning the research design are discussed. The chapter gives an explanation of Design Based Research (DBR) methodology and describes the framework used in this research in order to clearly situate the case studies carried out to answer the research questions posed.

The chapter outlines a formal approach to using DBR to develop a situated immersive VR game for Irish language learning. It’s a complex task to define what is
it we learn when engaging with a game. Decades of research into games has evolved the perception of how games affect learning. As the knowledge base of research in the field and games themselves have evolved in complexity, the methodologies and world-views have also changed thus changing how learning is assessed. (see section 3.1.7) One of the main critiques levelled at the foundational educational theories is that they do not offer a suitable framework for the design decisions required for educational designers, and often contradict each other on different aspects of learning (Anderson and Shattuck, 2012). The approach taken in this research is specifically designed with situated learning in mind. The thesis utilises DBR as a framework to show contextually valuable design decisions to help add to the state-of-the-art. The methodology uses a mixed methods analysis of qualitative and quantitative approaches in order to give a holistic analysis of an intervention.

### 4.2 Design Based Research

This section outlines DBR as an emerging methodology for the development of game-based learning environments. This methodology originates from the work of Brown (1992) and Collins (1992), it offers a flexible approach to educational research which is required for researchers authoring new environments to fulfil their learning agenda. DBR involves the creation of particular forms of learning, and the subsequent study of those forms of learning within the context defined by the means of supporting them. This designed context is subject to test and revision and the iterations that result play a role similar to that of variation in an experiment (Barab and Squire, 2004). The term DBR came into use in 2001; between 2001 and 2010 a total of 1940 papers using the term were published (Orngreen, 2015). While the testing methodologies incorporated under a DBR experiment can vary they have a set of underlying principles behind their utilization:

1. They are situated in a real educational context (Orngreen, 2015).

2. They focus on the design and testing of a significant intervention (Anderson
and Shattuck, 2012).

3. They utilize mixed methods as a means of analysing the interventions effects (Zheng, 2015).

4. They involve multiple iterations: refining their design based off the previous cycle (Abdallah and Wegerif, 2014).

5. They involve a collaboration between practitioner’s, researchers and participants (Koivisto et al., 2018).

6. They offer comparisons to action research (Randolph, 2008).

7. They seek to offer a practical impact on practice (Rüschoff and Ritter, 2001).

8. They introduce newly found design principles from the research process to advance theory and practice (Koivisto et al., 2018).

This focus on an authentic setting, multiple iterations and mixed methods analysis is vital because of the emergent nature of game-based technologies. The emphasis of the design is not on generating truths across all games but to inform specific interventions to help guide theoretical frameworks (Dawley and Dede, 2014). As Human Computer Interaction (HCI) researchers have discovered

“It will never be possible or desirable to establish an ideal, complete theory of interaction design practice” (Goodman et al., 2011, 8).

A DBR paradigm understands this same underlying assumption from an educational perspective. “River City” is one of the best-known games developed using a DBR methodology. It’s focus was on examining situated learning in a multi-user environment game environment. Their ability to iterate and change their theory and research methods as the cycle unfolded lead them to discovering learning patterns that were ... “not well captured in traditional pre/post-test measures” (Ketelhut et al., 2007, 21).

Figure 4-1 highlights the structure of DBR research in education and technology studies. The preliminary phase may include a range of strategies to formulate the
research problem including a literature review, research about previous similar studies and interviews with the context group the intervention involves. After the preliminary phase a design framework is created which is followed by an iterative design of the intervention. Each iteration is informed by the results from the previous iteration. This is followed by a reflective phase where the results are analysed and contributes to theory and practice and frameworks are developed.
Figure 4-1: Diagram of Ph.D. Structure of Design-Based Research In Educational Enquiry And Technological Studies (Abdallah and Wegerif, 2014)
4.2.1 Framework of DBR

Design based research is based on the continual refinement of a design intervention (Barab and Squire, 2004). It is cyclical in its nature and follows six stages:

1. A review of the literature in the field the intervention is being targeted (Zheng, 2015).

2. This is followed by the design of a new intervention using the previous state of the art as a starting point (Goff, 2017).

3. The third phase is the implementation of the design intervention within the specific context group it intended for (Koivisto et al., 2018).

4. The fourth phase is to use traditional science methodologies for data gathering on the intervention (Ketelhut et al., 2007).

5. The fifth phase is to analyse the results of design intervention (Dawley and Dede, 2014).

6. This analysis leads to a new cycle where the product is refined, and the cycle begins again (Abdallah and Wegerif, 2014).

In a postpositivist research experiment a hypothesis is constructed and tested rigorously with experimentation. The results then align with a hypothesis, partially align, or do not (Creswell, 2014). These results are then disseminated, and this is how impact is traditionally analysed. The next section will outline how DBR experimental design differs to this traditional approach.

4.2.2 How DBR Differs from Scientific Method Design

The scientific method follows the postpositivist world view. It challenges the absolute truth of knowledge and recognizes we cannot be positive about our claims of knowledge when studying the behaviour and actions of humans and derives from the work of regarded theorists including Newton (Newton and Thayer, 2012) and Locke.
(Locke, 1912). Design based research separates itself from the scientific method in three ways:

1. Design based research was developed to deal with the complexities and the large number of variables that exist in educational research: the participants, the context, the teacher and a myriad of other variables exist in educational research. Traditional scientific measures being used in the field of education ignore these variables or isolates them from the experiment. This leads to conclusions that don’t have a full picture of the impact an intervention can have in an educational context (Easterday et al., 2016).

2. Design-based research accepts that educational contexts have too many variables to account for and instead it attempts to focus on understanding the messiness of real-world practice. Context is key under the methodology and not a trivial variable (Orngreen, 2015).

3. As context serves an important purpose under the methodology the design of interventions leads to localised small-scale experiments to refine the design of the intervention and measure the impact it’s having. These localised results are then used to create generalisable theoretical claims based on the results (Nelson et al., 2013). This is a major split from the scientific method of experimental research, but it is a crucial element when focusing on the design of games. This is due to the vast number of variables underlying game design. Focusing on the exploration of a specific context and how the game has modified this context under specific design parameters leads to more applicable results which gives a fuller account of the nature of the impact of the game.

Figure 4-2 shows how design based research has developed. It combines the six stages of design and incorporates mini design cycles of quasi experimental design in order to compile a holistic measure of an intervention and its effects.
Design-based research measures its success by the impact the design has on its context. If a designed intervention is failing to achieve its desired impact the design is seen as failing in its intent (Abdallah and Wegerif, 2014). To measure if an intervention is successful its important to use accurate research instruments that validate the theory under investigation. The next section examines the mixed methodology being implemented in this thesis.

### 4.3 Mixed Methods Research

Qualitative and quantitative approaches should not be viewed as rigid dichotomies. Instead, they represent different ends on a continuum where mixed methods intersects in the middle (Newman et al., 1998).

Qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem (Grbich, 2012). The process of qualitative research involves emerging questions and theories from data collected in the participant’s setting (Charmaz, 2006). Analysis is built through general themes or specifics found in the data. The researcher makes interpretations of the meaning of the data (Cardano, 2020). This method of research supports a focus on individual meaning and representing the complexity of situations (Creswell, 2014).

Quantitative research is an approach for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically...
on instruments, so that numbered data can be analysed using statistical procedures (Sukamolson, 2007). Those who engage in this form of inquiry have assumptions about testing theories deductively, building in protections against bias, controlling for alternative explanations, and being able to generalize and replicate findings (Creswell, 2014).

Mixed methods research is an approach to inquiry that involves collecting both quantitative and qualitative data, integrating the two forms of data using distinct designs involving philosophical assumptions (Vanderstoep and Johnson, 2008). The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Brannen, 2017).

This thesis follows an explanatory sequential mixed methods method (Creswell, 2014). In this methodology the researcher first conducts quantitative research, analyses the results then builds on them with qualitative data. In the next section the research instruments of the experimental design are discussed in detail.

### 4.4 Research Instruments

This section examines the data gathering methods used in this research in more detail. In keeping with the aforementioned guiding principles of DBR, a number of different methods are used. A number of case studies have been carried out using these methods and tools, and the overall approach of these case studies are discussed.

#### 4.4.1 Questionnaires

Questionnaires were chosen as the main source of data for the study as they offer a measurable metric for comparison between the pre-test and post-test. They are useful for asserting attitudes towards specific languages and the language learning process in different environments (Dörnyei and Csizér, 2012). The questionnaires involved in this study include: The L2 Motivational Self System Questionnaire, a vocabulary retention questionnaire, a simulation sickness questionnaire, a presence questionnaire
and a National Aeronautics and Space Administration Task Load Index (NASA TLX) questionnaire.

### 4.4.2 Participants

The context of the participants was vital for the study as it measured the motivation of current adult Irish language learners in a language learning context. The first case study was used as a pilot study. Usability of the research questionnaires and the game’s design was the chief concern of this study. Therefore, a local easily accessible participant group was recruited for this. Game design students from TU Dublin were chosen for the investigation. A total of seven students participated in the first study.

For the second case study in order to assess the impact in a more suitable context, information sheets were given to Irish language classes organised by Oifig na Gaeilge TU Dublin. All participants of the study had to be currently partaking in the Irish language classes. This had a potential pool of participants of around 100 students currently taking Irish language classes within TU Dublin. A total of thirteen students participated in the study.

In the third case study participants were second and third year students from a primary school teaching university. Each student was required to take Irish language classes throughout their time in the university. Information sheets were given to each student about the study. Participants were recruited from these classes, with a potential recruitment pool of 220 students across years 2 and 3. There was a total of ten students in the third case study.

Each iteration was conducted with a limited number of participants due to educational ethical concerns. It was not possible to conduct the study during classroom time as this would affect the teaching time for lecturers in the colleges. This had a limiting effect on the number of participants it was possible to gather. Virtual reality technology is also a solitary experience where it is only possible for one participant to engage in the experience at a time. The equipment needed someone near the participant in order to ensure they did not walk into anything in their real-world environment and cause themselves injury. The third case study involved
participants going through multiple sessions of interaction with the game in order to get an accurate picture of how the game affected participants once they were comfortable with the control system and the novelty of a new experience wore off.

As a result of these issues each iteration involved a large voluntary time investment of one hour for each participant engaging in the study. It was not possible to incentivise participants with a reward for engaging with the research as the research involves motivated behaviour and this incentive would have impacted the results.

4.4.3 Pre-test

Before interacting with the virtual environment a pre-test questionnaire was given to participants in each case study. This was to address an issue with current educational research studies where only 19% of technology in education studies contain a pre-test to post-test condition (Randolph, 2008). Educational studies, in particular those that investigate classroom interventions that focus on motivational and attitudinal changes often lack a suitable pre-test questionnaire which does not allow for comparison or the ability to measure post intervention data (Randolph, 2008). The questionnaires were adapted into an Irish context from the motivation questionnaire used in a 2008-2009 comparative study by Zoltan Dörnyei (Dörnyei, 2010) utilizing his L2 Motivational Self System. Only minor adaptations were made including modifying the target language mentioned from English to Irish and changing the locations mentioned in the questionnaire to Ireland and the Gaeltacht. This questionnaire was utilised as it a commonly used quantitative measure of situated language learning. In the third case study a vocabulary test of the possible words the player could be asked to find in the virtual environment was added in order to test the retention rate of words learnt in the VR space. This was introduced in the third case study as participants had multiple interactions with the design so retention could be measured.
### 4.4.4 VR Space

In the first and second case studies once the questionnaires were completed each participant was brought to the virtual reality interaction lab (Figure 4-3a). This lab has been specifically designed for virtual reality research and offers a large space of 3.3m x 2.0m giving the participant free movement around the virtual reality space with soundproof walls so no audio distractions could break the participants presence during the experience (Witmer and Singer, 1998). The room has two VIVE lighthouses tracking the user around the space. Each game utilises VIVE’s Chaperone system which tells the participant immersed in the game where the real world boundaries are which had been marked out previously in the lab space.

In the third case study a large empty classroom located near the participants was utilized (Figure 4-3b). The third case study used the Oculus Rift S as a HMD and therefore did not need the VIVE lighthouse system as it contains an inside out tracking system capable of turning any area into a virtual reality environment (see section 7.3.2). This was valuable in order to recruit and retain participants in a location convenient to them.

![Figure 4-3: Images of the VR Spaces Used For Experiments](image-url)
4.4.5 Post-test Questionnaires

After the experience was finished in the first case study participants completed a simulation sickness questionnaire (Bouchard et al., 2012b) followed by a presence questionnaire (Witmer et al., 2005) reporting on their time interacting with the experience. These questionnaires were used to investigate if the design was working for its intended purpose.

Simulation sickness is a common concern for virtual reality environments and this made it an important aspect to consider when exploring the impact the experience had on the participants. The NASA TLX questionnaire was also used to investigate the task load of participants interacting with the game however the study already contained many questionnaires for the participants to complete and the NASA TLX didn’t give reliable results, as only the unweighted version of the test could be trialled in the time permitted to the participants. Finally participants completed a post-test motivational L2 self system questionnaire, this version of the questionnaire was modified to only include items that were deemed to be the most pertinent in relation to this research: Ideal Self and specific features of the L2 learning experience: linguistic self-confidence, Irish anxiety, attitudes towards learning and integrativeness. Minor alterations were made to ask about interactions in the virtual reality environment rather than the classroom environment in the Irish anxiety, attitudes towards learning and linguistic self-confidence scales. It also included open-ended questions designed to investigate the exploratory aspects of the research. These questions helped elicit open-ended answers and insights so were maintained in subsequent iterations. In the third case study focus groups were added alongside a post-test vocabulary questionnaire.

4.4.6 Vocabulary Design

In the third case study’s game there are four levels of difficulty. The level of difficulty was decided by how common the frequency of use for the vocabulary in the shop was. Sixty four items from the shop were chosen out of the possible 153 objects.
These sixty four items are all the possible combinations from each level in the game that participants can be asked to retrieve by the characters in the game. The levels were designed by grading the frequency that a group of ten fluent speakers from different Gaeltacht regions including: Connemara, Donegal and Kerry, were able to accurately identify the sixty four items. The items were then divided into four groups of twelve items. The first group of twelve items were the items that had been correctly identified the most by the fluent speaker group. These items were then used as the objects required for the easy level. The next twelve items were grouped as the medium level and the same process was used to designate the items for the hard and very hard levels. This approach was utilised in order to offer a sense of authenticity to the vocabulary utilised in the design and to give the vocabulary mixed regional dialectic recognition (see section 2.3). In each level the participant was required to retrieve four items. The game was designed to randomise between the twelve items in each difficulty level to choose four items for the player. This meant that the player was not able to memorise the exact combination to complete a level but instead, on each play-through they were presented with a different selection of the vocabulary. This required the player to understand the vocabulary in order to progress through each level. This ad hoc method of creating a difficulty curve for the vocabulary within the situated environment highlights some of the gaps within minority language research. Major global languages have large-scale ethnographic studies examining the frequency of use of common terminology and word frequency for their communities of practice in relation to different regions. This allows them to build tools of use to language researchers and teachers. The "Dolch List" created by Edward William Dolch in English language learning is a widely utilised frequency list of the most useful 220 'service' words for reading instruction used by English language teachers (Simonton, 2019). Among minority language researchers there is a lack of the same breadth and depth of investigative sociological ethnographic studies. Teresa Lynn and the Adapt centre in DCU currently investigate these issues with Irish language research utilizing machine translation tools to investigate Irish language use with popular internet social sites like Twitter and Wikipedia. These tools
have been utilized to examine linguistic features among the Irish speaking community such as code switching (Lynn and Scannell, 2019), and morphological features (Lynn et al., 2017). Designing situated environments will always present a certain degree of challenge for linguists, researchers and game designers. The language in an immersive situated environment is very specific towards the context. For minority languages this can pose problems as with the case of Irish. The community of speakers in Gaeltacht regions use English word substitutes in their everyday language for vocabulary that aren’t widely spoken in the community. These substitutes become recognised as authentic speech among the native speaking communities and the official standardised words within dictionaries are referred to in a derogatory fashion by the authentic native speakers as "Book Irish" as it isn’t used in authentic settings and feels false to the native speaking communities (Nic Fhlannchadha and Hickey, 2018). Situated immersive environments offer speakers a real context to use these definitions in a more naturalised setting which can help to naturalise their use. If the gaming environment however uses too much inauthentic language it will lose authenticity for players and thus make players feel less present and less willing to adopt practices from the game. This is a challenging dichotomy to overcome and highlights the benefits of design based research in involving the context group of an intervention during the design phase to ensure the experience is authentic for players. A full investigation of this particular aspect of the study is beyond the full scope of this research but warrants future investigation.

4.4.7 Focus Groups

In the third case study of the experiment focus groups were conducted with the participants. This was done in order to gather more qualitative data about how the intervention effected the participants. The questions of these focus group interviews were themed across the various aspects under investigation uncovered by the literature review, the following themes were the focus of these questions:

1. Situated learning.

3. Task Based Learning.

4. Flow and Scaffolding.

5. Novelty and Enjoyment.

6. Presence and Simulator Sickness.

7. Language Anxiety and Self-Efficacy.

8. Design Improvements.

The following section examines the methods of analysis for the research. As it is a mixed methods study this involves a mixture of both statistical analysis and thematic coding.

4.5 Analysis Methods

In order to correctly investigate if an intervention is having the desired effect on participants it is important that the analysis methods of the study justify its direction. This section begins with an investigation of statistical analysis followed by a discussion on the student t distribution, finally thematic analysis and the coding process of the qualitative work is discussed.

4.5.1 Statistical Analysis

Two main statistical methods are used in data analysis: descriptive statistics, which summarizes data from a sample using indexes such as the mean or standard deviation, and inferential statistics, which draw conclusions from data that are subject to random variation (Härdle et al., 2013).

Descriptive statistics are most often concerned with two sets of properties of a distribution sample or population: central tendency seeks to characterize the distribution’s central or typical value, while dispersion characterizes the extent to
which members of the distribution depart from its center and each other (Raykov and Marcoulides, 2013).

Inferences on mathematical statistics are made under the framework of probability theory, which deals with the analysis of random phenomena (Tabak, 2014).

This thesis uses the T distribution in its analysis alongside an evaluation of the descriptive statistics found during the study. The next section gives a brief description of the T distribution and explains why it was suited to this study.

4.5.2 The Student T Distribution

The T-Distribution, also known as Student's T Distribution gets its name from William Sealy Gosset who first published it in his 1908 paper titled Biometrika using his pseudonym "Student" (Student, 1908).

The distribution was created at the Guinness Brewery in Dublin, where analysing the chemical properties of barley involved very small sample sizes. He published the paper with the title "Student" because Guinness did not want competitors to know they were using the t-test to investigate their raw goods quality (Boslaugh, 2012). The most common usages of t-tests are:

The two-sample location test of the null hypothesis so the means of two populations are equal. All such tests are usually called Student's t-tests, but should be named the Welch t-test if the variance is not equal. They are known as "unpaired" t-tests, as they are used when the statistical units underlying the two samples are non-overlapping (Skaik, 2015).

Paired samples t-tests consist of a sample of matched pairs of similar units, or one group that has been tested twice a "repeated measures" t-test. This is the version of the t-test used in this investigation. The participant's numbers before and after an intervention are compared, therefore each participant acts as their own control. The correct rejection of the null hypothesis of an intervention making no difference can become much more likely, with statistical power increasing simply because the random inter-participant variation is eliminated (Raykov and Marcoulides, 2013).

The paired version of Student's t-test has only n/2-1 degrees of freedom n being
the total number of observations. Pairs become individual test units, and the sample has to be doubled to achieve the same number of degrees of freedom. Normally, there are n-1 degrees of freedom n being the total number of observations (Kim, 2015). Paired samples t-tests are often referred to as "dependent samples t-tests".

Once the t value and degrees of freedom are determined, a p-value can be found using a table of values from Student’s t-distribution. If the calculated p-value is below the threshold chosen for statistical significance the 0.05 level, then the null hypothesis is rejected in favour of the alternative hypothesis (Boslaugh, 2012). The next section details the qualitative method of analysis which consisted of thematic and a priori coding from the qualitative questionnaires and open ended questions.

4.5.3 Thematic Analysis and Coding Process

Much of qualitative coding can be attributed to either grounded or a priori coding. Grounded coding refers to allowing notable themes and patterns emerge from the document themselves, where as a priori coding requires the researcher to apply pre-existing theoretical frameworks to analyse the documents (Grbich, 2012).

Coding methods are applied across various texts, in the case of this study they were applied across the interview transcripts and the open ended questionnaires. It allows the researcher to apply axial coding, which is the process of selecting core thematic categories present in several documents to discover common patterns and relations (Charmaz, 2006). There are “no absolute hard-and-fast rules” to coding (Blair, 2015) making the process subjective to the researcher’s theoretical framework and priori schema. The priori schema was built from the literature review this is referred to as template coding. Eight themes were developed for the schema including:

1. Situated learning
2. Motivation
3. Task Based Learning
4. Flow and Scaffolding
5. Novelty and Enjoyment

6. Presence and Simulator Sickness

7. Language Anxiety and Self-Efficacy

8. Design Improvements

The process at this point involves In Vivo coding where the researcher codes the terms and phrases used by the participants themselves. The objective of this process is to attempt to give the participants a voice in the research (Cardano, 2020). This allows for collaboration between researchers and participants a key underlying principle of the DBR paradigm (discussed in section 4.2.)

After assembling codes they are organised into broader themes and categories. The process involves identifying themes from the existing codes, reducing the themes to a manageable number, creating hierarchies within the themes and then linking themes together through theoretical modelling (Brannen, 2017). The coding process is very particular to the individual study (Elliott, 2018). Qualitative data seeks to highlight emergent questions and reasoning, is open and depends on context and therefore it requires a flexible non-rigid individualistic analysis of the data.

The process can be done manually, which can be done by highlighting different concepts with different colours, or a software package such as Nvivo can be used. This research opted to use the Nvivo package in order to save time to utilise some of the other functionality in the software that was deemed to be useful for the qualitative aspect of the investigation. Nvivo is a tool for speeding up the coding process however it is only a software for aiding the work but not doing the work (Zamawe, 2015). The researcher still makes the judgements of what is to be included or not through their priori schema.

In this thesis, the researcher recorded and transcribed the interview transcripts from the focus groups and used the Nvivo package to code the transcripts. The priori schema was broken into the eight themes detailed above. In Nvivo the researcher created eight nodes from these themes and read through the transcripts highlighting
and analysing any of the participant’s feedback that corresponded to a particular theme. The process was repeated several times to ensure rigour in the selection of feedback for each node. The feedback from each node was then analysed and contextualised with prior research and is detailed in chapter 8.

Figure 4-4 shows an example of node analysis using Nvivo coding. The following section explains the specifics of the experimental design for the thesis.

![Node Analysis Example Using Nvivo Coding](image)

**Figure 4-4: Node Analysis Example Using Nvivo Coding**

### 4.6 Experimental Design

The design of the virtual reality learning game named GaeltechVR was developed using DBR methodologies. Its goal is to investigate the effect of VR technology for situated Irish language learning. As discussed previously in section 3.2, the main function of VR is for the user to perceive themselves in a virtual environment and draw upon spatial cues in order to suspend belief and accept the imaginary world as reality (Neville et al., 2009). This evolves the nature of a DBR experiment as the VR environment becomes the context of the user. The authentic setting of the classroom/the real-world dissolves if the user accepts the VR environment as real. DBR allows researchers to examine how users interact in this immersive game environment. Utilizing a mixed methods examination of the context the research seeks
to create a profile of the language community, examine their in-game experiences and explore their learning outputs after use.

Figure 4-5 illustrates the intended methodology which involves:

1. A profile of the users’ attitudes and motivations towards the language are recorded using language questionnaires.

2. Post-test questionnaires are used to explore usability issues in the design along with closed and open-ended questions to explore the learning that took place.

3. This process is iterated upon, with changes made to the environment based on the data.

4. Focus groups are utilized in the third case study to uncover new learning dynamics along with the other research tools from phase 1 in order to build a holistic view of the intervention and see how the changes to the context are modifying the users’ learning patterns.
The following section highlights how this experimental design aligns the research instruments to the central research question of the study and the subsequent questions defined through the literature review.

4.7 Mapping the Research Instruments to the Research Questions

In order to answer the research questions posed in this study its important that the research instruments clearly align with the questions posed. In this section each research question is linked to the research instruments being used in order to answer the question. The central question of the thesis asks:

**Can contemporary immersive game based tools and methods be used to develop situated language learning game environments to improve learner’s motivation and anxiety in the Irish language?**

This question is divided into four novel research questions:

1. **Can game based situated Irish language environments improve language learner’s motivation?**

   This is being investigated through the pre-test to post-test situated language questionnaires using the L2 self system questionnaire (Dörnyei, 2010) and the focus groups in the third cycle of the experiment.

2. **What consideration must be given to pertinent design issues, like presence, when designing and implementing a VR language learning experience?**

   This is being investigated through the user’s sense of presence and simulator sickness in the environment using the Witmer and Singer (1998) presence questionnaire and the Bouchard et al. (2008) simulator sickness questionnaires alongside data analytics from the Unity game engine and the focus group in the third cycle of the research design.
3. How does interaction in an immersive situated game based Irish language learning environment affect a participant’s self-efficacy and anxieties to engage with the Irish language?

This is being investigated through the pre-test to post-test situated language questionnaires using the L2 self system questionnaire (Dörnyei, 2010) and the focus groups at the end of the third cycle of the experiment.

4. Can immersive situated game based Irish language learning environments lead to improved Irish language vocabulary retention for participants?

This is being investigated through a pre-test to post-test vocabulary test that all participants will complete during the third cycle of the experiment.

Figure 4-6 highlights each research question and the research instruments being used in order to investigate the specific question. The next section highlights the ethical considerations undertaken to ensure that rigid procedures in ethics were adhered to.
4.8 Ethical Considerations

As this research involved human participants alongside a variety of data collection procedures and required the permission of two third level colleges in order to conduct the study, there were several important ethical considerations to consider.

### 4.8.1 Ethical Committees

The study required clearance from two separate ethical committees: TU Dublin’s Research Ethics Committee and MERC, Marino Ethics in Research Committee. The TU Dublin committee was required in order to allow the first two experiments to be considered alongside the ethical clearance for the entire experimental design. The MERC committee was required to give clearance in order to allow the third case study to occur inside the college grounds. The following sections highlight the main areas

---

**Figure 4-6: Diagram Mapping Research Instruments to the Research Questions**

| Research Question 1 | 
|---------------------|---|
| Can game based situated Irish language environments improve language learner's Ideal L2 Self? |  |
| Dornyei L2 Self System Questionnaire | Open Ended Questionnaires | Debriefing Session Recordings |

<table>
<thead>
<tr>
<th>Research Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>What consideration must be given to pertinent design issues, like presence and simulator sickness, when designing and implementing a VR language learning experience?</td>
</tr>
<tr>
<td>Witmer Presence Questionnaire</td>
</tr>
<tr>
<td>Bouchard Simulator Sickness Questionnaire</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>How does interaction in an immersive situated game based Irish language learning environment affect a participant's confidence and anxieties to engage with the Irish language?</td>
</tr>
<tr>
<td>Dornyei L2 Self System Questionnaire</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can immersive situated game based Irish language learning environments lead to improved Irish language vocabulary retention for participants?</td>
</tr>
<tr>
<td>Pre-Test to Post-Test Vocabulary Assessment</td>
</tr>
</tbody>
</table>
of ethical interest in the study.

### 4.8.2 Informed Consent

Informed consent is required in all studies and research using human participants. The consent to participate should clearly outline the purpose of the study and what the information gathered will be used for. This study clearly outlines its goals and purposes in the information sheet given to the participants during the recruitment phase. All participants were required to sign and agree to the consent form before engaging in the study which also outlines these goals and purposes.

It was ensured that only students from year 2 and 3 of their undergraduate degree were recruited to ensure that all participants were over the age of 18. In each cycle of the design the experiment was designed independently of any Irish language courses the students were engaging in. They did not take place during any lecture time and were independent of any classes being held. The experiment was also on a voluntarily basis and therefore no student was being advantaged/disadvantaged by their engagement with the study in relation to their education. There were no incentives used with participants and they were participating out of their own free will. There was no power dynamics between the researcher and the students. The experiment was timetabled during each cycle so it did not interrupt regular attendance of class. All emails and phone numbers collected during the period of recruitment followed GDPR guidelines.

### 4.8.3 Data Protection Guidelines

The following protocols were used to ensure adherence to data protection guidelines during the studies:

1. Data Minimisation: Only the minimum amount of personal data was retained from subjects.

2. Retention: Contact information for the participants was only retained for the duration of the experiment.
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3. Security: The email and phone numbers was kept confidential and password protected with only the researcher having access to them.

In addition to these measures specifically for the collection and recording of the focus groups interviews the 8 general rules of data protection were followed:

1. Fairly obtained: the investigator identified who they may share the data with an informed explicit consent through a plain language statement.

2. Processed only for a specified lawful purpose(s): The purpose the data is required for i.e. the nature of the research was stated.

3. Data cannot be used later for an alternative purpose: The data was anonymized before being used and the subjects were made clear in the consent form of this policy.

4. Kept safe and secure: Only the investigator had access to the data and it was encrypted and password protected in a locked cabinet.

5. Accurate up to date: The data was periodically reviewed for accuracy.

6. Adequate, relevant not excessive: No unnecessary data was asked for.

7. Not retained for longer than necessary: The data was anonymized so wasn’t to be retained after this process.

8. Data Subject’s ‘Right to Access’: The data was anonymized so the subject has no personal data belonging to the researcher to have a right to access.

Any names or identifiable information were deleted from the recordings by the primary investigator using sound editing software. The transcription was done by the primary investigator whereby the subjects names and identifiable information was anonymized and instead used coded letters instead of names e.g. "aa"

All data was stored on an encrypted hard drive in a locked press in TU Dublin Aungier Street. The encrypted hard drive containing the data will be reformatted, wiping it of all information and then it will be destroyed once the data is no longer
needed for the study. This will be after the work has been disseminated through papers and the PhD is completed and evaluated. The next section highlights some specific ethical considerations of the study as a VR investigation.

4.8.4 Restrictions with VR Technology

VR technology has several specific ethical restrictions in a research context. The primary concern involves simulator sickness which is a common aliment associated with prolonged VR interaction. It is associated with minor feelings of nausea similar to car sickness.

The Oculus Rift the VR equipment being utilized for the experiment is compliant with the European medical device directive 93/42/ECC. This means the device is deemed suitable for consumer usage in Ireland.

The study is upholding top ethical conduct for research in VR with specific cautions taken into account sourced from up to date published research in the field (Brooks et al., 2010).

Procedures were put in place to safeguard participants who experienced any feelings of nausea or sickness. These procedures included: each session being monitored and guided by the researcher, sick bags, towels, and water that was available for all participants.

4.9 Conclusion

As technologies have evolved over the last 30 years the nature of game-based learning has also been evolving. VR technologies are aiding the sense of immersion by removing players from their real-life context and placing them into a new virtual context. This offers unique opportunities for the research community to investigate the learning potential of virtual environments. Design based research is a methodological toolkit which reflects these needs and demands. Iterative design and an investigation of the changes they cause to participants enriches the design of the game and can be used to investigate that the game is having its intended effect. Utilising a mixed methodology
allows for a holistic investigation of participant’s experiences of an intervention. This holistic analysis gives a much deeper understanding of how the intervention is effecting participants and how design changes alter the learner’s understanding. Figure 4-7 demonstrates how the design has changed over the course of the research and its iterative design stages.

![Figure 4-7: The Design Based Research Development Of GaeltechVR](image)

Over the course of this chapter there was a discussion of mixed method research. DBR research was explained with the need of this methodological toolkit being highlighted. A conceptual framework for its usage followed this. A description of the research instruments guiding the research and the analysis methods of the research was discussed. Finally the experimental design was highlighted, the research questions were mapped to the research instruments and the ethical considerations of the study were considered.
Chapter 5

First Case Study

5.1 Introduction

The following four chapters discuss the prototyping phase of the thesis where the intervention was iterated upon in three separate design cycles. The first case study of the experimental design began the prototyping phase of the DBR research design (see section 4.2). This case study involved the creation of an initial prototype for the intervention. It was used as a pilot study to test the questionnaires and implementation of the game being used for the study. A basic implementation of the game was created in Unity3D (Haas, 2014) (game development software used...
by professional game development companies). Participants were capable of moving around a shop environment and picking up the items in the shop. The items in the shop had a physics-based system so interacted in a realistic manner, grounding the experience in a real-world context. When a participant picked up an object an audio cue played telling the participant what they were holding. This was to provide feedback to the participant and to scaffold their learning so they could improve their vocabulary acquisition. Participants engaged with the VR game for 20 minutes and completed pre-test and post-test questionnaires about their interaction with the game, alongside motivation, simulator sickness and presence questionnaires. These questionnaires contained both quantitative and qualitative elements for analysis.

5.2 Experimental Design

The first case study involved B.A. in game design students from TU Dublin (n=7). The aim of the first case study was to test basic functionality and implementation of the VR game and to evaluate the questionnaires being proposed for the study. Figure 5-1 outlines the experimental design of the first case study which is outlined in further detail in the following sections.
Chapter 5 First Case Study

Case Study One
Pilot Study

TU Dublin Game Design Students (n=7).

Figure 5-1: First Case Study Research Design

5.2.1 Pre-test

The pre-test involved the participants completing the Dörnyei L2 Motivational Self System questionnaire (Dörnyei, 2010). As discussed in section 4.4.3 only minor adaptations were made changing the target language mentioned from English to Irish and changing the locations mentioned in the questionnaire to Ireland and the Gaeltacht. This questionnaire was used in order to measure the motivational experiences of the context group before participants interacted with the intervention.

5.2.2 Experiment

Participants then played the first version of the game for a twenty minute sessions. The game consisted of a VR environment that resembled a shop with 63 items each of which the participant could pick up. Audio would play and text would be displayed telling the participant what they were holding in Irish. Scaffolding is a constructivist theory that explains social learning. Learners first succeed in
performing a new function with the assistance of an experienced mentor and then internalize this function so that they can perform it unassisted (Ellis, 2000). Games can act as the experienced mentor and allow participants to progress at their own pace and get information when they need it (Gee, 2006) as explained in section 2.2.2. The system of the game does this through feedback. In the VR game scaffolding is incorporated when a participant picks up an item the word is said in Irish and text appears showing the word above the object in Irish. The participant could teleport around the environment and all the items had real world physics implemented. The participant could place any object they found in the shop into a bag they were holding.

5.2.3 Post-test

The post-test involved the following questionnaires:

1. A post-test L2 Motivational Self System Questionnaire with amendments to questions to include the virtual reality environment and open ended questions to measure the exploratory aspects of the study (Dörnyei, 2010).

2. A simulation sickness questionnaire (Bouchard et al., 2012b).


4. The NASA TLX questionnaire (Hart and Staveland, 1988). The NASA TLX questionnaire enables various loads to be tested to ensure that the experience is not too demanding or stressful on the various scales (Physical, Mental, Temporal, Performance, Effort, Frustration). It also ensures that the design was not influenced or skewed by unknown stressors. It acted as a validation of sorts to the overall design of the VR experience.

5.3 Design Of The VR Game

This section details the specifics of the design of the VR game highlighted the decision choices of the initial build of the game. Figure 5-2 shows several screenshots of the
Chapter 5  First Case Study

prototype design.

![Prototype Screenshot 1](image1)
(a) Prototype Screenshot 1

![Prototype Screenshot 2](image2)
(b) Prototype Screenshot 2

![Prototype Screenshot 3](image3)
(c) Prototype Screenshot 3

![Prototype Screenshot 4](image4)
(d) Prototype Screenshot 4

Figure 5-2: Screenshots Of The First Case Study Of The VR Game

The screenshots show the basic layout of the shop and the graphical fidelity of the scene. Figure 5-2c shows how players are capable of interacting with the items in the shop and knocking them over. There was over 60 items in this iteration of the shop. The context and the vocabulary chosen for the shop derived from the National Irish primary school curriculum themes (na hÉireann, 1999). Every word was translated for accuracy using www.tearma.ie, the national terminology database for Irish (Tearma.ie). The Irish speech synthesis system, abair.ie (Ní Chiaráin and Ní Chasaide, 2016) was used for the vocabulary.

5.3.1 Immersion

Immersion is usually defined as the technical, objective aspects of virtual environments (Jennett et al., 2008) (see section 3.2.3). Facilitating the immersive aspects of the experience was important as the designer has direct control over these
Chapter 5  First Case Study

aspects of the design. Figure 5-3 shows an image of the HMD used for the experiment the VIVE Pro Headset alongside the controllers. At the time the experiment was conducted the VIVE Pro was the most advanced virtual reality headset available offering a deeper level of immersive design.

![Vive Pro Headset And Controllers](image)

Figure 5-3: Vive Pro Headset And Controllers

The design decisions implemented in order to improve the immersive aspects of the design included:

1. Designing for the HTC VIVE Pro. Its features are currently the highest specifications for VR equipment. This includes an AMOLED display, 2880 x 1600 (615PPI) resolution and a 90Hz refresh rate.

2. The use of the soundproof VR lab with suitable space for movement for participants.

3. The virtual world was designed and tested using an Alienware desktop with dual 1080ti graphics cards, 16gb RAM and an i7 processor.

5.3.2 Presence

Presence is defined as the subjective experience of being in one place or environment, even when one is physically situated in another (Witmer and Singer, 1998). It is the core aspect of virtual reality technology (see section 3.2.3). These are subjective
elements but altering the design aspects of the game may improve these subjective elements.

1. Movement: Careful planning and design was carried out for the movement system within the virtual reality game as poor movement design leads to an increase in simulator sickness as it is believed to be caused by not being able to adapt to new transportation modes (Duzmanska et al., 2018). In this design a teleportation system was used that allowed the participant to appear in specific spots around the world without the image moving separately to their eye tracking.

2. Audio: Each object gives its name in Irish as it’s interacted with.

5.4 Results

This study was the first case study for the DBR based experiment as defined in section 4.2. The main intention was to measure the instruments being used to record the experiment and see how the designed experience was affecting participants. The pre-test motivation questionnaire was marked on a five-point Likert scale. The intervention was intended to improve language learner’s Irish language motivation.

5.4.1 Motivational L2 Self-System Results

The context’s Ideal L2 Self results in the pre-test were low with a mean of 2.14. In the post-test result there was a large increase with learner’s Ideal L2 Self increasing to 3.64. This was the intended outcome of the intervention. As the Ideal L2 Self represents the intrinsic motivation of the participants.

The context group displayed low scores among the extrinsic motivational factors for learning Irish including Ought to L2 Self, Family Influence, Promotion, Prevention, Attitude Towards Learning Irish and Attitudes Towards L2 Community. The extrinsic motivational factors are focused on external attitudinal influences such as learning Irish in order to get a promotion or family pressure to learn Irish (see section 2.2.4).
These low scores highlight the lack of external motivation among the context group to learn Irish.

While the target group wasn’t the intended context group for the intervention, the post-test questionnaires demonstrated a reduction in their Irish Anxiety from a mean of 3.57 to 2.67 and an increase in their Attitude Towards Learning Irish from 2.66 to 4.29.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ought to L2 Self</th>
<th>Family Influence</th>
<th>Promotion</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.11</td>
<td>2</td>
<td>1.57</td>
<td>2.08</td>
</tr>
</tbody>
</table>

Table 5.1: Motivational Self-System Pre-Test Only Scale First Case Study Results

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ideal L2 Self</th>
<th>Irish Anxiety</th>
<th>Attitudes Towards L2 Community</th>
<th>Attitudes Towards Learning Irish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>Mean</td>
<td>2.14</td>
<td>3.57</td>
<td>3.36</td>
</tr>
<tr>
<td>Post-Test</td>
<td>Mean</td>
<td>3.65</td>
<td>2.67</td>
<td>3.67</td>
</tr>
</tbody>
</table>

Table 5.2: Motivational Self-System Pre/Post-Test Results

5.4.2 Simulator Sickness Results

The simulator sickness questionnaire was measured on a 7 point Likert scale and used a combination of several factors for its total scores in each category. It reflected little to no sickness among the participants with mean of 9.54 in nausea and 11.91 in oculo motor issues along with a total score of 5.77.
### 5.4.3 Presence Results

The presence questionnaire was measured on a 7-point Likert scale. Participants rated each scale with a mean in the range between 5-6 which indicated a high degree of presence felt. Only the Sounds scale fell below this range which was given a mean of 4.86.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possibility to act</td>
<td>6.07</td>
</tr>
<tr>
<td>Realism</td>
<td>5.33</td>
</tr>
<tr>
<td>Possibility to examine</td>
<td>6.19</td>
</tr>
<tr>
<td>Self-evaluation of performance</td>
<td>6.14</td>
</tr>
<tr>
<td>Sounds</td>
<td>4.86</td>
</tr>
<tr>
<td>Haptic</td>
<td>5.79</td>
</tr>
<tr>
<td>Quality of Interface</td>
<td>5.24</td>
</tr>
</tbody>
</table>

Table 5.4: Presence Questionnaire First Case Study Results

### 5.4.4 NASA TLX Results

The NASA TLX Questionnaire was measured on a 6-point Likert scale. These results are the un-weighted version of the questionnaire. There was a very high level of standard deviation between the results of this test so these scores were quite unreliable.
Table 5.5: NASA TLX Questionnaire First Case Study Results

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Demand</td>
<td>7.00</td>
</tr>
<tr>
<td>Physical Demand</td>
<td>3.29</td>
</tr>
<tr>
<td>Time Demand</td>
<td>2.43</td>
</tr>
<tr>
<td>Performance</td>
<td>7.29</td>
</tr>
<tr>
<td>Frustration</td>
<td>2.29</td>
</tr>
<tr>
<td>Effort</td>
<td>7.57</td>
</tr>
</tbody>
</table>

5.4.5 Paired Samples T-Test Results

A paired-samples t-test was conducted to compare the Ideal L2 Self of participants, their attitude towards learning Irish and their Irish Anxiety before and after engaging with the game.

There was a statistically significant improvement in the scores for Ideal L2 Self and their attitude towards learning Irish.

Ideal L2 Self pre-test (M=2.14, SD=.964) and post-test (M=3.64, SD=.48) conditions; t(6)=-3.898, \( p = 0.008 \).

Attitude towards learning Irish pre-test (M=2.66, SD=.67) and post-test (M=4.29, SD=.30) conditions; t(6)=-5.110, \( p = 0.002 \).

Irish Anxiety pre-test (M=3.57, SD=.64) and post-test (M=2.67, SD=1.01) conditions; t(6)=2.395, \( p = 0.054 \).

These results suggest that the game did raise the Ideal L2 Self for participants and their attitudes towards learning Irish also improved. The mean for Irish Anxiety also had a one-point reduction and while it was not statistically significant it demonstrated the intended effect of the intervention.
Chapter 5  
First Case Study

<table>
<thead>
<tr>
<th>Pair</th>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal L2 Self Pair</td>
<td>Pre-test</td>
<td>2.14</td>
<td>7</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>3.64</td>
<td>7</td>
<td>0.48</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish Pair</td>
<td>Pre-test</td>
<td>2.66</td>
<td>7</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>4.29</td>
<td>7</td>
<td>0.30</td>
</tr>
<tr>
<td>Irish Anxiety Pair</td>
<td>Pre-test</td>
<td>3.57</td>
<td>7</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>2.67</td>
<td>7</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Table 5.6: Case Study One Paired Samples

<table>
<thead>
<tr>
<th>Pair</th>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the difference</th>
<th>T</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal L2 Self</td>
<td>Pre-test - Post-test</td>
<td>-1.5</td>
<td>1.01817</td>
<td>.38483</td>
<td>-2.4416 - .55835</td>
<td>-3.898</td>
<td>6</td>
<td>.008</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish</td>
<td>Pre-test - Post-test</td>
<td>-1.629</td>
<td>.64315</td>
<td>.31868</td>
<td>-2.4083 - .84879</td>
<td>-5.110</td>
<td>6</td>
<td>.002</td>
</tr>
<tr>
<td>Irish Anxiety</td>
<td>Pre-test - Post-test</td>
<td>.9048</td>
<td>.99934</td>
<td>.37771</td>
<td>-.01947 - 1.82900</td>
<td>2.395</td>
<td>6</td>
<td>.054</td>
</tr>
</tbody>
</table>

Table 5.7: Case Study One Paired T Test Results

5.5 Discussion

Although this case study’s primary purpose was to examine the validity of the experimental design and methodology, some promising results were obtained from the group. There was an increase in participant’s Ideal L2 Self. Participants were also less anxious and more positive about their attitude towards learning after the intervention.
The first case study was enacted with a game student context group and therefore was not the ideal context group for the future iterations of the study. In future iterations of the experiment a context group of current Irish language learners were chosen. While this context group helped to confirm the usefulness of the design, DBR seeks to interpret data from an authentic context group to measure its educational impact.

There were several scales in the L2 motivational self-system questionnaire deemed unnecessary based on the results found in this study including Travel Orientation, Fear of Assimilation and Ethnocentrism, which were not being targeted by this intervention.

The language used in the L2 motivational self-system post-test questionnaire was slightly different to its pre-test counterpart when discussing the virtual reality experience as opposed to the classroom experience in the pre-test questionnaire. This may have impacted the results for this case study and was amended in future iterations.

The simulation sickness and presence questionnaires were found to be effective and found very little evidence of simulation sickness. The level of presence of the participant group was rated to be very high with most results being rated with a value of 5 or higher in a 7 point Likert scale.

High levels of variance were found in the standard deviation from the NASA TLX questionnaire and it also required more time and explanations from participants in order to get an accurate reading. The study already contained a large demand from participants in terms of the number of questionnaires they were asked to complete causing some minor issues in the administering of the questionnaires during the experiment and will be removed from future iterations.

The open-ended questions were thematically coded and were used for triangulation purposes as discussed in section 4.5.3. Participants found the experience to be highly immersive and one participant in particular noted the advantages of this immersive environment for their ability to focus and concentrate on the lesson:

Participant A: “Not at all. This is completely engrossing, and in some sort of selfish way, it’s a 1-on-1 lesson without anybody else interfering”
This is interesting to note, as a key aim of the intervention is to make users feel present in the game in order to become situated in the experience. This case study was mainly focused on testing the experimental procedure and wasn’t the correct context group of participants, as such, stronger conclusions can’t be drawn from this feedback.

Participants indicated that the game was engaging with each participant interacting with the game for the entire time allotted however after picking up some items in the environment there was no goal or direction for the players and they quickly tired of the experience. Future iterations sought to improve the task and goals embedded in the design.

Participants commented on how fun it was to engage with the VR game and how this was very different to their usual Irish language experience and they were motivated to want to play further:

Participant A: “Sure! It was really fun to jog my memory on Irish again in a fun environment. My memories of Irish in school were mostly negative, but this portrayed Irish as a fun thing and I would totally play more of it if given the opportunity”

Participants commented on the ability to engage with the situated environment in a way they couldn’t in a classroom experience:

Participant E: “The benefits I saw was that I could hold and see the objects that the vocabulary represented”

Participant C: “Yes it’s much more enjoyable when you’re interacting then just reading from a book”

Another participant noted how the game allowed them to remember a lot of the Irish they learnt in school:

Participant A: “I can’t remember anything to do with the Irish language if someone spoke to me before the vr experience, however, this game
helped jog some memories of the stuff I learned in school which was pretty enlightening”

Participants noted some difficulties with trying to pick up the words they were looking for and trying to remember what words were left in the environment:

*Participant E: “It was difficult remembering the words of what I needed to pick up, and knowing how many words there were and were left”*

Participants also had difficulties placing items in the bag at times and noted how important a tutorial would be in future iterations to help teach the main methods of interaction with the game:

*Participant A: “As well as this, the mechanic of putting things into the bag wasn’t explicit enough, maybe some sort of tutorial phase would be useful for learning this without being told would be great.”*

The quantitative and qualitative feedback from this experiment was used to inform the design of the second case study of the experience.

In order to provide authentic virtual environments for learning they must offer an experience which is deemed authentic by its users. The first case study found an increase in the Ideal L2 Self of participants, the intended goal of the intervention to improve the motivation of participants.

In future iterations, the situated nature of the design was improved to make the experience reflect a more realistic scenario and more task-based learning tasks were incorporated into the design.

A tutorial was added to help participants understand the main mechanics before playing such as how to place items into the bag.

Several questionnaires had flaws in this iteration and were corrected in future versions of the intervention. The post-test version of the L2 motivational self system questionnaire was amended to reflect the same wording as the pre-test questionnaire when discussing the classroom experience as opposed to the virtual reality environment in the post-test. The NASA TLX questionnaire was removed from future studies as there were problems with its implementation.
Finally, future iterations gathered an authentic context group of Irish language learners for the intervention.

5.6 Conclusion

This chapter gave a full account of the first case study of a design-based research experiment that focused on using a virtual reality design intervention to improve the motivations of adult Irish language learners. The targeted intervention was explored with a detailed account of the rationale. This was followed by a detailed discussion of the results.

The first case study of the design led to an increase among participants in their Ideal L2 Self. In terms of the design of the game, participants felt present in the game and experienced very little simulation sickness. Qualitative feedback found that participants quickly tired of the experience with no tasks or objectives to engage with.

Finally, while the test group was utilised to investigate the experimental conditions of the research design for future case studies and was not the target intervention context group, there were significant measurable changes in their anxiety scores. A decrease in Irish language anxiety after engaging with the VR game was detected alongside an improvement in their Attitudes Towards Learning Irish and Linguistic Self Confidence. As a result of the case study the NASA TLX questionnaire was removed and minor alterations to the motivation L2 self scale were made for future iterations.
6.1 Introduction

Following on from the first case study, this case study considers the outcomes and addresses the shortcomings of the first case study. This intervention was investigated with a real context group of Irish language learners. Twelve participants were involved in the second case study. Participants were given the opportunity to engage with a VR training exercise to learn the basics of virtual reality. They engaged with the VR experience for a twenty minute period after the training exercise was completed. Participants completed a pre-test questionnaire about
their Irish language motivation and following their interaction with the experience, they completed post-test questionnaires about their interaction with the experience, simulation sickness and presence. These post-test questionnaires contained both quantitative and qualitative elements for analysis.

6.2 Experimental Design

The second case study involved TU Dublin Irish Adult Irish classes (n=12). The aim of the second case study was to test the implementation of the design of the VR language game in a localised context to measure its effect on motivation and language anxiety. Figure 6-1 outlines the experimental design of the second case study which will be outlined in further detail in the following sections.

Figure 6-1: Second Case Study Research Design
6.2.1 Pre-test

As in the previous case study, the pre-test involved the participants completing the Dörnyei L2 Motivational Self System questionnaire (Dörnyei, 2010). This questionnaire was used to measure the motivational experiences of the context group before participants interacted with the intervention.

6.2.2 Experiment

Participants engaged in a training exercise in VR before playing the main game in order to learn the basic controls of the VR game they were going to engage with. Participants then played the second version of the game for twenty minutes. This game consisted of a VR environment that resembled a shop with sixty items each of which the participant could pick up. The shop was altered from the initial design and now featured a higher graphical fidelity and had signage, shelves and items which resembled a realistic shop scenario much closer than in the first case study (see section 3.2.3 for a discussion on the importance of high visual and graphical quality to meet the expectations of players). Audio would play and text would display telling the participant what they were holding in Irish. The participant could teleport around the environment and all the items had real world physics implemented in order to immerse the participants even further. Participants were given a goal to achieve where they had to collect four items and bring it to the front counter of the shop. There was an inventory system created so participants could keep track of the items in their bag.

6.2.3 Post-test

The post-test involved participants completing the Motivational L2 Self System Questionnaire (Dörnyei, 2010) which was amended from the first case study to also include the Linguistic Self Confidence scale along with the Ideal L2 Self, Attitudes Towards learning Irish, Irish Anxiety scales and open ended questions to give
qualitative feedback about the design implementation. Participants completed a simulation sickness questionnaire (Kennedy et al., 1993) and a presence questionnaire (Witmer and Singer, 1998) to measure if participants felt sick in the environment and if they felt present in the virtual context.

6.3 Procedure For The Second Case Study

6.3.1 VR Training Exercise

Each participant put on a wireless VIVE Pro headset and engaged with a training exercise in a game created by the researcher. This was to teach the participants the basic control system of the virtual environment they were about to engage in. The researcher introduced the different systems and told the participants how to interact in the training world. Participants could only move onto the next virtual environment when they displayed a clear ability to:

1. Physically move their body around 360 degrees, with a clear understanding they had 360 degree movement in the game.

2. Pick up objects using the VIVE controllers.

3. Move around the space using the teleportation system.

Figure 6-2 shows screenshots from the training exercise. Figure 6-2a shows the objects participants were asked to pick up and throw. Figure 6-2b shows an overview of the training area.
6.3.2 GaeltechVR Experience

After completing the basic training game, the participants began the main Irish language VR experience. Each session lasted between 10 - 20 minutes. Figure 6-3 shows an overview of the VR game environment.
6.4 Design Of The VR Game

6.4.1 Task Based Language Teaching

The first case study lacked an objective for participants to achieve as noted in section 5.6. In order to better simulate a situated learning environment TBLT methodology was incorporated into the learning approach. It focuses on the use of authentic language asking participants to do meaningful tasks using the target language. The game follows a modified version of the framework developed by Jane Willis (Willis, 1996) (see section 2.2.6).

VR seems well suited to TBLT as a participant is immersed in the game, adding realism and new meaning to the actions for the participant. The participant is asked to complete a meaningful task by collecting the items required by the security
guard in the shop. All language in the game is in the target language, Irish. The context and the vocabulary chosen for the shop once more derived from the National Irish primary school curriculum themes (na hÉireann, 1999). Every word was translated for accuracy using www.tearma.ie, the national terminology database for Irish (Tearma.ie). The Irish speech synthesis system, abair.ie (Ní Chiaráin and Ní Chasaide, 2016) was used for the vocabulary and in this iteration a fluent Irish language voice actor from the Connemara Gaeltacht was utilized as the security guard giving instructions to participants. It was felt that using abair for the security guard was too artificial. In order to improve the sense of realism, a native speaker was recruited to create the security guards voice and instructions.

The objective for players during the game was to find specific objects in a shop. A shop was chosen as the contextual setting for the environment as it was a social situation that participants would be familiar with and therefore it would be easier to involve them in a task they are familiar with doing in reality i.e. getting groceries. The shop setting was also chosen because it is easy to modify and customise the different items the player must find in the setting. This allows designers to change the Irish language vocabulary necessary for the participant while still making contextual sense for the player. To begin a participant has to approach a character in the shop. He lists out items for the participant to collect and put into their bag. When the participant finds each item they are searching for, they can approach the front desk of the shop and the shopkeeper tells the participant if they collected all the items that was asked for. The experience ends when the participant picks up all the items they need and gives it to the shopkeeper.

6.4.2 Immersion

Immersion is usually defined as the technical, objective aspects of virtual environments (Jennett et al., 2008). Facilitating the immersive aspects of the experience was important as the designer has direct control over these aspects of the design. At the time the experiment was conducted the VIVE Pro was the most advanced virtual reality headset available offering a deeper level of immersive design.
The design decisions implemented in order to improve the immersive aspects of the design were the same as in the first case study in section 5.1.

### 6.4.3 Presence

Presence is defined as the subjective experience of being in one place or environment, even when one is physically situated in another (Witmer and Singer, 1998). It is the core aspect of virtual reality technology discussed in section 3.2.3. These are subjective elements but altering design aspects of the game may improve these subjective elements.

1. **Movement**: Careful planning and design was implemented for the movement system within the virtual reality game as poor movement design leads to an increase in simulator sickness as it is believed to be caused by not being able to adapt to new transportation modes (Duzmanska et al., 2018). The movement system was kept from the first case study as this was deemed effective according to the results of the simulator sickness questionnaire see section 5.1.

2. **Liveable environment** – The environment was designed to have multiple characters placed around the scene and music playing to give the approximation of a real shop in the game.

3. **Hands** – The hand model was designed to grab and grip naturally mapping itself to the user’s controller. The rubber hand illusion (Ehrsson, 2005) has shown it is possible to produce feelings of ownership and embodiment with tools to the extent the mind tricks the body into believing the tool is an extension of the body. The hand model’s interaction system was designed with this theory in mind for how the player would interact with the virtual world feeling ownership of the controller as if it was their own hand.

4. **Audio** - Each object gives its name in Irish when it’s interacted with. Characters in the shop speak and give instructions to the participants and the music in the shop gives a shopping ambiance to the scene. All of audio in the experience has
been spatialised so the player has a sense of where audio is coming from in the environment.

### 6.4.4 Scaffolding

As mentioned earlier, there is a very limited group of native speakers in the Irish context (see section 2.3). For this reason it is difficult for learners to find opportunities to interact with the living Irish language community. This is an essential part of language learning where an individual acts in the correct way in the target language and is recognised for it by the target community (Gee, 2015a). This allows an individual to build their confidence and motivations as an understanding of the target language as a living community. In turn this improves their Ideal L2 Self self in the target language (see section 2.3.2.) In order to help participants interact with the language community in the VR game it incorporates scaffolding. Scaffolding is a constructivist theory that explains social learning. Learners first succeed in performing a new function with the assistance of an experienced mentor and then internalize this function so that they can perform it unassisted (Ellis, 2000). Games can act as the experienced mentor and allow participants to progress at their own pace and get information when they need it (Gee, 2006). In the VR game scaffolding is incorporated in a number of ways:

1. When a participant picks up an item the word is said in Irish and text appears showing the word above the object in Irish similar to the design of the first case study.

2. The security guard’s dialogue says everything the participant needs in the shop.

3. There is an inventory system so the player can keep track of what they have collected.

4. The participant is told at the front counter when they’ve retrieved everything needed in the shop. This is further enforced with a clapping animation that
tells them they have succeeded. If they don’t have all the required items there is a head shake animation and they are told to keep looking.

Figure 6-4a shows a screenshot of a player interacting with the security guard who tells the player what they need to find in the shop. Figure 6-4b shows an example of the scaffolding affordances in the game. When the player interacts with any object in the game green text lights up along with an audio cue telling the player what they have interacted with.

Figure 6-4: Screenshots Of Character Interaction and Scaffolding Affordances Second Case Study

6.5 Results

As this is a DBR experiment it was interested in a localised study with an authentic context group. The aim was not to make inferences about a population from a sample but to examine the specific context through localised results to make generalisable claims about the design. The pre-test motivation questionnaire was marked on a five point Likert scale. The participants were aged between 24-59 and there was an even distribution of ages. The participants were also predominately female 83%.

The intervention’s main intention was to create a positive change in the learner’s ideal self as an Irish language learner.
6.5.1 Motivational L2 Self System Pre-test and Post-test Results

The context’s Ideal L2 Self results in the pre-test were high with a mean of 4.1. In the post-test result there was a slight increase of .17 in the mean with learner’s Ideal L2 Self increasing to 4.27. This demonstrates the goal of the intervention but at a very small change. There was also a minor increase in the linguistic self-confidence of the context group from the pre-test mean of 4.35 to 4.39 in the post-test. The intervention had the intended effect on the level of Irish anxiety among the group. The level of Irish anxiety was found to be quite high in the pre-test with a mean of 2.96. In the post-test there was a decrease in the anxiety scale with the mode dropping to 2.29. The ought to L2 self investigates the extrinsic motivations involved with the target language. The learner’s pre-test ought to L2 self was low with a mean of 1.92. This corresponded with low means in all the extrinsic motivation scales in the pre-test: promotion, prevention and family influence which had low means of 2.19, 1.63 and 1.98 respectively. The integrativeness score lowered in the post-test from 4.3 to 4.19. The integrativeness questions were added to the second case study in order to have a clearer understanding about how the context groups perceived their L2 language community. Integrativeness is a measure first constructed by Gardner (Gardner, 1987). His research into the field demonstrated that a person’s beliefs about the target language community influences their motivation of the target language. Dörnyei agreed with this, however he saw with the advent of globalisation, that language communities don’t always exist in fixed locations thus rather than focusing on the fixed space of a target language community Dörnyei’s integrativeness scale is interested in investigating the perceived beliefs of the individual to a target language group real or imaginary (Ushioda and Dörnyei, 2009) see section 2.2.4, for a further discussion on Dörnyei and Gardner’s work.
<table>
<thead>
<tr>
<th>Scale</th>
<th>Ought to L2 Self</th>
<th>Family Influence</th>
<th>Promotion</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.92</td>
<td>1.98</td>
<td>2.19</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Table 6.1: Motivational Self-System Pre-Test Only Scale Results

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ideal L2 Self</th>
<th>Irish Anxiety</th>
<th>Integrativeness</th>
<th>Linguistic Self Confidence</th>
<th>Attitudes Towards Learning Irish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.1</td>
<td>2.96</td>
<td>4.3</td>
<td>4.35</td>
<td>4.06</td>
</tr>
</tbody>
</table>

Pre-Test

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ideal L2 Self</th>
<th>Irish Anxiety</th>
<th>Integrativeness</th>
<th>Linguistic Self Confidence</th>
<th>Attitudes Towards Learning Irish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.27</td>
<td>2.29</td>
<td>4.19</td>
<td>4.39</td>
<td>4.28</td>
</tr>
</tbody>
</table>

Post-Test

Table 6.2: Motivational Self-System Pre/Post-Test Results

6.5.2 Simulator Sickness Results

The simulator sickness questionnaire was measured on a 7 point Likert scale and it reflected little to no sickness among the participants with a total score of 11.925 in nausea, 9.475 in oculo motor issues 13.92 in disorientation and a total score of 13.09. This score has a maximum value of 300 and these values demonstrate very minor effects among a few participants.
### Table 6.3: Simulator Sickness Questionnaire Results

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>11.925</td>
</tr>
<tr>
<td>Oculo Motor Issues</td>
<td>9.475</td>
</tr>
<tr>
<td>Disorientation</td>
<td>13.92</td>
</tr>
<tr>
<td>Total Score</td>
<td>13.09</td>
</tr>
</tbody>
</table>

#### 6.5.3 Presence Results

The presence questionnaire was measured on a 7-point likert scale. Participants rated each scale with a mean in the range between 5-6 which indicated a high degree of presence felt. Only one scale fell below this range the Sounds scale which was given a mean of 4.8.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possibility to act</td>
<td>5.3</td>
</tr>
<tr>
<td>Realism</td>
<td>5.3</td>
</tr>
<tr>
<td>Possibility to examine</td>
<td>5.6</td>
</tr>
<tr>
<td>Self-evaluation of performance</td>
<td>5.4</td>
</tr>
<tr>
<td>Sounds</td>
<td>4.8</td>
</tr>
<tr>
<td>Haptic</td>
<td>5.4</td>
</tr>
<tr>
<td>Quality of Interface</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Table 6.4: Presence Questionnaire Results

#### 6.5.4 Paired Samples T-test Results

A paired-samples t-test was conducted to compare the Ideal L2 Self of participants, their attitude towards learning Irish, their Irish Anxiety and their Linguistic Self Confidence before and after engaging with the game. There was no statistical signification found in any of the results in the second case study.
Ideal L2 Self pre-test \((M=4.1, \ SD=.23)\) and post-test \((M=4.27, \ SD=.52)\) conditions; \(t(11)=-1.387, \ p = 0.193\).

Attitude towards learning Irish pre-test \((M=4.07, \ SD=.39)\) and post-test \((M=4.28, \ SD=.66)\) conditions; \(t(11)=-1.307, \ p = 0.218\).

Irish Anxiety pre-test \((M=2.96, \ SD=1.09)\) and post-test \((M=2.29, \ SD=1.22)\) conditions; \(t(11)=1.825, \ p = 0.095\).

Linguistic Self Confidence pre-test \((M=4.35, \ SD=.34)\) and post-test \((M=4.40, \ SD=.58)\) conditions; \(t(11)=.330, \ p = 0.748\).

The results displayed a minor improvement to the target context’s Ideal L2 Self and while there were no statistically significant results there was large decrease in Irish language anxiety, an increase in linguistic self confidence and an increase in attitudes towards learning Irish.

<table>
<thead>
<tr>
<th>Pair</th>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal L2 Self Pair</td>
<td>Pre-test</td>
<td>4.1</td>
<td>12</td>
<td>.234</td>
</tr>
<tr>
<td>Ideal L2 Self Pair</td>
<td>Post-test</td>
<td>4.27</td>
<td>12</td>
<td>.521</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish Pair</td>
<td>Pre-test</td>
<td>4.07</td>
<td>12</td>
<td>.392</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish Pair</td>
<td>Post-test</td>
<td>4.28</td>
<td>12</td>
<td>.663</td>
</tr>
<tr>
<td>Irish Anxiety Pair</td>
<td>Pre-test</td>
<td>2.96</td>
<td>12</td>
<td>.502</td>
</tr>
<tr>
<td>Irish Anxiety Pair</td>
<td>Post-test</td>
<td>2.29</td>
<td>12</td>
<td>1.22</td>
</tr>
<tr>
<td>Linguistic Self Confidence Pair</td>
<td>Pre-test</td>
<td>4.35</td>
<td>12</td>
<td>.345</td>
</tr>
<tr>
<td>Linguistic Self Confidence Pair</td>
<td>Post-test</td>
<td>4.40</td>
<td>12</td>
<td>.527</td>
</tr>
</tbody>
</table>

Table 6.5: Case Study Two Paired Samples
## Paired Differences

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the difference</th>
<th>T</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ideal L2 Self</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test - Post-test</td>
<td>-.1667</td>
<td>.41633</td>
<td>.1202</td>
<td>-.4311</td>
<td>.09786</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.4311</td>
<td>.09786</td>
<td>-.1387</td>
<td></td>
<td>11</td>
<td></td>
<td>.193</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test - Post-test</td>
<td>-.2139</td>
<td>.56684</td>
<td>.16363</td>
<td>-.57404</td>
<td>.14626</td>
<td></td>
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<tr>
<td></td>
<td>-.57404</td>
<td>.14626</td>
<td>1.825</td>
<td></td>
<td>11</td>
<td></td>
<td>.218</td>
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<tr>
<td>Irish Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test - Post-test</td>
<td>.66667</td>
<td>1.2653</td>
<td>.3653</td>
<td>-.13727</td>
<td>1.47061</td>
<td></td>
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<td>1.825</td>
<td></td>
<td>11</td>
<td></td>
<td>.095</td>
</tr>
<tr>
<td>Linguistic Self Confidence</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test - Post-test</td>
<td>-.04167</td>
<td>.43736</td>
<td>.1263</td>
<td>-.31955</td>
<td>.23622</td>
<td></td>
<td></td>
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<td>-.31955</td>
<td>.23622</td>
<td>-.330</td>
<td></td>
<td>11</td>
<td></td>
<td>.748</td>
</tr>
</tbody>
</table>

Table 6.6: Case Study Two Paired T Test Results

### 6.6 Discussion

While the intervention only displayed a minor improvement to the target context’s Ideal L2 Self, it is believed this may be due to the possibility that the participants have a lack of awareness in their L2 language ability making it difficult for the questionnaires to measure their motivation and confidence to interact with the L2 community. Larger scale studies for adult Irish language learners have found that a lack of native Irish speakers makes learners question their authority in language ownership (Nic Fhlannchadha and Hickey, 2018). Irish language learners have a passive positive motivation for the language rather than a proactive motivation to become fluent speakers (Ó Laoire, 2007). They feel positively inclined towards the language as this data also demonstrates but they do not proactively believe in their ability to become fluent speakers. The context group voluntarily attend Irish language classes in order to improve their Irish language ability and volunteered for this study...
with no incentive which reflects the high pre-test Ideal L2 Self. After engaging in the VR experience their Ideal L2 Self could only raise slightly from their already very high scores on the Likert scale.

The data shows that there was very little external motivations for the context group to learn Irish. The participants had very little interactions with Irish in their daily life and no social need to attain the language as their low ought to L2 self mode of 1.29 demonstrates. The participants had a relatively high level of anxiety around Irish but also state they are highly confident of their linguistic skills in Irish in the pre-test. In self-reporting attitude surveys such as this it is common to see conflicting attitudes about how an individual perceives their own sense of self. The self is irrational in nature and is based on the continual renegotiation of ones beliefs and attitudes (Gee, 2004). This offers further evidence towards the theory as it demonstrates a lack of interaction between the context group and native Irish speakers as they display an anxiety towards the L2. The large reduction in anxiety in the post-test reveals that participants didn’t feel the same anxiety in their interactions in the virtual world while interacting with native speaking avatars that they felt in the real world. This finding is consistent with other research into virtual reality which finds a reduction in anxiety for participants interacting with virtual reality environments (Gorini and Riva, 2008). The social pressure and stigma of making mistakes doesn’t exist in a game and so it gives the participant the opportunity to experiment in the target language (Reinders and Wattana, 2015). The rise in the integrativeness scale offers evidence that participants saw the game as a believable reality. Their attitudes to the Irish language community improved as a result of their interaction with the native speaking avatars. The simulator sickness result offers evidence that the design of movement in the game combined with the use of the short tasks along with using the HTC VIVE Pro in the ViRAL lab space led to an experience without the issue of simulator sickness. The high values in the presence questionnaire offers further evidence that the design was effective in creating a believable virtual context for the participants. The open-ended questions were thematically coded and were used for triangulation purposes. Participants found the experience to be highly immersive and
when asked about the issues with the environment one participant noted:

*Participant B*: “Remembering not to physically move around! I haven’t used VR before so I got absorbed and initially forgot that I wasn’t really in the room I was seeing.”

This gives further evidence that participants felt present in the game a key aim of the design. Another participant noting:

*Participant D*: “.... due to the immersiveness of it, it really transforms you out of current situation into a new one.”

Many participants noted the native speaker used in the environment. When asked about if the experience was beneficial one participant commented:

*Participant A*: “Yes. I think if I used experience this often I will speak Irish like a native speaker.”

Another participant noting:

*Participant C*: “Yes, more fun and interesting hearing how the words are pronounced by different people and dialects.”

This highlights the importance of native speakers and different dialects to the context group which was a focus in future iterations. On the issue of Irish anxiety the participants noted:

*Participant C*: “Yes. It is much more fun interacting. You feel frustrated if you get it wrong so you want to try again to "win" instead of giving up.”

*Participant B*: “This was absolutely enjoyable. I felt no learning pressure, no time pressure and my brain was really forced to work on what I have already learnt.”
The simulation effects as noted earlier seems to boost the confidence and remove the pressure participants felt of making mistakes in the L2. The participants noted some areas where improvement is needed in terms of the immersive aspects of the design. One participant noted several areas where the game didn’t meet reality

**Participant K**: *The items didn’t appear in the bag either - I was disappointed with that. Also, it’s not realistic to put a massive table in a small bag. Maybe an interaction with the person giving instructions in a more natural way and for a more genuine reason."

Feedback was another area that participants commented on the need for improvements with one participant noting

**Participant C**: *“Maybe a clue at counter – e.g. You have 4 items correct”.*

This refers to the scaffolding in the game and in future iterations there will be even more feedback to guide participants as they progress. Finally, the size of the area and number of items was an issue for many participants. The shop contained over 90 items and some participants found it challenging to navigate the virtual environment to find the item they needed even when comprehension was not an issue. Other participants noted the shortness of the experience and the lack of a challenge for them with comments such as:

**Participant J**: *“The experience was very short -but I could see the benefits”*

**Participant L**: *“Would have liked a second challenge”.*

The quantitative and qualitative feedback from this experiment was used to inform the design of the third case study.

In order to improve the feedback and scaffolding elements of the game, the third iteration incorporated levels. Each level was designed to improve the situated design of the experience. For example, a smaller number of items in each level. Once a participant finds the objects they need they will be able to progress. This reduces the item count in the main area and allows the design of each area thematically to suit the
items located in it. It also allows for increased challenge as the participants progress. In the second case study of the VR language learning environment there wasn’t a significant change in the L2 Ideal Self of participants. The length of the intervention may have affected this as participants only got one twenty minute opportunity with the intervention. Future iterations tested over a longer period of time and gave participants more opportunities to engage with the environment. This was done to remove the novelty element of trying a new technology. For many participants this was their first time engaging with virtual reality and the novelty factor may have affected the results. The renegotiation of one’s language motivation is also a long term perpetually occurring complex process. In order to capture this process its valuable to have data from a longer time frame interacting with the game. Future iterations will seek to further improve on the design choices which lead to participants feeling present without any simulator sickness by making the game reflect the expectations of the participants.

6.7 Conclusion

This chapter gave a full account of the second case study of a design-based research experiment focusing on using a VR design intervention to improve the Irish language motivation of adult Irish language learners. It explored the targeted intervention with a detailed account of the design decisions and the overall rationale. This was followed by a detailed discussion of the results.

While the intervention only displayed a marginal increase in improving the target context’s Ideal L2 Self, this iteration proved invaluable for the future progress of the design of the VR learning game. In terms of the design of the game, participants felt present in the game and experienced little to no simulation sickness, two positive outcomes for the design choices of the intervention. The second case study has led to several design decisions moving forward:

1. The introduction of levels to the design in order to promote scaffolding opportunities.
2. A further focus on creating a more situated experience in the design of the context in order to improve the usability and believability of the game. This includes hearing different dialects of Irish from the game’s characters.

Finally, in terms of the impact the experience had for participants a significant decrease in Irish language anxiety was detected after engaging with the VR game. There was also an increased level of language confidence after engaging with the VR game. Participants valued being able to interact with the target language using avatars that spoke with native dialects.
Chapter 7

Third Case Study

7.1 Introduction

Following on from the second case study, this case study considers the outcomes of the previous case studies and aims to further improve the intervention. The aim of the third case study is to improve the design of the situated learning experience based on the results from the previous cycles. These potential improvements were then investigated with a real context group of Irish language learners. In this iteration of the experiment participants were given three opportunities to engage with the experience over a five week period. This was done to remove any potential novelty
element of trying virtual reality for the first time and to give the participants a longer time period to renegotiate their language motivation and language anxiety through interacting with the game. This factor was not considered in the second case study and could potentially weaken the overall findings if not addressed. Finally, participants who interacted with the situated experience took part in focus group sessions to expand the qualitative data about their personal experience.

7.2 Experimental Design

The third case study involved students from Marino Institute of Education students (n=10), which is a primary school teacher training college, where Irish is a mandatory subject. The aim of the third case study was to test the implementation of the design of the VR language game in a localised context to measure its effect on motivation and language anxiety along with measuring any vocabulary retention made through the participants engagement with the game. This was examined in the third iteration of the game as it was more polished and provided a better experience overall for participants, and was based on similar research in an English language setting that examined vocabulary retention (Vazquez et al., 2018). This case study investigated vocabulary retention to identify whether VR provided a measurable learning impact with an authentic learner context in the Irish language context. Each iteration utilised teaching methodologies such as TBLT to improve the vocabulary retention of participants. The pre-test and post-test vocabulary questionnaires were added to this case study as this was the final iteration of the design thus, measuring the educational impact of the game was an important factor in this study’s experimental design. Figure 7-1 outlines the experimental design of the third case study which will be outlined in further detail in the following sections.
7.2.1 Pre-test

As in the previous case studies the pre-test involved the participants completing the Dörnyei L2 Motivational Self System questionnaire (Dörnyei, 2010). In addition, the participants also completed a vocabulary pre-test questionnaire of all of the vocabulary within the game.

7.2.2 Experiment

Participants engaged in a training exercise in VR before playing the main game in order to learn the basic controls they were going to engage with. Participants then played the third version of the game for twenty minutes each week for three weeks. Further time with the game was added to ensure participants were familiar with the control system of the game. The game consisted of a VR environment that resembled a shop with 149 items each of which the participant could pick up. Audio would play and text would display telling the participant what they were holding in Irish. The participant could teleport around the environment and all the items had real world
physics implemented. Participants were given a goal where a character at the start of each level would ask the participant for four random items from the shop. The participant could place any object they found in the shop into the basket they were holding and had to place all four of the correct items onto the counter in order to progress to the next level. There were four levels in the game. This was increased due to participant’s feedback in the previous case study requesting a longer play experience and to provide a greater challenge. The VR game used spatialized audio along with more non-player characters around the shop that the player could interact with in order to improve the situated design of the game.

7.2.3 Post-test

The post-test was the same as the second case study with the addition of a vocabulary post-test and focus group sessions to gather more qualitative data about the impact of the game on participants. The qualitative impact is discussed in the following chapter. This allowed for a holistic investigation of the intervention. While the quantitative analysis is useful for measuring the impact of the intervention, the qualitative analysis allows for an in-depth exploration of how participants felt about individual design decisions and how they impacted participants.

7.3 Procedure For Case Study Three

7.3.1 VR Training Exercise

Similar to the second case study each participant put on the VR headset (see section 7.4.2 for the reason the Rift S was chosen for this case study) and engaged with a training exercise game on their first session of the experience. This was used to teach the participants the basic control system of the game they were about to engage with. The different systems were introduced and participants were told how to interact in the training world. Participants could only move onto the next virtual environment when they displayed a clear ability to:
1. Physically move their body around 360 degrees, with a clear understanding they had 360 degree movement in the virtual world.

2. Walk to the end of the virtual reality boundary to understand the physical space limitations.

3. Pick up objects using the Rift S controllers.

4. Move around the space using the teleportation system.

Only minor changes were implemented to the design of the virtual reality training exercise from the initial design in the second case study. The second case study of the design was found to be mostly effective as all participants felt comfortable with their ability to interact with the VR experience after they engaged in the training world. In the new design of the training exercise, cosmetic changes were implemented along with refined interactions to enhance the ease of use for participants. This was to improve the sense of presence and immersion in the virtual experience and to improve the situated experience overall. The environment was simplified with any unnecessary objects removed from it. This iteration included gloves that the player could grip objects with and see in the 3D space in order to improve their sense of presence. A target board was also implemented which allowed players to throw objects against thus providing them with a simple task to improve the goal based nature of the training. It also helped the immersive nature of the scene as participants saw the objects behave similar to how they would in the real world.

Figure 7-2 shows screenshots from user’s interactions in the training exercise. Figure 7-2a gives an overview of the area. Figure 7-2b shows a player implementing the teleporting mechanic. Figure 7-2c shows the interactable objects in the environment. Figure 7-2d demonstrates the ability of the player to pick up objects. The object turns blue and is given a yellow outline when the player’s hand is closer in order to highlight to the player it can be interacted with. Figure 7-2e shows how the hand model animates and grips the object in a natural movement. Figure 7-2f demonstrates a player attempting to throw an object at the target.
7.3.2 GaeltechVR Experience

After completing the basic training game, the participants began the VR experience. Participants engaged in three sessions lasting twenty minutes each over the course of five weeks. Figure 7-3 shows overview screenshots of the virtual environment used in the third case study. The context was altered to make the area appear more like a realistic shopping centre. Lighting and reflective surfaces were added to the floor to give the impression of a tiled surface as can be seen in figure 7-3a. The shop was
divided into sections in order to add to the sense of realism and make it easier for players to navigate their way around the environment. Figure 7-3c shows the fruit and vegetable aisle while figure 7-3d shows the butchers area.

![Overview Screenshots Of GaeltechVR Third Case Study](image)

(a) GaeltechVR A  
(b) GaeltechVR B  
(c) GaeltechVR C  
(d) GaeltechVR D

Figure 7-3: Overview Screenshots Of GaeltechVR Third Case Study

### 7.4 Design of GaeltechVR

#### 7.4.1 Task based language teaching

The third case study of the VR language learning experience once more utilized TBLT methodology in its learning approach (Willis, 1996). This was found to be effective at guiding the player in the second case study and gave them a goal and a challenge which are two major aspects of what a game is (See section 3.1.2). The player was asked to complete a meaningful task by collecting the items required by different characters in the shop. In the third case study various levels of difficulty for the player was incorporated into the game. As the player progressed through each level a different character in the shop asked for various items. This was done in order to prevent
players from using a trial and error method to succeed at the tasks that wouldn’t require language knowledge to succeed. All language in the game was in the target language, Irish. The context and the vocabulary chosen for the shop derived from the National Irish primary school curriculum themes (na hÉireann, 1999). Every word was translated for accuracy using Tearma.ie, The National Terminology Database for Irish (Tearma.ie). The Irish speech synthesis system, abair.ie (Ní Chiaráin and Ní Chasaide, 2016) was used for the vocabulary and several native fluent Irish language voice actors were utilized as the characters giving instructions to players. The speakers were chosen from a range of different areas around Ireland with different dialects including Kerry, Dublin, Galway and Donegal. Hearing different dialects of Irish was found to be important by the context group in the second case study. The objective in the game world of GaeltechVR was to find specific objects in a shop. To begin a player had to approach a character standing in the front of the shop. They list out the items required for the player to collect. When the player has all the items they need in their bag they can approach any of the checkout desks. Checkout desks were implemented into the third case study in order to situate the experience in a more realistic environment for the player. In the second case study players were confused where to place their items once they completed the task. In this instance, the players must put all their items on the checkout counter. Once this is done the shopkeeper tells the participant if they collected all the required items. In the third case study the shopkeeper offers prompts to the player if they still need certain items in the shop by telling them how many items they still need to find. The shop keeper also shakes their head if the player has not found all the objects yet and gives the player a thumbs up if they were successful. When the player completes the activity they are transported to the next level.

7.4.2 Immersion

Immersion is usually defined as the technical, objective aspects of virtual environments (Jennett et al., 2008). Facilitating the immersive aspects of the experience was important as the designer has direct control over these aspects of
the design. In the third case study these decisions included:

1. Designing for the Rift S. The Rift S features the most advanced inside out tracking of any HMD currently of the current range of VR headsets. It includes an LED display, 1280 x 1440 per eye resolution and a 80Hz refresh rate.

2. The use of a space specifically designed to cater for virtual reality with suitable area for movement for participants.

3. The virtual world was designed and tested using an Alienware m15 laptop with a 2060 RTX graphics card, 16gb RAM and an i7 processor.

Figure 7-4 shows the HMD utilized for this iteration of the experiment.

Figure 7-4: Oculus Rift S Headset And Controllers

The Rift S was chosen because of its inside out tracking system which allowed for setting up the virtual reality space in any room without the need for external sensors. This allowed the experiment to take place in an area convenient for participants. This was particularly important for the third case study as participants were being asked to try the game several times so it was deemed important in order to recruit participants to make the experiment as convenient as possible in terms of location.
### 7.4.3 Presence

Presence is defined as the subjective experience of being in one place or environment, even when one is physically situated in another (Witmer and Singer, 1998). It is one of the main advantages of VR technology. These are subjective elements but may be improved by how the game is designed.

1. **Movement** - The movement system within the VR game was carefully implemented as poor movement design leads to an increase in simulator sickness as it is believed to be caused by not being able to adapt to new transportation modes (Duzmanska et al., 2018). In the design a teleportation system was implemented that allowed the participant to appear in specific spots around the world without the image moving separately to their eye tracking. The movement system used in the third case study was the same as in the last iteration of the design. Little to no evidence of any simulation sickness experienced by the participants was found therefore the implemented movement system was kept.

2. **Liveable environment** – The environment was designed to have multiple characters placed into the appropriate locations in the scene and music playing to make the game a more immersive, believable environment. This was further iterated upon in the third case study which featured much more characters than in the second case study. Players were able to teleport near many of the characters in the shop. Some of the characters talked to the participants if they were in close proximity to them telling them about their job in the shop.

3. **Hands** – This case study implemented several design changes to the hand models in the game. It was decided to give the model gloves to wear. This decision was made to remove any presumptions of gender and race of the player from the experience. The hand model in this iteration is capable of gripping any object in the shop in a natural way native to that object. This required the researcher to individually model separate animations for each object the hand is capable of interacting with in the shop. It was deemed worthwhile in order to improve the player’s sense of agency within the environment.
4. Audio - Each object gives its name in Irish as it’s interacted with. Characters in the shop speak and give instructions to the participants and the music in the shop provides a shopping ambiance to the scene. All of audio in the experience has been spatialised so the player has a sense of where audio is coming from in the environment. The spatialisation was improved in the third case study making it far more obvious to players that it was occurring in the environment. Ten voice actors were incorporated into the third case study in response to feedback from the second case study that the players responded well to hearing native dialects in the environment.

7.4.4 Scaffolding

Scaffolding is a constructivist theory that explains social learning. Learners first succeed in performing a new function with the assistance of an experienced mentor and then internalize this function so that they can perform it unassisted (Ellis, 2000). Games can act as the experienced mentor and allow participants to progress at their own pace and get information when they need it (Gee, 2006). Game systems do this through feedback. In this case study of the virtual reality experience scaffolding is incorporated in a number of ways:

1. When a participant picks up an item an audio recording plays the word in Irish along with text appearing above the object saying what it is.

2. The characters the player interacts with tell the player every item they need to find in the shop.

3. The inventory system was removed in this case study as players did not understand or notice it. In this version each item placed in the bag stayed in the bag so the player could keep track of what they had collected. This also improved the situated nature of the design.

4. The participant is told at the counter when they’ve retrieved everything needed in the shop. This is further enforced with a clapping animation that tells them
they have succeeded. There is a head shake animation and they are told to keep looking if they don’t have all the required items. This case study also has audio clues for the player telling them how many items they have correct and how much more they need when they place their items on the counter.

Figure 7-5 shows screenshots of the player interacting with the various characters in the shop. Figure 7-5a shows a player successfully finding the items needed in the shop and getting a thumbs up from the shop keeper at the counter. Figure 7-5b shows a player interacting with one of the characters giving the player a task to complete. While not fully reflected in the above screenshots the characters in the shop were balanced in terms of gender and race. Figure 7-5c shows a player interacting with another character in the shop. In order to improve presence in the environment a lip syncing feature was added. This gave the impression of the characters moving their mouths as the audio played as their lips were synced to the audio. Figure 7-5d shows one of the characters featured around the shop to add to the sense of a living environment.

![Interaction With Characters A](image1)

![Interaction With Characters B](image2)

![Interaction With Characters C](image3)

![Interaction With Characters D](image4)

Figure 7-5: Screenshots Of The Character Interactions In The Third Case Study
Figure 7-6 shows screenshots of the scaffolding system in the game. Figure 7-6a shows the player moving their hand close to the object which highlights the item with a yellow border indicating it can be interacted with. Figure 7-6b shows the player’s ability to grip the item in a natural grip alongside the text of what the item is appearing Irish with an audio cue of the item. In this version of the design participants could clearly see the items they were placing in the bag and the items could fall out if the bag was moved to make a more naturalised interaction in contrast to the previous design.

Figure 7-6: Screenshots Of The Scaffolding Affordances In The Third Case Study

7.5 Results

This case study was interested in a localised study with an authentic context group. According to DBR methodology (see section 4.2) the aim is not to make inferences about a population from a sample but to examine the specific context through localised results to make generalisable claims about the design. The pre-test motivation questionnaire was marked on a five point Likert scale. The participants were aged between 18-40, most participants were between the ages of 20 - 30. The participants were also predominately female (80%). Due to the difficulty in recruiting participants, it was not possible to achieve a 50/50 gender balance as this would have led to a greatly reduced sample size. It is recognised within current VR research that women report symptoms of simulator sickness at a higher rate than men and this in turn can effect the results of VR educational interventions (Duzmanska et al., 2018).
This is an area of consideration for future work to consider.

The design intervention seeks to examine if the situated immersive environment can raise the learner’s Ideal L2 Self. The second case study didn’t lead to a significant rise in the learner’s Ideal L2 Self as it didn’t create any significant changes in the Ideal Self scale. The main hypothesis is that by allowing individuals to experience Irish in a fully immersive situated environment where the learners encounter challenge at a level they are ready to engage with according to Vygotsky’s theory of the ZPD, as discussed in section 2.2.2 it will raise their motivation and confidence in their Irish language ability. Scaffolding is incorporated through a myriad of techniques to ensure the learner has assistance when it is required so the learner can overcome the challenge presented. This challenge has been incorporated through task based language teaching, where learners are capable of seeing themselves succeed in tasks which in turn change how they view themselves and what they are capable of in Irish. This study ran for six weeks with participants. Levels were introduced along with other design changes (See section 6.4). The context group for this study were longer term Irish language learners as compared with the second case study. All participants were trainee Irish primary school teachers and Irish language competency is a requirement of entrance into the course. They engage with Irish language classes for three years of their degree with classes weekly. This offered a slightly different context of learners from the second case study’s context group as the data illustrates.

7.5.1 Motivational L2 Self-System Pre-Test and Post-Test Results

The motivational self-system questionnaire was measured on a 5 point Likert scale. Table 7.1 captures the scales measured only in the pre-test questionnaire. Participants had an Ought to L2 Self mean of 2.4444. The Ought to L2 Self is the way the learner feels they "ought to" be in the L2 language. It is a measure of all the extrinsic motivations that exist for the learner. This involves the influence and impact of their perceived social expectations towards how they should be as an L2 learner. The
influence of family expectations was measured in the Family Influence scale and had a mean of 2.225. The Promotion scale measured the motivation of the learner in terms of language use from a promotional interest for their future work and social status. This had a high mean of 3.375 which aligns with the need of participants for the language in order to pass their degree. The Prevention scale measures the motivations of a learner to learn Irish in order to prevent a negative outcome from happening. Prevention was also quite high among participants with a mean of 3.5714.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ought to L2 Self</th>
<th>Family Influence</th>
<th>Promotion</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.4444</td>
<td>2.225</td>
<td>3.375</td>
<td>3.5714</td>
</tr>
</tbody>
</table>

Table 7.1: Motivational Self-System Pre-Test Only Scale Results

This case study gave participants three opportunities to interact with the game and they answered the post-test motivational self system questionnaire one week after completing the game. This allowed more time for participants to renegotiate their language motivation after their interactions with the game. It was also more effective at measuring if participant’s new motivation was retained rather than being an immediate response to the intervention. A prior study in the area of VR for language retention (Vazquez et al., 2018) administered a test directly after their study and then another with a similar delay of one week and found that the correlation to word retention in VR was stronger than the control in the delayed test, thus concluding that VR offered a higher rate of word retention than non-VR. While this study was limited in the number of participants required for a control study, it opted to measure retention to get a longer lasting indication of the design’s impact.

Table 7.2 refers to the pre-test/post-test scales for the measures the intervention was targeting. The Ideal L2 Self scale is the most important value to the study as it describes the long term intrinsic motivations for the learner’s Irish language abilities. It measures the learner’s ability to imagine themselves as an Irish language speaker. This had a mean of 3.5 in the pre-test which was lower than the context group from the second case study. As stated previously this context group were much
more experienced as Irish language learners and this offers further evidence that the context group from the second case study were too new as Irish language learners to correctly assess the discrepancies between their perceived possible abilities and their actual abilities.

The Irish Anxiety scale measured the level of anxiety participants felt towards Irish. This scale was very high for experienced language learners with a mean of 3.1333. The Integrativeness scale is interested in investigating the perceived beliefs of the individual to a target language group real or imaginary (Ushioda and Dörnyei, 2009) Further detail on this scale can be found in section 6.5. Integrativeness had a high mean of 4.0667 which demonstrates a positive outlook among the context group towards Irish language speakers. The Linguistic Self Confidence scale measures the level of self confidence had towards their language ability. This scale had a mean of 3.875 among participants. The Attitudes Towards Learning Irish scale measures the attitudes of the context group towards their environment for learning Irish and their personal attitudes for learning Irish. This scale had a mean of 3.2833 for the context group. In the Post-Test the intervention saw a rise in the mean of the Ideal L2 Self scale from 3.5 to 4.02. This outcome demonstrates the intervention having its intended effect among participants (for the VR intervention to lead to a rise in the Ideal L2 self of participants). The Irish Anxiety scale mean reduced from 3.1333 to 1.95 and this is a similar large 1 point reduction as in the second case study. The Integrativeness scale mean showed little movement to 4.0 from 4.0667. The Linguistic Self Confidence mean among the participants rose from 3.875 to 4.375 showing a .5 increase to the mean after the intervention. Finally the Attitudes Towards Learning Irish increased from a mean of 3.2833 to a high mean of 4.48.
## Pre-Test

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ideal L2 Self</th>
<th>Irish Anxiety</th>
<th>Integrativeness</th>
<th>Linguistic Self Confidence</th>
<th>Attitudes Towards Learning Irish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.5</td>
<td>3.1333</td>
<td>4.0667</td>
<td>3.875</td>
<td>3.2833</td>
</tr>
</tbody>
</table>

## Post-Test

<table>
<thead>
<tr>
<th>Scale</th>
<th>Ideal L2 Self</th>
<th>Irish Anxiety</th>
<th>Integrativeness</th>
<th>Linguistic Self Confidence</th>
<th>Attitudes Towards Learning Irish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.02</td>
<td>1.95</td>
<td>4.0</td>
<td>4.375</td>
<td>4.48</td>
</tr>
</tbody>
</table>

Table 7.2: Motivational Self-System Pre/Post Test Results

### 7.5.2 Vocabulary Retention Results

The third case study measured the vocabulary retention from participant’s interactions with the game. Table 7.3 refers to the pre-test and post-test scores of participants. Participants scored 29.8 out of a possible 64. Players scored a mean of 42.4 representing a mean increase of 13.6 words. This represents a 21% increase after an hour of interacting with the VR experience over three weeks. The post-test was administered one week after the final time the participants interacted with the experience in order to measure word retention. The words were also graded in difficulty by their frequency thus meaning that higher scores were increasingly challenging to achieve.
7.5.3 Analytics for Level Completion

Table 7.4 shows the data from the analytics carried out during each playtime. On the first attempt participants scored a mean completion of 2.1 levels, which increased to 2.3 on their second attempt finally on their final attempt each participant completed all four levels. This suggests that the usability of the game was designed to a level that made it playable for all participants as they were all able to complete the game after the sessions.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Attempt</td>
<td>2.1</td>
</tr>
<tr>
<td>Second Attempt</td>
<td>2.3</td>
</tr>
<tr>
<td>Third Attempt</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 7.4: Data Analytics On The Amount of Levels Completed

7.5.4 Simulator Sickness Results

The simulator sickness questionnaire was carried out three times, once after each session. The results were similar to the second case study but had slightly higher results. The results of each session can be seen in table 7.5. The simulator sickness questionnaire was measured on a 7 point scale and it reflected little to no sickness overall among the participants with a total maximum score of 14.31 for nausea and
a minimum of 8.586. There was a maximum of 15.16 in oculo motor issues and minimum of 9.09. There was a maximum of 20.88 in disorientation with a minimum score of 6.96. There was a maximum total score of 18.7 with a minimum of 10.098. This scoring system has a maximum value of 300 and these values demonstrate very minor effects among a few participants. The Oculus Rift S has a lower refresh rate than the HTC VIVE Pro used in the last case study which may have contributed to the higher result. Participants also engaged with the VR equipment for a longer period which may have contributed to the slightly higher figures. Only one participant recorded moderate feelings of simulator sickness to the questionnaire with all other participants rating mild or none to all the questionnaire’s questions after each session.

<table>
<thead>
<tr>
<th>Session</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Nausea</td>
<td>8.586</td>
<td>14.31</td>
<td>9.54</td>
</tr>
<tr>
<td>Oculo Motor Issues</td>
<td>9.0960</td>
<td>15.16</td>
<td>15.16</td>
</tr>
<tr>
<td>Disorientation</td>
<td>8.352</td>
<td>20.88</td>
<td>6.96</td>
</tr>
<tr>
<td>Total Score</td>
<td>10.098</td>
<td>18.7</td>
<td>13.09</td>
</tr>
</tbody>
</table>

Table 7.5: Simulator Sickness Questionnaire Results

### 7.5.5 Presence Results

After each session the participants also rated their feeling of presence within the virtual experience. The presence questionnaire was measured on a 7-point Likert scale. The results of each session can be observed in table 7.6. Participants rated each scale with a mean in the range between 5-6 which indicated a high degree of presence felt. The scores for each session were higher than the scores in the last study. This indicates that the design decisions discussed earlier in section 7.4 helped to improve the feeling of presence for the participants. The scores also increased between each session. This is evidence that as participants became familiar with the controls and the environment, they felt more in control of themselves. The Sounds
scale also increased to a mean in line with the other results for this iteration providing evidence that the efforts to improve the spatialisation and native speaker recordings made the experience more natural for participants.

<table>
<thead>
<tr>
<th>Session</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Possibility to act</td>
<td>6.025</td>
<td>6.425</td>
<td>6.55</td>
</tr>
<tr>
<td>Realism</td>
<td>5.7714</td>
<td>6.0</td>
<td>6.2714</td>
</tr>
<tr>
<td>Possibility to examine</td>
<td>5.6667</td>
<td>5.8333</td>
<td>6.3667</td>
</tr>
<tr>
<td>Self-evaluation of performance</td>
<td>5.9</td>
<td>6.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Sounds</td>
<td>5.5</td>
<td>5.7667</td>
<td>6.1667</td>
</tr>
<tr>
<td>Haptic</td>
<td>5.35</td>
<td>5.8</td>
<td>6.35</td>
</tr>
<tr>
<td>Quality of Interface</td>
<td>5.8</td>
<td>6.2</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Table 7.6: Presence Questionnaire Results

### 7.5.6 Paired T-Test Results

A paired-samples t-test was conducted to compare participant’s vocabulary retention along with the Ideal L2 Self of participants, their attitude towards learning Irish, their Irish Anxiety and their Linguistic Self Confidence before and after engaging with the game.

There was statistical significance found in the scores for Irish Anxiety, their attitude towards learning Irish and their vocabulary retention after playing.

Ideal L2 Self pre-test (M=3.5, SD=1.22) and post-test (M=4.02, SD=.76) conditions; t(9)=−1.145, p = 0.282.

Attitude towards learning Irish pre-test (M=3.28, SD=1.28) and post-test (M=4.48, SD=.47) conditions; t(9)=−2.451, p = 0.037.

Irish Anxiety pre-test (M=3.13, SD=1.27) and post-test (M=1.95, SD=.81) conditions; t(9)=2.308, p = 0.046.

Linguistic Self Confidence pre-test (M=3.88, SD=.69) and post-test (M=4.38,
SD=.53) conditions; t(9)=−1.639, p = 0.136.

Vocabulary Retention pre-test (M=29.8, SD=7.81) and post-test (M=42.4, SD=7.78) conditions; t(9)=−.6.05, p = 0.0001.

These results suggest that the game improved vocabulary retention for participants alongside a reduction in Irish anxiety and an improvement in their attitudes towards learning Irish. While not statistically significant the mean for Ideal L2 Self and Linguistic Self Confidence had their largest improvements among the case studies, highlighting the intended effects of the intervention.

<table>
<thead>
<tr>
<th>Pair</th>
<th>Test</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
</tr>
</thead>
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<tr>
<td>Ideal L2 Self Pair</td>
<td>Pre-test</td>
<td>3.5</td>
<td>10</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>4.02</td>
<td>10</td>
<td>0.76274</td>
</tr>
<tr>
<td>Attitudes Towards Learning Irish Pair</td>
<td>Pre-test</td>
<td>3.28</td>
<td>10</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>4.48</td>
<td>10</td>
<td>0.47329</td>
</tr>
<tr>
<td>Irish Anxiety Pair</td>
<td>Pre-test</td>
<td>3.13</td>
<td>10</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>1.95</td>
<td>10</td>
<td>0.80527</td>
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<tr>
<td>Linguistic Self Confidence Pair</td>
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<td>3.875</td>
<td>10</td>
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<tr>
<td></td>
<td>Post-test</td>
<td>4.375</td>
<td>10</td>
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<tr>
<td>Vocabulary Retention Pair</td>
<td>Pre-test</td>
<td>29.8</td>
<td>10</td>
<td>7.814</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>42.4</td>
<td>10</td>
<td>7.778</td>
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Table 7.7: Case Study Three Paired Samples
### Paired Differences

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<th>Std. Error Mean</th>
<th>95% Confidence Interval of the difference</th>
<th>T</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
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<tr>
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</tr>
<tr>
<td><strong>Mean</strong></td>
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<tr>
<td><strong>Std. Deviation</strong></td>
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<tr>
<td><strong>Std. Error Mean</strong></td>
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</tr>
<tr>
<td><strong>Mean</strong></td>
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<tr>
<td><strong>df</strong></td>
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<tr>
<td><strong>Sig. (2-tailed)</strong></td>
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<td>Ideal L2 Self</td>
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<tr>
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<td>-1.145</td>
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<td>Attitudes Towards Learning Irish</td>
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<td></td>
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<td></td>
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<tr>
<td>Pre-test - Post-test</td>
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<td>1.5438</td>
<td>.48819</td>
<td>-2.3010</td>
<td>-2.451</td>
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<td>.037</td>
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<td></td>
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<td>1.6211</td>
<td>.51265</td>
<td>.02364</td>
<td>2.308</td>
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<td>.046</td>
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<td>Linguistic Self Confidence</td>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Pre-test - Post-test</td>
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<td>.30505</td>
<td>-1.19</td>
<td>-1.639</td>
<td>9</td>
<td>.136</td>
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<td>Vocabulary Retention</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pre-test - Post-test</td>
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<td>6.58618</td>
<td>2.0827</td>
<td>-17.311</td>
<td>-6.050</td>
<td>9</td>
<td>.000</td>
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</tbody>
</table>

Table 7.8: Case Study Three Paired T Test Results

### 7.6 Discussion

The intervention confirmed the design’s effectiveness at improving the target context’s Ideal L2 Self. Participants felt more confident about their ability to imagine themselves as future Irish language speakers after engaging with the VR game for three sessions. It is believed the improvements to the research design helped to contribute to this improvement.

The context group was very suitable for the intervention. In their pre-test scores the participants displayed a moderate extrinsic motivation for learning Irish. The Prevention scale was the highest score among this rating. This highlights the need for Irish among the participants in order to gain their qualifications and their personal anxieties and fears of failing to achieve their required grades. In order to gain entry
to their course they need to accomplish an honours grade in honours Irish in their secondary school education. This means that the context group would have a higher Irish language aptitude than the average college student in Ireland. In their pre-test score however, they displayed a moderate Ideal L2 Self score along with a moderate Irish Anxiety score and Attitude Towards Learning Irish. These scores reflect a context group that didn’t feel very confident about their ability in Irish. The post-test scales displayed a much more confident context group as a result of their interaction with the game. Their Irish Anxiety reduced along with an increase in their Linguistic Self Confidence and Attitudes Toward Learning Irish. The situated nature of the game allowed the participants to self-assess their ability and motivations in a context where they were able to interact with the language in a more naturalised environment as opposed to their classroom experience.

The longer period of the research design gave the participants three sessions of interaction with the game. This allowed for the observation of a gradual increase in the presence ratings from participants after each session with the game. In particular the result from the Self-Evaluation Of Performance scale was notable. After each session participants had a higher rating of their own evaluation of their performance. This was due to their improving ability at understanding the control scheme of the virtual reality headset and controllers and an improving memory of the situated environment such as where items were placed within the game world. This allowed them to exert greater control in the virtual environment. The Possibility to Act, Possibility to Examine and Quality of Interfaces scales within the presence questionnaire confirm this with participants giving a gradually higher rating on all three scales after each session. The analytics captured on level completion also helps to confirm that participant’s self assessment of their performance was accurate. By the third session each participant was able to complete all four levels in one session.

In terms of the design of the virtual environment the design succeeded in its usability goals with each participant capable of interacting with the game and completing the goals within.

The simulator sickness questionnaire confirmed that the teleportation movement
system was still an effective design implementation for the movement system similar to the second case study. This iteration displayed higher scores on the simulator sickness scales which is believed to have occurred due to the use of the Oculus Rift S device which has a lower frame rate than the HTC VIVE Pro utilised in the second case study. A much larger context group or set of repeated experiments would be necessary to make any conclusive or robust determination on the design. Each level was designed with only four tasks in mind and each participant engaged with the experience for a maximum of 20 minutes each session. This was longer than the participants in the second case study and may have also contributed to the simulator sickness effects which are longer after prolonged interaction (Gallagher and Ferrè, 2018) but overall were minor among participants.

A 21% increase in word retention was found after the intervention. The simulated environment increased the Irish language vocabulary the participants had in the real world. All participants saw an increase in their language vocabulary.

7.7 Conclusion

This chapter gave a full account of the third case study of a DBR experiment focusing on using a virtual reality design intervention to improve the Irish language motivation of adult Irish language learners along with an investigation of the vocabulary retention of participants engaging with the experience. The targeted intervention was explored with a detailed account of the design decisions and the overall rationale. This was followed by a detailed discussion of the results. The third case study of the design led to an increase among participants in their Ideal L2 Self. There was also a 21% increase in their vocabulary retention after engaging with the experience. In terms of the design of the game, participants felt present in the game and experienced very little simulation sickness. After repeated interaction with the game participants felt more comfortable with the control systems and their ability to navigate the environment which led to an increase in presence scores after each session. Finally, results from the second case study found similar results to this case study: a significant decrease
in Irish language anxiety after engaging with the VR environment alongside an improvement in their Attitudes Towards Learning Irish and Linguistic Self Confidence.
Chapter 8

Focus Groups

8.1 Introduction

This chapter presents the qualitative results of the third case study of the thesis. The qualitative methodological tools were chosen in order to give a more complete picture of the research context from a number of approaches. As a DBR research experiment the research follows a methodology that was undertaken to enable the research to contextualize theoretical questions about learning within people’s lives (Hermes et al., 2012). As described in chapter 4, DBR seeks to work with participants
as co-designers of the intervention and therefore it is vital that the research highlights
the participant’s voice in the interventions outcomes.

As detailed in the previous chapter participants were given three opportunities
to engage with the VR game over a five-week period. Once all the participants
completed their three separate sessions of the game and completed the quantitative
questionnaires they engaged in thirty-minute focus group interviews in groups of three
and four participants at a time. There was a total of 10 participants and three focus
groups were conducted. The same questions were asked in the same order for each
group. This chapter highlights the insights uncovered through the analysis of this
qualitative feedback. As per the aim of DBR studies it seeks to provide guidelines for
the process rather than the product (Hermes et al., 2012) through rich and complex
practice bounded by process decisions and decisions about needs, opportunities and
the form of the context group.

The open-ended questions in the questionnaire were thematically coded along with
the focus groups after the intervention as described in section 4.4. The focus group’s
feedback was transcribed and thematically coded using the same coding schema
as the open-ended questions they were both used for triangulation purposes. An
iPhoneXR microphone was used for the recordings with each recording saved locally
to a password protected computer folder. Themes were then ordered by their ranked
order of importance to the priori coding schema. Which lead to a total of 8 themes
including:

1. Situated learning
2. Motivation
3. Task Based Learning
4. Flow and Scaffolding
5. Novelty and Enjoyment
6. Presence and Simulator Sickness
7. Language Anxiety and Self-Efficacy

8. Design Improvements

Figure 8-1 displays a word cloud of the frequency of words mentioned during the focus group sessions. This gives a visual frame of reference of the impression the intervention had on participants through their interactions with the virtual reality game.

Figure 8-1: Word Cloud Of Frequency Of Words From the Focus Group Sessions

8.2 Theoretical Purpose for the Focus Group Interviews

The immersive situated virtual reality game was designed with a constructivist pedagogical perspective specifically with situated cognition theory in mind aiming to promote a situated language learning experience for participants in order to improve their motivation in Irish language learning. Constructivism is generally described as
an umbrella term, which describes a series of ideas that share some resemblances for example: learning as an active process of constructing knowledge to make sense of the world (Adams, 2006). The situated cognitive perspective is a branch of constructivist theory. It considers the value of context when thinking about learning. It posits that “knowing” is a contextual and participatory act, and that the context where one learns content shapes the understanding of the content (Barab and Dede, 2007) (See section 2.2.2). Situated cognition theory is particularly popular among researchers examining games as a site for learning:

“Video games are interesting not for their content but for the way new explorations initiate negotiations, constructions, and journeys into knowledge (Egenfeldt-Nielsen, 2006, 18).”

This chapter examines the internal factors shaping language learner’s motivation through the use of qualitative methods. Situated theorists see a universally applicable theory of linguistic motivation to be impossible to derive due to the factors that influence one’s motivation which are dependent on the context the speaker is engaged in (Kormos and Csizér, 2008) (see section 2.2.4). Firth and Wagner’s ground-breaking work expanded the work of second language research to appreciate the importance of context (Firth and Wagner, 2007). This challenged the mainstream cognitive second language research. This research seeks to highlight the contextual interrelation between linguistic and situational elements involved in language learning. These are factors that tend to be viewed as minor or inconsequential in traditional second language research. The lack of focus on context and community is regarded in Irish language research as an important aspect when it comes to why language revival policy hasn’t been seen as widely successful. Examination of the achievement of the compulsory Irish policy found the lack of a speech community was hindering the success of Irish language revival via the educational system:

“The problem was that schoolchildren and their parents realised there were limited opportunities to use Irish in the broader society, while
teachersoneselfswere theonlygroupchargedwitheffectingthe revival”
(Moriarty, 2017, 7) For more information on the current state of the Irish language revival policy see section 2.3.2. The qualitative analysis was performed through Nvivo coding. The aim of which is to give a voice to the participants in the research. The statements were coded thematically through a priori coding schema matching them to central themes of the study. In the following section an analysis of the participants statements with regards to each coded theme is discussed.

8.2.1 Situated Learning

This study examines how a game based situated learning environment effects participant’s motivation and vocabulary retention. Participants found the situated learning of the experience to be fundamentally different to their previous experience in Irish language learning:

Participant 9: “You weren’t just told oh this is this word here’s a picture of that word Let’s all repeat the word again blah blah blah going on again exactly like I know with all the things we do when we teach but like when you’re actually given a purpose I want you to go find these things when you’re actively gone out to do it you’re thinking more about it you’re trying to like... cos it’s not like you had a list in the game like you had to actively think about it more and try and connect it to what you think it would have been. So it was definitely better than what we would do in class.”

Situated learning is difficult to realise in a classroom environment as the classroom cannot possibly have the resources and communities to involve the learners in a range of possible scenarios, thus virtual reality games offer the promise of authentic problem solving with communities where learners can interact with others whether they are computer generated or real (Ternier et al., 2012). Participants commented on the authentic nature of the environment and how this led to an authentic learning experience:
Participant 3: “Like exactly what they were saying like if you’re not just learning it you feel like you’re actually you’re going shopping you have to pick these out and you have to get them to the cashier kind of thing.”

Participant 1: “Yeah it’s a practical purpose for what you’re doing. It wasn’t just learning for the sake of learning.”

Participant 8: “And that gave you context you weren’t just looking at a page with the word apple and you actually got to go around and find the apple.”

Participant 7: “Yeah because it was just like being in the shops and you’re going shopping.”

Game environments can simulate complex real-life social networks, through their use of virtual avatars and how games respond to a players input by staging information at an appropriate level for learners. (See section 2.2.2 for further discussion on the ZPD.) Participants directly referred to how the VR game developed new meaning in their interaction with Irish:

Participant 3: “Like you it didn’t feel totally like learning because when you think of learning Irish you think of looking at a picture with words underneath it whereas this is kind of you picking up the objects it made a lot more interactive and a lot more meaningful.”

Participant 8: “It just changed my perception about how to learn. Yeah. So I think I have quite a negative view of the way it’s taught. I don’t yeah I’m not a fan of the way it’s taught and I think this is a nice different way to teach it where it’s more experiential they are using it more”

As stated previously, Firth and Wagner’s re-conceptualised account of second language learning influences the theory of this thesis (Firth and Wagner, 2007). Language learning is not only a cognitive phenomenon, but also fundamentally a
social phenomenon, acquired through interaction, in a variety of contexts for practical purposes (Firth and Wagner, 1997). This was referred to by participants in the skill set they feel they needed to utilise to use the game:

Participant 10: “You haveta employ like a lot of skills to actually play the game because you have to... so you have to like listen to the word you haveta try and remember what it kind of sounds like then you have to actually go out go into an environment find the correct like section of the place you have to get it to grab it you have to listen to it and then you have to put it into the basket and then it’s like an experience like and it’s like having the experience as well. So it’s like by the time you’ve gotten to the checkout desk you’ve already probably heard that word a couple of times you know and it’s a lot better than just being told like flash cards like this is the word do you remember that one?”

Participants perceived the game space contextually as an Irish language environment and referred to how it differed from their classroom experience of language learning:

Participant 4 “Yeah I.... I really like Irish when I’m caught up in Irish when I’m in an Irish environment. It’s just it’s only when you’re in a room on your own and trying to study Irish and everyone around you is speaking English. It kinda feels like a waste but when you’re immersed in the whole Irish environment you do get.... it is nice like...”

8.2.2 Motivation

The aim of the research is to improve the participant’s internal factors shaping their language motivation. This ability to self-actualize as Irish language learners is a complex process due to the sociolinguistic context of Irish. The officially designated Irish language regions where Irish is the primary language of the community are known as the Gaeltacht regions however less than one third of daily Irish speakers
reside in the Gaeltacht (Murchadha, 2012). These regions have cultural capital in terms of language production and are culturally viewed as target models for language excellence. They are divided into three main regional dialects Munster, Connacht and Ulster (Murchadha, 2012). The Irish in these regions is viewed as authentic due to its “profoundly local” association to Gaeltacht communities. This can be problematic in contexts of minority language revitalisation, where learners become deterred from speaking the minority language as they don’t sound as ‘natural’ as those who speak a “profoundly local” variety (O’Rourke and Brennan, 2019). Participants frequently mentioned how their associations with Gaeltacht dialects impacted their own language beliefs:

Participant 6: “We went to the Gaeltacht there last Easter and I probably wouldn’t have been as confident having a conversation with it.. with the person and they’d know that and they’d speak to you in English whereas now if you go in like knowing that you have the Irish for it it’s much better and they’ll speak to you back in Irish. So I think it does improve your.. like standard and your confidence that way.”

Participant 7: “You might be accused in the Gaeltacht of using book Irish if you use some of those translations...”

Participant 9: “So I guess it just kind of depends on where you were and what kind of canuimtu you have. So like if you’ve travelled around like that Gaeltacht parts of Ireland a lot you’d be probably much better at it because you have more exposure to the different kinds of phrases.”

A post-Gaeltacht variety of Irish has emerged which operates independently of Gaeltacht norms (Phaidin, 2008; Ó hIfearnáin and Ó Murchadha, 2011) as most speakers of Irish outside the Gaeltacht tend to have little contact with the Gaeltacht community and, instead, converse with other post-Gaeltacht speakers for the most part (Murchadha, 2012). This dialect of Irish has very little sociolinguistic currency as it is not considered authentic due to its lack of a traditional community rooted
in a geographical space. Varied communities of speakers and dialects are rarely demonstrated in the Irish language schooling system where strict language separation is favoured and promoted by the current educational policy which is at odds with the lived sociolinguistic reality of the Irish context (Moriarty, 2017). This is true in many minority language contexts where native speakers and legitimacy are closely linked such as in the Irish context. The revitalisation initiatives are centred on processes of standardisation. The aim of policy makers is to increase the anonymity of the minority language and make it a neutral and objective means of expression which is equally available to all users (Woolard and Frekko, 2013).

‘Language revitalisation is not about bringing a language back, it’s about bringing it forward’ (Hornberger, 1996, 14)

Recently in the field of applied linguistics the standardisation viewpoint has been highlighted as having a reductive nature which removes the importance of context and social experience. Scholars are advocating for a shift to a more dynamic and flexible approach to bilingualism, where language is identified as a malleable resource (Moriarty, 2017). This study was approached from a sociolinguistic perspective, which means that it doesn’t subscribe to the assumption of the natural ascendancy of the native speaker (Firth and Wagner, 2007). Linguistic production can be used as a means of supporting and enhancing a positive self-image by positioning oneself in the web of intergroup relationships (Murchadha, 2012). Learners must be viewed as more than simply as language learners, each learner should be considered as a unique self-reflective intentional agent, with particular social identities, located in particular cultural and historical contexts (Ushioda and Dörnyei, 2009). This person-in-context relational view of motivation, does far greater justice to the complexity and idiosyncrasy of a person’s motivational response to particular events and experiences in their life (Mhurchadh, 2011).

The game was designed with a mixture of dialects and attempted to create a working community rather than separating language and dialects. Participants were also rewarded by their ability to engage in meaningful tasks through their
understanding of the language being spoken to them. There was no attempt to
standardise or decide on the correct production of speech which allowed them to
experiment with comprehending and interacting with authentic language use.

Participants appreciated this ability to experiment and found the interactions
with different speaker groups enlightening. Many participants talked about how
it shaped their view of the Irish language in a new light. This highlights longer
lasting motivational changes where the virtual reality experience posed questions to
the participants lived experiences:

Participant 3: “Yeah I wasn’t overly worried about it you know having the
different pronunciations things actually kind of made me think little bit
more about it which I kind of liked in a way because you know it’s a new
way of hearing things. I’m so used to hearing say prataí one way and
hearing phrataí threw me off a bit but then now I know two different ways
of saying it.”

Participant 5: “Just being in it, you kind feel a bit more I don’t know... I
like Irish so I like being able to speak it. It’s kind of one of those situations
because you’re so immersed in it that you got a chance to feel like.... Like
I’d love to live in the Gaeltacht or something like that. So yeah I really
liked it.”

Participant 4: “The more I heard the word like I was kinda tryna translate
it into my own Irish because I knew them... I dunno same words but... it
different to my way”

Participant 9: “It made me think about more how Irish should be just out
in the environment more rather than just like the same posts on the road
saying that in English an Irish like if it was in the shops if it had the two
words and stuff I think it’s just more exposure for people and would be a
good support to their learning in school as well.”
Participant 10: “I felt like I was very deprived like the way we were learnt. The way that we were like taught Irish it was like very like you know it or you don’t know it. And then I went into first year in secondary school and there was all these people who were fluent... people coming in with this like amazing level of Irish and you kind of felt like inferior or whatever being like oh I don’t know that and then you kind of end up giving up on it because it’s just continued to be taught as an exam... it was never just like Irish is fun and it’s something that we can like its life and all it’s your heritage your life. It’s always a stepping stone to something else.”

8.2.3 Task Based Learning

The game’s use of tasks in order to build the situated Irish language context was key to the participant’s experience. Participants appreciated the importance of these interactions. The pedagogical decisions utilised the social-interactional approach through TBLT which sees learning as an inseparable part of activity and therefore situated in social interaction (Firth and Wagner, 2007). More comparisons were made to their classroom experience where participants felt the interactivity of the virtual environment allowed them to engage with the objects in a deeper way:

Participant 3: “If you are in a classroom you just have a picture of it you’re not gonna remember it as much. Whereas you know in the VR your kind of you’re picking it up and stuff.”

Interaction and tasks are “an essential force rather than as merely a helpful condition for learning” according to situated theorists (Dalton, 2016a). More traditional approaches to L2 research can place a large emphasis on individual’s linguistic and pragmatic failure rather than a focus on successful interaction (Firth and Wagner, 2007). Tasks allow for social building of knowledge.

Interacting in a learning environment allows learners to connect with authentic situations (Gautam et al., 2018). New powerful motivated identities are created through this interaction. Situated identities are the identities one adopts when
engaged in a social activity, for example in a classroom one may act as a teacher but when one leaves the classroom and arrives home one interacts in a new identity as a brother, sister or parent. Therefore the multiple situated identities one adopts are context specific and one only adopts an identity in order to interact with the context they are engaging with (Martín-Rubio, 2006). Game technology in combination with educational theory allows for interactivity and choice to combine with a participant’s expressive and communication patterns to become a dynamic process in a social and cultural constructed virtual world (Sorensen, 2007). Participants highlighted the comparisons between their classroom learning and virtual reality learning outlining how tasks in the VR game were transformative for their experience:

Participant 3: “Yes. Being able to interact with it I think makes it easier to learn the words.”

Participant 4: “It’s more hands on learning I suppose than just looking in worksheets.”

Participant 7: “Language learning is changed into something fun and interactive.”

The task based learning of the game was designed to improve the vocabulary retention of participants. A study by MIT which implemented a VR intervention for English language learning found performing actions in VR has a positive effect on the retention of words when learning new vocabulary (Vazquez et al., 2018). They focused on the kinaesthetic aspects of VR. Participants referred to this same phenomenon, but the main feedback was on the task based nature of the design and how this realism made it easier to remember vocabulary:

Participant 1: “Yeah I definitely learnt a lot more vocabulary like I guess which is more focused on things you’d get in a shop like products and stuff but yeah I definitely learnt a lot of different things.”

Participant 10: “You would recognise them possibly if you heard them again. Or someone showed you like oh this is like.... you would kind of have a slightly better like recognition of it”
8.2.4 Flow

The theory of flow is commonly referred to in work about games and their effect on learning. Flow can be thought about as immersion into an action (Shin, 2018). It is related to presence and is usually described as a state of profound enjoyment and concentration experienced during an activity. Csikszentmihalyi the researcher credited with discovering flow describes it as:

“a state of optimal experience, whereby a person is so engaged in activity that self-consciousness disappears, time becomes distorted, and people engage in complex, goal-directed activity not for external rewards, but for simply the exhilaration of doing” (Csikszentmihalyi, 1990, 6).

It is now believed that clear goals, feedback, and the balance of challenge and skill are understood best as the preconditions for flow, while the other elements are the experience of flow (Bachen et al., 2016). Flow is a binary experience that either occurs for the player when all the requirements are met, or it does not occur. It is a vital component for motivation in game experiences. The preconditions required for participants to enter a flow state were important factors under consideration during the design phase of the game. When a participant is in a flow state they are involved with goal-driven activity where nothing else matters. The activity is so pleasant for participants that they engage in intrinsic motivated behaviours where they act with the willingness to engage with the task for its own sake without the need for an external reward (Kiili et al., 2012). Engagement in intrinsically motivated action leads to higher levels of self-efficacy among learners which in turn makes them more likely to have positive language learning experiences (Piniel and Csizér, 2013). As many participants specifically referred to the factors involved in creating flow and how the game created these factors, the game can be said to have achieved its goal of creating the experience of the flow state for participants:

Participant 2: “I definitely did because I felt like a sense of accomplishment when I’d go up and like get all the things and liked wanted to keep doing because it was fun.”
Participant 6: “Yeah I agree VR and then being so involved like you were in control of the whole thing.”

Many other participants directly referenced how the passage of time was altered and how they were fully engrossed in the task to the point where they were intrinsically motivated to engage with the task for its own sake:

Participant 6: “Once you go in and you just kind of forget where you are, and you just do it”

Participant 6: “You’re just ready to keep going because like you’re just so engrossed in it and the time flew as well it didn’t feel like we were doing that for 20 minutes like it just went so fast. So you kinda just wanna stay on doing it.”

Participant 10: “Yeah I was worried when we were doing the training the throwing things like I’m terrible at this I’m going to be…. but like it’s like you wanted to get to the next level.”

Participant 4: “Yeah I just get totally immersed in it then and just forget about everyone else and just you’re on a mission to get your food.”

Participant 2: “You know I liked it just didn’t feel like we were learning Irish kinda it just felt more like we were... We were really involved in the game so it didn’t even feel like we were learning new vocabulary and stuff.”

8.2.5 Scaffolding

For this flow state to be enacted through the game’s design scaffolding was vital. Scaffolding has been adopted from a socio-cultural viewpoint of learning and believes that positive intrinsic motivation and autonomy are built through a social environment that supports a learners’ ability to pursue optimal challenges through the zone of proximal development (Chik, 2014). The zone of proximal development is the
range of tasks that a learner can perform with the help and guidance of others but cannot yet perform independently (Vygotsky, 1962). It views learning as a two-way process of learning from and creating social environments. A learner develops their knowledge through a more competent peer who gives the learner the tools necessary for new learning through interaction in the environment. In a game this competent peer is created through the ruleset of the game where the game context offers the player affordances to match the challenge with their level of skill. This balance between skill and challenge is at the heart of game design where the key is to keep the player engaged by increasing the skill level of the game while the player’s skill increases (Kiili et al., 2012). Scaffolding is aligned with the theory of flow in that the quality of the flow experience is the function of the learner’s motivation through clearly set proximal goals for the learner to engage in and pursue a task guided by their experience and judgment of their capacities (Piniel and Csizér, 2013). Participants directly referred to scaffolding elements of the game’s design such as the ability to check the name of each item they picked up and how this supported their learning:

Participant 2: “I liked the fact that like you could pick things up and like and like check what they were and like could go back because I had kept having to go back and like ask them again.”

Participant 3: “Actually getting to kind of you know go around the shop and like pick up each object and stuff and you know it called out what the object was whenever you’re picking it up and I thought that was really good.”

Participant 2: “Also the fact that like you have to like say if I don’t remember the word for something then the next round I’m gonna have to test it again to see if it’s the same words like you do it multiple times so it kind of”

Participant 4: “I thought yeah it was really good and when you go to put it on the belt as well it says the same word again. So just hearing the words. The more times you hear it the more times you remember it.”
Participant 6: “I found it kind of reassuring like even if you didn’t know what the word was and you’re just testing out some things it came up and it told you if you’re right or if you’re wrong it was just handy to have.”

Participant 10: “I think it’s good when like I don’t have the best Irish vocabulary but like when you’re picking up things it told you what it was”

Participant 8: “I think when you pick things up and it said the word that was really helpful because even if I wasn’t looking for it at that time if I needed it on the next level I’d remember what it was. Yeah. Just that was very good that I said it.”

8.2.6 Novelty and Enjoyment

A common affordance attributed to games is their ability to motivate (Herodotou et al., 2015). This is discussed in terms of “gamified learning” with the addition of scoreboards and challenges to learning material. There are very few formal theories of motivation that have been applied to games, the motivations of players, and the outcomes of play. Ryan et al. (2006) hypotheses that games are primarily motivating to the extent that players experience autonomy, competence and relatedness while playing. For most participants it was their first time interacting with a virtual reality experience. This led to some participants being motivated due to the opportunity of trying a new experience. Novelty is a common concern for educational interventions as researchers must discover if the technology under investigation is motivating or is the unfamiliarity of a new experience effecting the results. Participants made some references to being motivated due to the novelty of the technology thus it is highlighted as a potential limitation of the study. This requires further longitudinal research in real educational settings to measure its overall effect on VR technology as prolonged usage with virtual reality experiences would eliminate the motivational advantages of the novelty participants discussed:

Participant 7: “I’ve never had the mask on or the gloves or anything so that was cool.”
Participant 5: “Yeah. I’ve never done VR as well. So it was very different it kinda made it more fun because it was something so new.”

Participant 4: “It was good to get a go of Virtual Reality, it was something new.”

Participants also frequently mentioned how much they enjoyed the experience and that playing led them to have fun. They discuss how this fun led them to an intrinsic motivational state where their primary object was play and consequently, they were learning. This in turn led to a reduction in their anxiety of providing wrong answers. Language learning games are often used to stimulate motivation and authentic communicative practices, games are referred to as the “the fun factor” of language learning (Sorensen, 2007).

Participant 7: “Yeah I think same as that and it was just fun. You’re playing the game. and just as a consequence learning words”

Participant 9: “Yes. When language learning is changed into something fun and interactive, it takes fear out of wrong answers because in games you try again and you have motivation to get to the next level.”

8.2.7 Presence and Simulator Sickness

The immersive situated environment leveraged more than the task based nature afforded to game systems. VR technology augments the “believability” of the context the participants were situated in. VR is defined by the human experience it evokes rather than the technological hardware used to create this experience (Steuer, 1992). VR creates an experience known as “presence”. It is a psychological state of “being there” mediated by an environment that engages our senses and fosters our active involvement (Witmer et al., 2005). Immersive technology provides an alternative environment for situated learning, due to its ability to make participants believe they are “present” in a new context (Dawley and Dede, 2014). Participants commented on
the realistic nature of the environment referring to how they felt like they were really there:

Participant 1: “I thought it was really realistic like. It actually was like what you do in a shop like it just made it more fun like that so realistic”

Participant 4: “Just like you could pick things off the shelves and things would fall out your basket if you swung it too much and there was cashiers there and you could move throughout the level and if you weren’t in the right one you couldn’t just reach out to the next you have to move yourself into next aisle so it was very real.”

Participant 1: “I thought it was really like natural like if you picked up the thing like you could actually look at it and eh like it was very lifelike.”

Participant 5: “Even the small bit of music in the background. It was very real and then like all the cash registers and your basket and like the detail was very good.”

The fidelity of the models being used, along with the realistic gravity simulation, the music and the design of the shop itself all effected these aspects of presence among participants. While the head mounted display HMD effected how immersed the participants felt, the design of the environment was also a major contributing factor as illustrated by the comments of the participants. The iterative approach to the design of the context helped to create an environment that maximised feelings of presence for participants, iterating the design aspects based on feedback from previous case studies. Participants commented on the immersive aspects of several features that were introduced in this version of the game for example, according to participants the environment felt like a real place due to the ability for the computer avatars to speak with one another during the experience:

Participant 6: “When you went up to the fish place or the meat place and the people were actually talking to you asking you what you wanted so everyone was like engaging with one another.”
Other aspects of VR also contributed to the immersive nature of the design in particular participants commented on the embodiment they felt through the input devices the Oculus Rift S uses. Participants interacting with the environment used their actual bodies to move rather than a mouse and keyboard which allowed for kinaesthetic movement which benefited the participants feeling of presence:

*Participant 3:* “Yeah again like you know it is really realistic like you know you had to get on your tippy toes to reach some things and bend and get other things is like what you would actually do in an actual shop like you wouldn’t just be on eye level the whole time you’d have to reach up and you’d have to reach down.”

Presence contributed to the participant’s recognition of the context as realistic and in turn this changed the goal expected of them. It was more than trivial but an authentic task, thus creating the desired experience for participants to engage with a situated environment:

*Participant 3:* “Like exactly what they were saying like if you’re not just learning it you feel like you’re actually you’re going shopping you have to pick these out and you have to get them to the cashier kind of thing.”

Current HMD’s such as the Oculus Rift S commonly have the adverse side effect of simulation sickness. While it is a minor side effect and causes no long-term health issues, it warrants investigation from an ethical viewpoint and also as it minimises the presence of participants engaging with the VR experience if they feel sick during their interactions. Studies have found about 5% of users immersed in virtual reality will report symptoms that are significant enough to warrant stopping the immersion, about 5% will not experience any symptoms at all and the remaining users between 70% to 90% may experience some mild symptoms caused by the immersion in VR (Bouchard et al., 2012a).

There are multiple theories about what causes simulation sickness, the most common of which believes it is due to a discrepancy between the sensory signals which provide information about the body’s orientation and motion: in many VR
applications, optic flow elicits an illusory sensation of motion which tells users that they are moving in a certain direction with certain acceleration. However, since users are not actually moving, their proprioceptive and vestibular organs provide no cues of self-motion. These conflicting signals may lead to sensory discrepancies and eventually simulation sickness (Gallagher and Ferrè, 2018).

Most participants reported very minor simulation effects or none at all with only one participant reporting any significant effect:

*Participant 8:* “Adjusting to the VR experience did take time for me as it initially made me nauseous and nervous. However with practice I began to improve.”

All other participants noted that it was strange getting used to the control systems in the environment in their first playthrough but quickly understood what they were capable of by their second playthrough.

### 8.2.8 Language Anxiety and Self Efficacy

Participants referred to the lack of anxiety they felt in the VR game. Language learning is generally viewed as a complex task where anxiety is more likely to inhibit the learning process (Piniel and Csizér, 2013). A reduction in anxiety is a common outcome of games for learning (Gorini and Riva, 2008). There can be a lower stress level involved with language learning in a virtual world, removing barriers to learning such as anxiety (Dalton, 2016a). The experiences of the participants illustrated some of the affordances of the VR game that allowed this to occur. Social anxiety was the primary cause for the anxiety the participants felt when speaking Irish. In the VR game participants referred to the extra time they had to understand the words being spoken to them. This affordance occurs by the player being able to approach the avatars repeatedly:

*Participant 1:* “I just think that it was a lot less nerve wracking because there was no like immediate need. Like if you’re in a conversation you
Participant 1: “Yeah I think sometimes when people speak to me I kind of panic because like yeah I don't know exactly what to say straight away but if I just gave myself a little bit of time like you had the opportunity to there.”

There were many comparisons made between their classroom environments and the gaming environment. Participants referred to feelings of judgement from their classmates and their teachers and the fear of making mistakes that they didn’t feel in the game environment:

Participant 2: “I felt a lot less anxious cause it’s not like someone’s there or like you’re not in a whole class of judging you or whatever but also the fact that like in a classroom like you could ask for clarification like even when you go back like you didn’t hear what they said or you don’t get it”

Participant 10: “You’re more feeling like okay I gotta focus on the game and find the objects than oh teacher’s going to ask me this.. to ask me what this is like im piseanna talun.. Yeah I remember that one but no like teachers going to ask me that and I’m not going to know the answer and then that’s like a lot more like everyone’s going to look at you. In VR you’re not being looked at like really like you feel like you’re in a different world or whatever."

Participant 3: “In a classroom environment you’re more aware of your mistakes and lack of knowledge rather than just enjoying the games.”

The virtual reality environment allowed for the participants to experience a situated language environment but removed the anxiety for learners as they knew they weren’t being judged for their language ability by the avatars in the experience. This highlights a valuable affordance of the virtual reality learning experience. Contextual
learning through situated environments can occur with the aid of the game’s systems that allow for the scaffolding of information at the learner’s level, but paradoxically social limitations to learning such as anxiety in this case were removed. This finding aligns with current theory on the advantages of VR technology. As argued by de Gelder et al. (2018) VR is useful by its differences from the normal environment. It’s non-realism can actually offer increased clarity with respect to the features of interest. In this case the non-realism allows learners to reduce their anxiety through feeling a lack of social judgement by knowing the avatars in the environment aren’t real.

The game was also found to increase the self-efficacy of participants in their ability to interact in Irish. In a design-based research experiment conducted by Ketelhut she investigated the relationship between self-efficacy and data gathering behaviours. She found self-efficacy initially predicted scientific inquiry behaviours among learners before they interacted with the virtual world but over time as learners returned to the environment the self-efficacy of the other learners improved to the extent that self-efficacy could no longer be used as significant predictor of scientific inquiry behaviour. This suggests that immersive games may act as a catalyst for change in students’ self-efficacy and learning processes (Barab and Dede, 2007). Through games learners are able to experience what they can do using their language skills rather than merely having corrected what they can’t. In turn, this helps build motivation, confidence and language knowledge (Preston et al., 2015). Even though the context group for the experiment achieved high grades in Irish in standardised tests they suffered from very low levels of self-efficacy:

Participant 9: “I think I’m always just more self-conscious speaking to fluent people because like you tell them oh I’m doing teaching then immediately they go oh teachers are meant to have a really good level of Irish talk with me you’re no I don’t at all.”

Participants referred to the lack of pressure in the game as opposed to their classroom experience which was beneficial to their self-efficacy as learners:
Participant 1: “Yeah again like it’s kind of just less seems less pressure in there because the only times I really learn Irish are in the classroom. And you need to learn it but I just seemed more like natural you know.”

Participants commonly referred to their anxieties around socially interacting with Gaeltacht speakers and how the VR experience gave them a context to perform this interaction without social judgement which built on their self-efficacy:

Participant 5: “I thought the VR was much much easier because you kind of felt like it was just you you forgot other people in the room so say in the classroom kids would be anxious or nervous talking to their teacher or even during the Gaeltacht I even get nervous enough or just afraid whereas in the VR you just feel like just you’re on their own so you’re not as kind of self-conscious if that makes sense.”

Participant 6: “Yeah definitely. Like just thinking back to the Gaeltacht. We went to the Gaeltacht there last Easter and I probably wouldn’t have been as confident having a conversation with it.. with the person and they’d know that and they’d speak to you in English whereas now if you go in like knowing that you have the Irish for it it’s much better and they’ll speak to you back in Irish. So I think it does improve your.. like standard and your confidence that way.”

The repeated interaction of the game over the course of three sessions improved the self-efficacy and confidence of participants in their ability to utilise the game’s features:

Participant 9: “My first session I was really bad at transporting but then I was like zoom, zoom, zoom.”

Participant 8: “I think from one week to the next you’re trying to improve you’re trying to beat what you got the last week.”
Participant 9: “I think each time that you did it more you were more motivated because you were more used to the layout and the setting and where everything was because it didn’t change each week.”

Participant 4: “Seeing my development of skill both in gameplay functions and in Irish literacy over the weeks was encouraging. I was able to remember more items and navigate the shop.”

8.2.9 Design Improvements

It is vital in a design-based research experimental study to investigate where the current intervention can be improved for future iterations. Qualitative feedback is illuminating in this regard, while quantitative metrics are valuable in confirming if an intervention is having its intended effect it doesn’t give a rich context of a participant’s experience of the intervention. While much of the feedback from participants was very positive they also noted several design issues and areas where the VR environment was lacking in their learning experience. The game was created to immerse the participant in an Irish language context in order to improve their Irish language motivation and language retention. For the game to become an educational experience capable of this goal certain prerequisites were required including good usability, an engaging task and a useful artefact. It is important to highlight that game designers cannot design the subjective experience of the participant only the context from which the experience arouses can be designed (Kiili et al., 2012). Therefore, only through participant feedback is it possible to alter a design to improve its intended goal. The intention was to psychologically immerse the participant in the experience which can be achieved through design strategies that combine actional, symbolic and sensory factors to further the suspension of disbelief that one is “inside” a virtual environment (Dede, 2005). As the analysis thus far has shown, these prerequisites were achieved in this intervention however many participants noted where further improvements to the usability of the design could be made. Issues with usability decreases the likelihood of experiencing task based flow because the player has to sacrifice attention and other
cognitive resources to inappropriate activity (Kiili, 2005). Thus, an important aim when designing educational games is to support the shift from cognitive interaction to fluent interaction (Michailidis et al., 2018). The controls of the game should become transparent as far as is possible and allow the player to focus on higher order cognition (Kiili et al., 2012). Participants referred to issues about remembering all the items they had to get in the shop:

*Participant 3:* “Cause they give you a list of like four or five things and I’d only ever remember say three at any one time so you have to go back and ask them again. Or not even again not knowing what something was and kind of having to make a guess as well.”

The layout of the shop was a common issue among participants where they referenced how easily they became lost. Proper signage of different food aisles could improve this issue in future iterations as referenced by the participants:

*Participant 2:* “maybe if there’s more like signage for the stuff so you’d don’t have to actually go and pick up everything and see what it was.”

*Participant 3:* “Yeah like I would kind of have a layout of what’s in each section so say you know glasraí is over this side amm anything for like bathrooms or whatever over this side of the shop.”

*Participant 9:* “I don’t know how much I personally learned. That’s cause I dunno I kept getting lost”

*Participant 4:* “I think if there was maybe like posters in the shop and stuff like some like photos of something and then you know just be like oh it’s an offer or something but just so that you see the vocab”

Designing the game so it was the correct height for all participants was another aspect that would have to be improved in future iterations:
Participant 9: “Actually making the shelves lower because three of us well no you’re not that short but the two of us are really short we actually didn’t know that there was another shelf. I had to jump did you? Then I knocked off the loads of items and I had to pick them up and I was so embarrassed.”

Some feedback from participants conflicted with one another. This highlighted the range of different ability levels among the context group with some participants feeling that the level of difficulty was too challenging and others feeling that early levels were too basic. As discussed earlier it’s vital that the task balances it’s challenge with the player’s skill in order for them to become immersed in the experience however some participants were experiencing too much challenge in later levels while others had the opposite experience:

Participant 4: “I found for the harder levels it was just... the words were hard. I didn’t understand like three or four words for one level and just trying to go around shop and you have to go back and hear the words again and you didn’t know what you’re looking for you’re trying remember three or four words when you don’t know what you’re looking for. That was the hardest part for me.”

Participant 5: “Yeah. Sometimes when at the start what you’re going to ask what you have to look for. Sometimes I struggled to hear what exactly they were saying. And then especially if I did know like what it was it kind of like it’s just that I’d get confused but then I suppose you go into the shop to try them out even if it takes a while.”

Participant 4: “I’d just change the levels just like the beginning levels. I knew every word he is asking for. So there was no trial or error looking for words like I knew where the milk was and the bread and butter. I knew what they looked like in the shop. So that was easy words whereas the harder levels so I wasn’t learning new vocabulary for those levels because I
knew what I was looking for whereas I’d put in a few hard words into each level. So there’s more trial and error”

Finally, the novelty of the VR experience lead to some minor usability issues among the participants. This included getting used to the input devices and the HMD itself alongside the design of the VR experience. Participants commented on how the VR training experience was helpful, but they would have liked to have a longer opportunity to engage with this in order to master the basics of movement and picking up objects.

Participant 9: “And the transporters worked way better than I thought they would. Yeah it took a while to get used to in the first session.”

Participant 10: “I don’t know. Like I was thinking just with how I was with adjusting to it. Like I don’t know if everyone would be like that but I feel like maybe the training module should have been a bit longer just to adjust the actual idea of being in VR. And maybe like doing a training round like in the shop if you know what I mean.”

Participant 2: “Adjusting to the headgear was hard at first.”

8.3 Conclusion

The situated immersive Irish language game improved the self-efficacy of participants by reducing their anxiety while they were engaging in the Irish language context as opposed to their wider social experience of learning Irish according to the qualitative analysis. This highlights another further area of research to investigate if VR technology can motivate in social contexts outside of the virtual environments. The improved outcomes stem from the opportunities games provide to act in ways that are congruent with idealized views of themselves in order to experience abilities that are difficult to access in everyday life (Przybylski et al., 2012).

Players were intrinsically motivated through their engagement in meaningful tasks and felt a sense of presence in the virtual Irish context. This afforded them the
opportunity to engage in Irish language tasks that can become internalised and meaningful. The scaffolding the game used allowed the participants to self-actualize their experience into success at tasks they didn’t believe they were capable of thus improving their motivation as Irish language learners:

Participant 1: “It kind of motivated me a little bit more conversational Irish. It was just the way they were asking ya to get the things. It was easy kinda to understand even when the cashier talked and stuff so it’d be nice to be able to just have those little conversations in real life”

Participant 4: “Yeah I…. I really like Irish when I’m caught up in Irish when I’m in an Irish environment. It’s just it’s only when you’re in a room on your own and trying to study Irish and everyone around you is speaking English. It kinda feels like a waste but when you’re immersed in the whole Irish environment you do get…. it is nice like…”

Participant 5: “Yeah it improved my attitudes as well I think just towards Irish. Sometimes I find that kind of frustrating. Just I think when your alone trying to do it. No one else is doing it but when you kind of see that everyone can be doing it together. It can be pretty nice you know well… with your imaginary people or whatever in VR.”

The thematic analysis of the focus group sessions and questions helped to confirm the rationale of the participants as to their improved scores in the post-test scores.
Chapter 9

Conclusions

9.1 Introduction

The following chapter represents the reflective phase of the thesis. The analysis of the case studies are analysed and evaluated and conclusions are drawn. The design and evaluation of game-based learning artefacts poses a challenge for the research community. There is long standing theoretical debate around theories of learning with no unifying theory towards what it is we learn and how. Alongside this issue currently, within the field of games for learning there is a very active discussion concerning a definition for games that can encapsulate their myriad of possibilities.
This is currently a contested space without a resolution in the academic space. This poses a large challenge for a research community interested in exploring the design and implementation of games for learning.

This thesis sought to overcome some of these obstacles by exploring a DBR study with three separate interventions implementing a VR game designed with Unity with a specific context group of Irish language learners to teach Irish language skills.

The thesis aims to give a practical framework for designers and researchers for the design and implementation of a virtual reality game for Irish language learners.

It sought to provide an overview of the key theoretical insights and developments as a result of the mixed method analysis of the three design phases and implementations of the study. This study has a pragmatic world view to its design and takes a situated learning theoretical approach to its implementation involving small scale context groups to refine the theory and design.

Theory was developed through the analysis of quantitative questionnaires about motivation and vocabulary retention along with open ended questionnaires and focus groups for qualitative explorative feedback.

The aim of the thesis was to give a practical insightful guide from one context of learning so researchers can gather insights towards their own research designs to see where theoretical approaches and design decisions align in order to achieve a successful learning intervention in a multitude of learning contexts.

This thesis is the first study of its kind utilising virtual reality to explore Irish language learners’ learning.

In this section the thesis is concluded by listing the research questions of the study and a summary of how this thesis has answered these questions. The strengths and limitations of the study are addressed. This is followed by the design recommendations from the work carried out through the thesis. The contributions to the literature are stated and finally areas of further research are discussed.
Chapter 9 Conclusion

9.2 Summary Of the Main Findings

9.2.1 Case Study One

The first case study of the design led to an increase among participants in their Ideal L2 Self. In terms of the design of the game, participants felt present in the game and experienced very little simulation sickness. Qualitative feedback found that participants quickly tired of the experience with no tasks or objectives to engage with. Finally, a decrease in Irish language anxiety after engaging with the virtual environment was found alongside an improvement in their Attitudes Towards Learning Irish and Linguistic Self Confidence.

Future Decisions

The results of the quantitative questionnaires along with the qualitative feedback informed the design of the second case study’s game. While the first intervention was successful in many regards, the context group wasn’t Irish language learners but game design students. This group was much more likely to understand the control systems of the game and be motivated to learn Irish through game-based learning. Future case studies were mindful of this and recruited an authentic context group of Irish language learners. The qualitative feedback through the open-ended questions also highlighted the need for a goal for participants to engage with along with an improvement to the situated nature of the design of the shop.

9.2.2 Case Study Two

The second case study displayed only marginal improvements of the target context’s Ideal L2 Self. In terms of the design of the game, participants felt present in the game and experienced little to no simulation sickness. Finally, in terms of the impact the experience had for participants, a significant decrease in Irish language anxiety after engaging with the VR game was found. There was also an increased level of language confidence after engaging with the VR game.
Future Decisions

The results of the quantitative questionnaires alongside the qualitative feedback informed the design of the third case study’s game. There was significant improvements implemented over the initial design. The qualitative feedback through the open-ended questions also highlighted the need for the introduction of levels to the design in order to stage the content of the game to the appropriate level for the learners as many participants found the game too hard or too easy. The qualitative feedback also highlighted the need for a further focus on creating a more situated experience in the design of the context.

9.2.3 Case Study Three

The third case study of the design led to an increase among participants in their Ideal L2 Self. There was also a 21% increase in their vocabulary retention after engaging with the game. In terms of the design of the game, participants felt present in the game and experienced very little simulation sickness. After repeated interaction with the game participants felt more comfortable with the control systems and their ability to navigate the environment this led to an increase in presence scores after each session. Finally, results from the second and third case studies of the intervention found a significant decrease in Irish language anxiety after engaging with the virtual environment and an improvement in their Attitudes Towards Learning Irish and Linguistic Self Confidence.

9.2.4 Focus Groups

The focus group analysis developed under eight themes that were analysed through a priori coding schema which evolved from the research questions. Each theme was matched to the corresponding research questions it was associated with. The thematic analysis of the focus group sessions and questions helped to confirm the rationale of the participants as to their improved scores in the post-test scores.
9.3 Research Questions

This thesis aimed to answer the question: "can contemporary immersive game based tools and methods be used to develop situated language learning game environments to improve learner’s motivation and anxiety in the Irish language?"

This question was answered by dividing it into four main research questions.

9.3.1 Research Question One

Can game based situated Irish language environments improve language learner’s motivation?

The study found the language game developed to be very motivating for participants. Statistically significant improvements were found for participant’s Attitudes Towards Learning Irish after their interaction with the final design, a key finding of the study. The final case study of the design led to an increase among participants in their Ideal L2 Self. The qualitative feedback discussed in section 8.2.2 was triangulated with the quantitative findings and found that participants were motivated by the game and it shaped their view of the Irish language in a new light highlighting longer lasting motivational changes due to the VR experience.

9.3.2 Research Question Two

What consideration must be given to pertinent design issues, like presence and simulator sickness, when designing and implementing a VR language learning experience?

All three case studies found low levels of simulator sickness. As the design changes were iterated upon across case studies the presence rating of the game increased. In the third case study after repeated interaction with the game participants felt more comfortable with the control systems and their ability to navigate the environment. This led to an increase in presence scores after each session. This was corroborated in
the qualitative feedback in section 8.2.7 where participants commented on the realistic nature of the environment referring to how they felt like they were really there.

### 9.3.3 Research Question Three

How does interaction in an immersive situated game based Irish language learning environment affect a participant’s self-efficacy and anxieties to engage with the Irish language?

A statistically significant reduction was found in participant’s Irish language anxiety. This was further corroborated in the qualitative feedback where participants referred to a lack of social anxiety in using Irish in the VR game. The virtual reality environment allowed for the participants to experience a situated language environment but reduced the anxiety for learners as they knew they weren’t being judged for their language ability by the avatars in the game as discussed in section 8.2.8. A statistically significant improvement to their Linguistic Self Confidence was also found in the final case study. In the qualitative feedback participants commonly referred to their anxieties around socially interacting with Gaeltacht speakers and how the VR experience gave them a context to perform this interaction without social judgement which built on their self-efficacy. The repeated interaction of the game over the course of three sessions further improved the self-efficacy and confidence of participants as discussed in section 8.2.8.

### 9.3.4 Research Question Four

Can immersive situated game based Irish language learning environments lead to improved Irish language vocabulary retention for participants?

The situated game was found to improve Irish language vocabulary retention for participants. A 21% statistically significant increase was found in participants vocabulary retention after engaging with the game in the final case study. This was further corroborated in the qualitative feedback where participants referred to
learning contextually relevant vocabulary from engaging with the shop scenario as discussed in section 8.2.3.

9.4 Limitations of the Study

Each iteration was conducted with a limited number of participants due to educational ethical concerns. It was not possible to conduct the study during classroom time as this would affect the teaching time for lecturers in the colleges. This had a limiting effect on the number of participants it was possible to gather. VR technology is also a solitary experience where it is only possible for one participant to engage in the experience at a time. The equipment needed someone near the participant in order to ensure they did not walk into anything in their real-world environment and cause themselves injury. The third case study focused on involving the participants with multiple interactions of the game in order to get an accurate picture of how the game effected participants once they were comfortable with the control system and the novelty of a new experience wore off. As a result of these issues each iteration involved a large voluntary time investment of one hour for each participant engaging in the study. It was not possible to incentivise participants with a reward for engaging with the research as the research involves motivated behaviour and this incentive would have impacted the results. Participants were also engaging with their regular weekly Irish language classes which could have resulted in some of the motivated behaviour gains along with the vocabulary gains. Qualitative data however suggests this was not the case as participants often referenced how the game experience differed to their classroom experience resulting in a much more motivating and involving experience, for example:

Participant 9: "You had to actively think about it more and try and connect it to what you think it would have been. So, it was definitely better than what we would do in class."
9.5 Design Recommendations

While these results were conducted with localised groups, as per the guidelines of a DBR experiment it is possible to generate generalisable claims about the design and theory based on the data. The iterative process highlighted several design decisions that helped to improve participants experience and in turn lead to motivational and vocabulary gains.

9.5.1 The Situated Nature of the Design

The situated nature of the game improved the believability of the environment. The more natural the interactions in an environment the easier it was for learners to engage with the game’s systems. Greater levels of immersion in the design also helped to give the learner a purpose towards their learning and meaning in their interactions in the game. This led to a greater sense of intrinsic motivation to achieve tasks and greater retention of the vocabulary interacted with in the environment.

9.5.2 Scaffolding the Learner to Success

The game had the ability to scaffold a learner’s progress (Vygotsky, 1962). The game mechanics were designed to help provide the learner with expert knowledge to succeed at tasks they couldn’t do independently yet. This helped them to retain this expert knowledge and provided them with motivation that in the future they will be able to achieve these tasks independently. The game allowed for feedback on a learner’s progress. Through success in levels and feedback during levels learners assessed if they were engaging with the content correctly and could change their interactions if required.

9.5.3 A Task Orientated Framework

The game aligned with the task based language teaching (Willis, 1996). Learners engaged with spontaneous language tasks with the goal of improving their motivation.
The tasks in the games allow learners to:

1. Experience spontaneous interaction.

2. Use language purposefully and co-operatively.

3. Participate in a complete interaction, not just one-off sentences.

4. Develop learners’ confidence that they can achieve communicative goals.

9.5.4 Staging Difficulty at an Appropriate Level

The level design in the game allowed for learners to experience a challenge that aligned with their current language knowledge. It is important to stage levels to cater for different degrees of experience to make it challenging for more experienced learners so they are stimulated and accessible for less experienced learners so they can engage with the content.

9.6 Contribution to the Literature

1. The study is multidisciplinary in its approach. While previous research has shown the positive benefits of games for motivation. This is the first study utilising the L2 self-system system of motivation utilising quantitative and qualitative methods to analyse the results within the Design Based Research framework.

2. The study disseminates the results of three cycles of a design based research experiment. This is valuable as it outlines the results of three cycles of a game that has been rigorously evaluated through several cycles of design and analysis.

3. The study found a statistically significant 21% increase in vocabulary retention after engaging with the final cycle of the VR design.
4. The study found a statistically significant reduction in anxiety towards Irish and a significant increase in attitudes towards learning Irish after engaging with the final cycle of the VR design.

5. The study illustrates novel qualitative analysis highlighting learner’s experience of an immersive situated game to learn Irish.

6. The study found evidence that the specific design of the game was highly immersive and did not cause simulator sickness for participants.

9.7 Further Research

Further research is warranted on many aspects discussed within this thesis. In this section several areas of interest are highlighted.

9.7.1 Longitudinal Case Studies

The DBR methodology utilised in this thesis was useful for exploring specific design decisions and how they affected learning in an agile capacity that allowed for changes to the design when required. This methodology however is limited through its focus on a fuller account of the learning that occurred. In order to collect the quantitative and qualitative feedback from each case study it required very long experimental designs that effected the number of participants it was possible to gather. Further work is warranted in order to increase the statistical power of the results of the experiments through a fourth phase of design that focuses on the feedback of the third phase but with a large scale study. The longer nature of the third case study effected the overall results of the third case study. Further study is warranted with longitudinal data on the impact of the VR environment with language learners over the course of a year of study to see if the effects diminish over time.

Participants made some references to being motivated due to the novelty of the technology (see section 8.2.6), which is a potential limitation of the study. This requires further longitudinal research in real educational settings to measure the
overall effect on VR technology as prolonged usage with virtual reality experiences would eliminate the motivational advantages of the novelty participants discussed.

9.7.2 Classroom Context

The case studies involved in this research reflect an ideal scenario whereby the learners had access to the researcher whenever required to help with technology issues etc. Many educational technology studies examine the impact of a new technology within a classroom domain to examine its usability in a classroom environment. For example, researchers in DCU have examined the use of Duolingo in a classroom context (Ó Doinn, 2018). Further research is warranted to examine the effects of VR on Irish language learning in a classroom environment.

9.7.3 Multi-user Environments

The VR game implemented within this thesis only allows for one participant to interact in the environment at a time. Further research is warranted on the creation of multi-user Irish language environments to examine its effects on the social language learning afforded through the task based design of the game.

As discussed in section 4.4.6, language standardisation is a complex process for the Irish language. The official standardised words within dictionaries are referred to in a derogatory fashion by the authentic native speakers as "Book Irish" as it isn’t used in authentic settings and feels false to the native speaking communities (Nic Fhlannchadha and Hickey, 2018). Situated immersive environments offer speakers a real context to use these definitions in a more naturalised setting which can help to naturalise their use. If the gaming environment uses too much inauthentic language it may lose authenticity for players and thus make players feel less present and less willing to adopt practices from the game. It is a challenging dichotomy to overcome and warrants future investigation.
9.7.4 Language Learning Focus

This thesis focuses its impact on language anxiety and motivation and participants did not have the capability to speak or interact with virtual avatars or one another in the virtual game. This was due to technical limitations and to keep the scope of the thesis to an achievable level. Further research is required on the use of Irish language speech recognition in virtual reality environments. This feature alongside a multi-user environment would allow for virtual reality to focus on other learning Irish language outcomes other than vocabulary retention such as oral language competency.

9.8 Conclusion

This thesis gave an account of three iterations of a mixed methods DBR experiment that focused on using a virtual reality game design intervention to answer the question, "can contemporary immersive game based tools and methods be used to develop situated language learning game environments to improve learner’s motivation and vocabulary retention in the Irish language?" It found that contemporary immersive game based tools and method can be used to develop situated language learning game environments to improve learner’s motivation and vocabulary retention in the Irish language.

A thorough analysis of previous research in the field was given in the literature review followed by an account of DBR methodology to investigate the research question. Three case studies were discussed along with paired t test analysis to find the statistically significant scales of each study and qualitative feedback to give a voice to participants.

The study found mean increases to participant’s Ideal L2 Self which is an intrinsic measure of motivation, alongside statistically significant improvements to vocabulary retention, Irish language anxiety and attitudes towards learning Irish. There was little evidence of simulator sickness found across the studies and presence questionnaires found participants to be highly present during their interactions with the VR games. Finally, the qualitative feedback was triangulated with the quantitative work which
further confirmed the findings of the research.
Bibliography


References


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Naughty Dog (2013). The Last Of Us.


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Tearma.ie. tearma.ie.


Appendix A

Publications

A.1 Conferences

1. Towards a Conceptual Framework for the Development of Immersive Experiences to Negotiate Meaning and Identity in Irish Language Learning, IEEE Games Entertainment Media, NUIG 2018

2. Shaping Immersive Worlds: Framing Design-Based Research as a Methodology for Investigating the Development of Immersive Virtual Environments for Game-Based Learning, Irish Game-Based Learning Conference, Cork 2019


4. Motivation in Situated Immersive Games for Irish Language Learning a DBR Approach, European Conference Game Based Learning, Bristol 2020
A.2 Journals

Appendix B

Conferences

1. Open Lab’s launch, TU Dublin Grangegorman 2018

2. State of Play: Game-based Learning Seminar, Aungier Street 2018

3. UXDX Conference, RDS Dublin 2018

4. Games for Peace Conference, Trinity College Dublin 2019

5. Celebration of Creativity, Technology and Talent with TU Dublin and Intel Ireland, Grangegorman 2019

6. State of Play: Game Research Seminar, Aungier Street 2019

7. ARVR Innovate, Education and Immersive Technology Roundtable, Online 2020
Appendix C

First Case Study
C.1 Call For First Case Study

VR study participants

Naoise Collins, a DIT Doctoral Researcher in the DIT School of Media invites learners of the Irish language to contact him to take part in an experiment using Virtual Reality (VR) technology. Participants are being sought who are 18 years of age or older who either feel unconfident about their Irish language skills or, who are beginners and are in the early stages of learning the language. Naoise has developed a virtual reality Irish language learning game and is investigating how Irish language virtual reality experiences effect the Irish language identity of players.

Participants will be asked to fill out a questionnaire about their attitudes towards the Irish language. They will then play a virtual reality game developed by the researchers here at DIT. Finally, they will complete a post-test questionnaire about their experience in the game. The whole process should take approximately one hour per participant.

The researchers will perform a screen capture, record the audio experience and collect analytics from the gameplay experience. All data and information provided by the participants will be anonymised. There will be no way to identify participants after this process therefore their privacy will be protected. The results of the study will be published in international conferences and journals in order to disseminate the results of the work.

The study will give participants the opportunity to try out cutting-edge virtual reality applications, be immersed in a virtual Irish language experience, and also to question and think about their identification with the Irish language.

I will meet participants for the study in angier street outside room 2005 at their chosen time. If there is a case of a double booking I will email the participant and we can work out a new time.

1. Email address *

2. Choose a time that suits you best?

Mark only one oval per row.

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C.2 First Case Study Questionnaires
Irish Learner Questionnaire

This survey is conducted by DIT by a research student interested in understanding the thoughts and beliefs of learners of Irish. Please read each instruction and write your answers. This is not a test so there are no "right" or "wrong" answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much

*Required

1. I study Irish because close friends of mine think it is important *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

2. My family believes I must study Irish to be an educated person *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

3. Studying Irish is important to me because I think it will be useful in getting a good job and/or making money *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

4. I have to study Irish because I don’t want to get bad marks in it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
5. I would like to spend lots of time studying Irish *  
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

6. I can imagine myself speaking Irish fluently *  
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

7. If I fail to learn Irish, I’ll be letting other people down *  
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

8. Studying Irish is important to me in order to make my family proud *  
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

9. Studying Irish is important to me because Irish proficiency is necessary for promotion in the future *  
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree
10. I have to learn Irish because without passing an Irish course I cannot get my degree *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

11. I am prepared to expend a lot of effort in learning Irish *
    *Mark only one oval.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

12. I can imagine myself speaking Irish with friends and family *
    *Mark only one oval.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

13. I consider learning Irish important because the people I respect think I should do it *
    *Mark only one oval.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

14. Being successful in Irish is important to me so that I can please my family *
    *Mark only one oval.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
15. Studying Irish is important to me because I think I’ll need it for further studies *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

16. I have to study Irish; otherwise, I think I cannot be successful in my future career *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

17. I would like to concentrate on studying Irish more than any other topic *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

18. I can imagine myself interacting with others in Irish *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

19. Studying Irish is important to me in order to gain the approval of my peers/teachers/family/boss *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
20. My family puts a lot of pressure on me to study Irish *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

21. Studying Irish is important to me in order to achieve a special goal (e.g. to get a degree or a scholarship) *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

22. Studying Irish is important to me because, if I don't have knowledge of Irish, I'll be considered a weak learner *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

23. If an Irish course was offered in the future, I would like to take it *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

24. Learning Irish is necessary because people around me expect me to do so *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree
25. My family encourages me to practice my Irish as much as possible *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

26. Studying Irish is necessary for me because I don't want to fail an exam *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

27. If my teacher would give the class an optional assignment in Irish, I would certainly volunteer to do it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

28. I can imagine myself writing Irish e-mails/letters fluently *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

29. I have to learn Irish because I don't want to fail at an Irish course *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
30. Studying Irish is important to me because other people will respect me more if I have a knowledge of Irish *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

31. I have to study Irish, because, if I don't my family will be disappointed in me *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

32. Studying Irish is important to me, because I would feel ashamed if I got bad grades in Irish *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

33. I would like to study Irish even if I were not required *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

34. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
35. Studying Irish is important to me because I don’t like to be considered a poorly educated person

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

36. Do you like the atmosphere of your Irish classes?

Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

37. How tense would you get if you were asked to give directions in Irish?

Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

38. I am sure I have a good ability to learn Irish

Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

39. If I make more effort, I am sure I will be able to master Irish

Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
40. How much would you like to become similar to the people who speak Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

41. Do you like the Irish music? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

42. Do you like the people who live in the Gaeltacht? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

43. Do you find learning Irish really interesting? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

44. How uneasy would you feel speaking Irish with a native speaker? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
45. Do you like Irish language films? *  
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

46. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *  
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

47. Do you like meeting people from the Gaeltacht? *  
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

48. Do you think time passes faster when studying Irish? *  
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

49. How nervous and confused do you get when you are speaking in an Irish class? *  
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
50. **Do you like TV programmes made for TG4?**
*Mark only one oval.*
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

51. **I am sure I will be able to write in Irish comfortably if I continue studying**
*Mark only one oval.*
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

52. **Do you like to travel to the Gaeltacht?**
*Mark only one oval.*
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

53. **Do you look forward to Irish classes?**
*Mark only one oval.*
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

54. **How afraid are you of sounding stupid in Irish because of the mistakes you make?**
*Mark only one oval.*
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
55. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

56. Would you like to know more about people from Irish speaking areas? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

57. Would you like to have more Irish lessons? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

58. How worried are you that other speakers of Irish would find your Irish strange? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

59. How much do you like Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

https://docs.google.com/forms/d/1ayzvbFQiXIG81qMh_6mn3RO9eN-Nr-yrDsAR2idAqtl4/edit
60. Do you like Irish magazines, newspapers or books? *  
Mark only one oval.  
☐ Not at all  
☐ Not so much  
☐ Neutral  
☐ Quite a lot  
☐ Very much

61. Do you really enjoy learning Irish? *  
Mark only one oval.  
☐ Not at all  
☐ Not so much  
☐ Neutral  
☐ Quite a lot  
☐ Very much

62. How afraid are you that other students will laugh at you when you speak Irish? *  
Mark only one oval.  
☐ Not at all  
☐ Not so much  
☐ Neutral  
☐ Quite a lot  
☐ Very much

63. Gender *  
Mark only one oval.  
☐ Female  
☐ Male  
☐ Prefer not to say  
☐ Other: ____________________________

64. Nationality *  
Mark only one oval.  
☐ Irish  
☐ Non-Irish

65. Age *

66. What is your employment status? *  
Mark only one oval.  
☐ University student  
☐ Working professional
67. Have you ever had or do you have a native Irish-speaking teacher? *
   *Mark only one oval.
   Yes
   No

68. Have you spent at least three months in total in the Gaeltacht? *
   *Mark only one oval.
   Yes
   No

69. Where are you studying Irish at the moment? *
   *Mark only one oval.
   At a private institution
   At my school
   At university
   With a private tutor
   On my own

70. Irish ability: Please rate your current overall proficiency in Irish by ticking one: *
   *Mark only one oval.
   Upper Intermediate level and over- Able to converse about general matters of daily life and topics of one’s specialty and grasp the gist of lecturers and broadcasts. Able to read high-level matters such as newspapers and write about personal ideas
   Intermediate level- Able to converse about general matters of daily life. Able to read general materials related to daily life and write simple passages
   Lower Intermediate level- Able to converse about familiar topics. Able to read materials about familiar everyday topics and write simple letters
   Post- Beginner level- Able to hold a simple conversation such as greeting and introducing someone. Able to read simple materials and write a simple passage in elementary Irish
   Beginner level- Able to give simple greetings using set words and phrases. Able to read simple sentences, grasp the gist of short passages, and to write a simple sentence in basic Irish
Irish language game attitudes

This survey is conducted by DIT by a research student interested in understanding the thoughts and beliefs of learners of Irish after using virtual reality technology. Please read each instruction and write your answers. This is not a test so there are no "right" or "wrong" answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much

*Required

1. I can imagine myself as someone who can speak Irish fluently *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

2. I can imagine myself speaking Irish with friends and family in the future *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

3. I can imagine myself writing Irish emails/letters fluently *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

4. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
5. How much do you like Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

6. I can imagine myself interacting with others in Irish *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

7. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

8. Did you like the atmosphere in the experience for learning Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

9. How tense would you get if you were asked to give directions in Irish in an experience similar to what you just played? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
10. How much would you like to become similar to the people who speak Irish? *

   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

11. Did time pass faster while studying Irish in the experience? *

   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

12. Would you look forward to trying the Irish language experience again? *

   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

13. If I make more effort, I am sure I will be able to master Irish *

   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

14. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *

   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
15. I am sure I will be able to write in Irish comfortably if I continue to study it*
*Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

16. I am sure I have a good ability to learn Irish*
*Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

17. Did you find learning in the Irish language experience really interesting?*
*Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

18. How uneasy did you feel interacting in Irish with a native speaker in the experience?*
*Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

19. How nervous and confused did you get when you were interacting with Irish in the experience?*
*Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
20. How afraid were you of sounding stupid in Irish because of the mistakes you made in the experience? *
   Mark only one oval.
   ☐ Not at all
   ☐ Not so much
   ☐ Neutral
   ☐ Quite a lot
   ☐ Very much

21. How worried were you that others would find your Irish strange in the experience? *
   Mark only one oval.
   ☐ Not at all
   ☐ Not so much
   ☐ Neutral
   ☐ Quite a lot
   ☐ Very much

22. Did enjoy learning Irish in the experience? *
   Mark only one oval.
   ☐ Not at all
   ☐ Not so much
   ☐ Neutral
   ☐ Quite a lot
   ☐ Very much

23. How afraid were you that others would laugh at you when you spoke Irish in the experience? *
   Mark only one oval.
   ☐ Not at all
   ☐ Not so much
   ☐ Neutral
   ☐ Quite a lot
   ☐ Very much

24. Do you think this experience helped with your Irish language ability, how? *

________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________
25. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?*

26. Would you use virtual reality to learn Irish again, why?*

27. What was the hardest part of the experience, why?*

28. What was the best part of the experience, why?*

29. Did you enjoy learning Irish in a virtual environment, why?*

30. If you could change anything about the experience what would you change? *
## C.2.3 NASA TLX First Case Study

### NASA-TLX

Hart and Staveland’s NASA Task Load Index method assesses workload on five 7-point scales. Increments of high, medium, and low estimates for each point result in 20 gradations on the scales.

*Required

### 1. How mentally demanding was the VR experience? *

Mark only one oval per row.

| | Very low | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very high |
|Mental demand| | | | | | | | | | | | | | | | | | | | |

### 2. How physically demanding was the VR experience? *

Mark only one oval per row.

| | Very low | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very high |
|Physical demand| | | | | | | | | | | | | | | | | | | | |

### 3. How hurried or rushed was the pace of the task? *

Mark only one oval per row.

| | Very low | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very high |
|Time demand| | | | | | | | | | | | | | | | | | | | |

### 4. How successful were you at completing what you were asked to do? *

Mark only one oval per row.

| | Very good | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very poor |
|Performance (Good is on the left this time )| | | | | | | | | | | | | | | | | | | | |

### 5. How hard did you have to work to accomplish your level of performance? *

Mark only one oval per row.

| | Very low | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very high |
|Effort| | | | | | | | | | | | | | | | | | | | |

### 6. How insecure, discouraged, irritated, stressed, and annoyed were you? *

Mark only one oval per row.

| | Very low | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 Very high |
|Frustration| | | | | | | | | | | | | | | | | | | | |
C.2.4 Ethics Application

Research Ethics Application

<table>
<thead>
<tr>
<th>Submission Date</th>
<th>2018-09-10 02:44:26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of Project</td>
<td>Situated gaming environments for Irish language learning</td>
</tr>
<tr>
<td>REC Ref no.</td>
<td>REC-18-110</td>
</tr>
</tbody>
</table>

Lay Summary

This research project will examine how immersive, gaming based, situated learning environments can be used to teach Irish language skills. It will focus on the player's identity as an Irish language speaker and how digital experiences can be utilised to transfer the learning of Irish language, culture, and knowledge through an immersed experience.

Language is a powerful tool, facilitating all thought and communication; when a learner is learning a second language they must conceptualise their actions and thoughts in a new way to forge a new identity. To become proficient, a speaker must be able to convey their thoughts accurately to be understood within the wider community of speakers. The Irish Language is intimately bound with issues of Irish identity and culture: for the learner to be recognised as proficient, their new language skills must be embedded within the broader context of this identity and culture.

Immersing the learner in a situated environment allows them to use their second language to carry out a number of simple objectives e.g. ordering food, and a number of more complex tasks; e.g. asking questions, giving answers, and listening to conversations in the Irish language. By completing and engaging with these, the user becomes a more proficient learner, embedding their experiences in practical situations and scenarios. This is a similar approach to the total immersion ideology of Gaelscoils, where the learner is immersed in the language. This project takes a similar approach to its methodologies.

This study aims to use cutting-edge technology and game development tools and methods, alongside virtual reality hardware (VIVE, Oculus Rift, Unity3d) to create virtual reality experiences where the user is completely immersed in an Irish language setting and can contextualise their thoughts and actions in Irish through the digital experience the game affords them.

Overall Aim of the Study

Central Question: Can contemporary immersive game based tools and methods be used to develop situated language learning game environments to teach Irish language skills?

In order to achieve this the project will have the following objectives:
1. Examine how game based situated Irish language environments can be leveraged to explore issues of Irish language identity and how it relates to Irish language learning.
2. Develop immersive situated game based language learning environments with contemporary game development tools and methodologies e.g. Unity 3D and VR
3. Develop innovative language learning assessment methodologies and compare with best practice in the area of language learning to assess the developed virtual environments.

Principal Investigator

Mr Naoise Collins

Principal Investigator E-mail

D15123239@mydit.ie

Phone Number

(85) 2717266
3.1 My research involves non-contentious work as described in points 1-4 above.

Please upload an overview of the project and/or the methodology of the proposed work. The emphasis here should be on the proposed methodology in relation to the proposed work rather than the theoretical underpinnings of the work. (max 1000 words)

5.1 Total number of Participants

20 - 30

5.2 Justification for this sample size

The research procedure is informed by designed based research which focuses on evaluating an educational intervention in a specific context using in depth mixed methods analysis. The sample size of 20 - 30 is the standard adult classroom context size.

5.3 Recruitment of Research Participants

Adults interested in learning the Irish language will be sent a link/letter to a form to fill out if they are interested in taking part. Full details of the experiments will be sent as part of the email/letter to fully inform them of the nature of the experiments before they express their interest in participating.

5.4 Will you provide any payment or remuneration to the participants?

No

5.6 Consent procedures

Full details of the experiments will be sent as part of the email/letter to fully inform them of the nature of the experiments before they express their interest in participating. They will then be sent a consent letter find attached

<table>
<thead>
<tr>
<th>Prefix</th>
<th>First Name</th>
<th>Last Name</th>
<th>Email</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr</td>
<td>Naoise</td>
<td>Collins</td>
<td><a href="mailto:D15123239@mydit.ie">D15123239@mydit.ie</a></td>
<td>DIT</td>
</tr>
<tr>
<td>Dr</td>
<td>Brian</td>
<td>Vaughan</td>
<td><a href="mailto:303149@dit.ie">303149@dit.ie</a></td>
<td>DIT</td>
</tr>
<tr>
<td>Dr</td>
<td>Keith</td>
<td>Gardiner</td>
<td><a href="mailto:060514@dit.ie">060514@dit.ie</a></td>
<td>DIT</td>
</tr>
<tr>
<td>Dr</td>
<td>Charlie</td>
<td>Cullen</td>
<td><a href="mailto:060832@dit.ie">060832@dit.ie</a></td>
<td>University of West Scotland</td>
</tr>
<tr>
<td>5.7 Consent form</td>
<td>Appendix-2 Naoise.docx</td>
<td></td>
<td></td>
<td></td>
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<td>------------------</td>
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<tr>
<td>5.8 Inclusion/exclusion criteria</td>
<td>Adults interested in learning the Irish language are the target group. Only healthy subjects will be included. All test subjects will be over 18.</td>
<td></td>
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<tr>
<td>5.9 Will any participants be a) under 18 years of age during the study or b) lacking in capacity to provide consent (e.g. due to incapacitation) or a vulnerable population?</td>
<td>No</td>
<td></td>
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<tr>
<td>5.12 Will any participants be your employees or students?</td>
<td>No</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6.1 Will your research involve interviews?</td>
<td>No</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6.11 Will your research involve focus groups?</td>
<td>Yes</td>
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<tr>
<td>6.12 Please describe the format and structure of the focus groups and how they will be carried out. Questions and thematic areas should also be included.</td>
<td>The focus group will be conducted by the principal investigator of the research. It will be conducted in a public space classroom in DIT aungier street. The participants will answer questions around their experience in the immersive virtual reality environment they engaged with. They will include all the test participants from the study and the questions will be open ended questions following on from the questionnaires they answered before and after the study. Thematic areas include: Identity, Motivation, Attitude towards learning Irish, Fear of Assimilation, Linguistic Self-confidence, Ought to L2 self, Family Influence, Irish anxiety, Attitudes towards Irish community, Interest in the irish language. Questions include: Do you think this experience helped with your Irish language ability, how?, Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?, Would you use virtual reality to learn Irish again, why?, What was the hardest part of the experience, why? What was the best part of the experience, why?, Did you enjoy learning Irish in a virtual environment, why?</td>
<td></td>
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<tr>
<td>6.13 Will the focus groups be recorded?</td>
<td>Yes</td>
<td></td>
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</tbody>
</table>
### 6.14 Describe how data from the focus groups will be collected and recorded

The collection and recording of the focus groups will follow the 8 general rules of data protection:

1) Fairly obtained – the investigator will identify themselves & who they may share the data with – obtain informed explicit consent (Plain Language Statement).
2) Processed only for a specified & lawful purpose(s) – The purpose the data is required for i.e. the nature of the research will be stated.
3) Data cannot be used later for an alternative purpose – The data will be anonymized before being used for any other purposes and the subjects will be made clear in the consent form of this policy.
4) Kept safe and secure – Only the investigator will have access to the data it will be encrypted or device, password protected, and in locked cabinets etc.
5) Accurate & up to date – The data will be periodically reviewed for accuracy.
6) Adequate, relevant & not excessive – No unnecessary data will be asked for.
7) Not retained for longer than is necessary – The data will be anonymized so won’t be retained after this process.
8) Data Subject’s ‘Right to Access’ – The data will be anonymized so the subject will have no personal data belonging to the researcher to have a right to access to.

### 6.15 Will transcripts be made of recordings?

Yes

### 6.16 Please describe how the recordings will be transcribed and analysed.

Any names or identifiable information will be deleted from the recordings by the primary investigator using sound editing software. The transcription will be done by the primary investigator whereby the subjects’ names and identifiable information will be anonymized and instead use coded letters instead of names e.g. “aa”

### 6.17 Will the participants have an opportunity to review and approve transcripts?

No

### 6.18 Justify why participants will not have an opportunity to review transcripts.

The transcripts will be anonymized thereby insuring the data subject’s “right to access” is not breached as there is no longer identifiable information so it is not personal data any longer.

### 6.21 Does your research involve surveys, either pen-and-paper or electronic?

Yes

### 6.25 Please describe any other data collection activities which will be used (e.g. observation).

The project will capture audio, video and analytics of the gameplay (captured using screen recording software and unity analytics). Subjects will not be recorded only their gameplay.

No identifying information will be in the audio: if any is present in the audio recorded (names, personal details etc.) it will be removed.
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.27 Does your research involve collection of any biological samples?</td>
<td>No</td>
</tr>
<tr>
<td>This includes, but is not limited to, samples of biofluids (e.g.</td>
<td></td>
</tr>
<tr>
<td>blood, urine) and cells and tissue (human, animal or bacterial)</td>
<td></td>
</tr>
<tr>
<td>6.28 Will samples be collected prospectively and specifically for the</td>
<td>No</td>
</tr>
<tr>
<td>purposes of this study?</td>
<td></td>
</tr>
<tr>
<td>6.37 Will previously collected sample material (i.e. retrospective</td>
<td>No</td>
</tr>
<tr>
<td>samples) be used in this study?</td>
<td></td>
</tr>
<tr>
<td>6.38 Please describe how this material will be accessed and made</td>
<td>N/A</td>
</tr>
<tr>
<td>available for use in the current study, and describe the consent</td>
<td></td>
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<tr>
<td>procedures that apply to this material.</td>
<td></td>
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<tr>
<td>6.39 Will biological material leave the institution where it was</td>
<td>No</td>
</tr>
<tr>
<td>originally collected?</td>
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<tr>
<td>6.41 Will any genetic testing take place in this study?</td>
<td>No</td>
</tr>
<tr>
<td>6.45 Does this study involve the consumption of any foodstuffs (and/or</td>
<td>No</td>
</tr>
<tr>
<td>food supplements)?</td>
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<tr>
<td>6.47 Does this study involve any medicinal products, including drugs or</td>
<td>No</td>
</tr>
<tr>
<td>medical devices?</td>
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</tr>
</tbody>
</table>
I confirm that:

Please upload evidence in support of the insurance and indemnity provisions for this study.

All research data will be encrypted and stored on a password-protected system or in a secure location (e.g. locked filing cabinet) in accordance with DIT data protection policy.

All research data will be retained in accordance with DIT data retention policy.

All health and safety policies applicable to the work will be upheld and risk assessments are in place for all research activity.

All researchers are competent to carry out the research and have received appropriate training.

All researchers are aware of their obligations under the national integrity policy.

Appropriate insurance and indemnity is in place for this research, at all participating sites and for each investigator (upload required).

Yes No

---

Upload signature - PI

Upload signature - Postgraduate Student (if required)
C.3 Open-Ended Responses First Case Study

1. Do you think this experience helped with your Irish language ability, how?

   (a) I can’t remember anything to do with the irish language if someone spoke to me before the vr experience, however, this game helped jog some memories of the stuff I learned in school which was pretty enlightening.

   (b) Yes, putting the meaning of the words into context and having to find them felt more effective than just learning them off.

   (c) It helped me remember the small bit I know!

   (d) It helped me remember Irish that I had previously known.

   (e) Yes, reminded me of vocabulary visually.

   (f) I did, the freedom of having reign of the room and being able to pick up everything is enjoyable.

2. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?

   (a) Not at all. This is completely engrossing, and in some sort of selfish way, it’s a 1-on-1 lesson without anybody else interfering.

   (b) Yes, you could have the items placed around the classroom and have the students pick them out.

   (c) Definitely not, unless you have a really visual teacher.

   (d) Yes, I can see the experience working in a real world environment.

   (e) Probably not, as the benefits I saw was that I could hold and see the objects that the vocabulary represented.

   (f) The virtual experience allows it to be enjoyable.

3. Would you use virtual reality to learn Irish again, why?

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(a) Sure! It was really fun to jog my memory on Irish again in a fun environment. My memories of Irish in school were mostly negative, but this portrayed Irish as a fun thing and I would totally play more of it if given the opportunity.

(b) It feels like a more direct and personal method of learning opposed to a classroom.

(c) Yes because it’s a really fun experience and I can see this helping people who want to learn a lot.

(d) Yes, I would be interested in learning more advanced Irish using Virtual Reality.

(e) Yes, I think I would enjoy it and spend longer learning yeah. Before i would have said no, but now I can really see the value of VR in a language learning environment.

4. What was the hardest part of the experience, why?

(a) Initially, the movement around the 3d space was quite difficult but this stopped being a problem after playing it for a little bit. The audio from the security guard broke immersion slightly but this can easily be solved by a better recording. As well as this, the mechanic of putting things into the bag wasn’t explicit enough, maybe some sort of tutorial phase would be useful for learning this without being told would be great.

(b) Figuring out the last item, as I wasn’t 100

(c) Remembering I could move around but also I had a different kind of cup in mind when asked for cupan so I had trouble finding it.

(d) Initially remembering the Irish I have learned.

(e) Remembering the words of what I needed to pick up, and knowing how many words there were and were left.

(f) Racking your brain for what little bit of Irish you have
5. What was the best part of the experience, why?

(a) Interacting with small objects and throwing them around was super fun
(b) The ability to interact with objects in real time
(c) The journey
(d) Exploring and interacting with the environment.
(e) Picking up different objects and hearing their audio
(f) It’s quite fun. Interactive and enjoyable to be in a virtual space.

6. Did you enjoy learning Irish in a virtual environment, why?

(a) Yes, it brought some enjoyment into a subject I absolutely despised in school
(b) Yes, it felt like a novel experience that would promote learning in a more subtle way
(c) Yes it’s much more enjoyable when you’re interacting then just reading from a book
(d) I did.
(e) Yes, It felt more immersive and I thought it was more beneficial to my memory of the vocabulary
(f) Yes, Something about the separation from the class room makes it fun.

7. If you could change anything about the experience what would you change?

(a) The audio an addition of a tutorial room to understand what you had to do instead of being told in real life before the experience.
(b) I really liked everything I felt very immersed other then the cup, I thought of a coffee cup rather then the one in the game
(c) Have more content/challenges
(d) More content (and Irish language) to explore.

(e) Less words to find, make objects at eye level

(f) Cleaner style, more interactive regarding objects and sounds.
Appendix D

Appendix Second Case Study

D.1 Ethics Second Case Study

Naoise’s research is concerned with identifying changes in a user’s language identity when interacting in a situated Irish language VR environment. He is using game based experiments as part of design based research experiment to examine whether there is a self-identified change in language identity when users interact in a virtual reality based gaming context. This is a mixed methods study informed by designed based research procedure. Therefore, there will be two trials of the experiment. An initial pilot trial followed by a larger second trial informed by the pilot.

In the pilot, Naoise will collect audio, video and analytics of the gameplay (captured using screen recording software and unity analytics) along with questionnaire data.

Pre-test questionnaires include: A questionnaire on Irish language identity.

Post-test questionnaires include: A presence questionnaire, a simulation sickness questionnaire and questionnaire on Irish language identity effects by interaction with the game (all are included in the appendix).

The second study will follow the same procedure as the first.

Naoise will collect audio, video and analytics of the gameplay (captured using screen recording software and unity analytics) along with questionnaire data (The same questionnaires will be used).
The second study will be expanded to include a post-test focus group interview with participants with questions based on the post-test questionnaire given to the participants.

D.1.1 Experimental details

Situated Irish language virtual reality environments effects on meaning and identity in Irish language learner’s

Main researcher: Naoise Collins

Supervisors: Dr. Brian Vaughan, Dr. Keith Gardiner, Dr. Charlie Cullen

Experimental goal: To obtain attitudes and identity data before and after virtual reality conditions for analysis, testing and development of tools and methods for the analysis and transformation of Irish language learner’s language identity using virtual reality equipment.

Participants will play a virtual reality experience developed by the researcher. The objective of the game is to listen to the items asked for by the shopkeeper and to pick them up in the shop put them in their bag and give them to the shopkeeper. The player will hear the sound of each item in the shop when they interact with them and the game will end when the player picks up all the items they need.

Each participant will fill out a questionnaire before the experiment to ascertain their personal attitudes, and identity to the Irish language. A copy of this is in the appendix of this document (Appendix, section 3.1).

Participants will play the game using an Oculus Rift headset and controls. The experiment will take place in a wide space with enough room for participants to freely move around in while they play the game. Only the researcher(s) and participants will be in the room during each experiment. For the duration of each gaming session audio, video and analytics data on their gameplay will be captured. During each gaming session, the participants will be asked to familiarize themselves with the game controls by playing a trial game for 2 minutes. Subsequently, the participants will be asked to restart the game and the recording of the gaming session will start. Each gaming session will last between 10-20 minutes or until the end of the game’s level.
Appendix Second Case Study

No identifying information will be in the audio: if any is present in the audio recorded (names, personal details etc.) it will be removed.

The players will then rate their attitude and identity changes from the game using a number of likert scales to answer a set of questions about the game along with a simulation sickness and presence questionnaire, as used in previous published research in this area. (Appendix, section 3.2, 3.3, 3.4).

The results of the attitudes and identity changes from the game will then be compared to the pretest information and the presence and simulation sickness questionnaires to determine if a relationship exists between the data.

In the second iteration of the study. These questionnaires will be followed by a post-game focus group interview to gain a deeper analysis and understanding of players changing identity and attitudes from the experiment. The interview will be recorded and transcribed. No identifying information will be present in the interview recordings or transcriptions. Names and other personal details will not be revealed and all data will be anonymized. The data will be kept anonymous by using codes to refer to each participant e.g. P1A, P1B etc.

Oifig na Gaeilge will post the information sheet of the study on their website along with details of how to get in contact with the research team. The email address and phone number of the research team will be given in order to get in contact with the team.

In the second stage of the research cycle participants will be gathered from Marino Institute of Education. A separate ethics procedure has been followed for this institute. The researcher will go into classes in Marino Institute of education to inform students of the study and give them the information sheet to contact if they want to participate in the study.

The research team will go to the Irish language classes held within DIT and inform participants of the study giving them the participant information sheet. The email address and phone number of the research team will be given in order to get in contact with the team.

The research team has had no previous interactions with these participants and
there is no relationship between the investigators and the participants other than for the purposes of this study

Any personal information including contact details of research participants will be destroyed after the study is conducted as per GDPR guidelines.

Please find attached written permission from Oifig na Gaeilge to gather research participants.

Full details of the experiments will be sent as part of the email/letter to fully inform them of the nature of the experiments before they express their interest in participating.

Full details of the experiments will be sent as part of the email/letter to fully inform them of the nature of the experiments before they express their interest in participating. They will then be sent a consent letter find attached

The research procedure is informed by designed based research which focuses on evaluating an educational intervention in a specific context using in depth mixed methods analysis. The sample size of 20 - 30 is the standard adult classroom context size.

The focus group will be conducted by the principal investigator of the research. It will be conducted in a public space classroom in DIT aungier street. The participants will answer questions around their experience in the immersive virtual reality environment they engaged with. They will include all the test participants from the study and the questions will be open ended questions following on from the questionnaires they answered before and after the study.

Thematic areas include: Identity, Motivation, Attitude towards learning Irish, Fear of Assimilation, Linguistic Self-confidence, Ought to L2 self, Family Influence, Irish anxiety, Attitudes towards Irish community, Interest in the irish language.

Questions include:

- Do you think this experience helped with your Irish language ability, how?
- Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?
Appendix Second Case Study

- Would you use virtual reality to learn Irish again, why?
- What was the hardest part of the experience, why?
- What was the best part of the experience, why?
- Did you enjoy learning Irish in a virtual environment, why?

The collection and recording of the focus groups will follow the 8 general rules of data protection

1. Fairly obtained – the investigator will identify themselves who they may share the data with – obtain informed explicit consent (Plain Language Statement).

2. Processed only for a specified lawful purpose(s) – The purpose the data is required for i.e. the nature of the research will be stated.

3. Data cannot be used later for an alternative purpose – The data will be anonymized before being used for any other purposes and the subjects will be made clear in the consent for of this policy

4. Kept safe and secure – Only the investigator will have access to the data it will be encrypted or device, password protected, and in locked cabinets etc.

5. Accurate up to date – The data will be periodically reviewed for accuracy.

6. Adequate, relevant not excessive – No unnecessary data will be asked for

7. Not retained for longer than is necessary – The data will be anonymized so won’t be retained after this process.

8. Data Subject’s ‘Right to Access’ – The data will be anonymized so the subject will have no personal data belonging to the researcher to have a right to access to.

Any names or identifiable information will be deleted from the recordings by the primary investigator using sound editing software. The transcription will be done
by the primary investigator whereby the subjects names and identifiable information will be anonymized and instead use coded letters instead of names e.g. "aa"

The project will capture audio, video and analytics of the gameplay (captured using screen recording software and unity analytics). Subjects will not be recorded only their gameplay. No identifying information will be in the audio: if any is present in the audio recorded (names, personal details etc.) it will be removed.
VR participants form Gaeilge

Naoise Collins, a DIT Doctoral Researcher in the DIT School of Media invites learners of the Irish language to contact him to take part in an experiment using Virtual Reality (VR) technology. Participants are being sought who are 18 years of age or older who either feel unconfident about their Irish language skills or, who are beginners and are in the early stages of learning the language. Naoise has developed a virtual reality Irish language learning game and is investigating how Irish language virtual reality experiences effect the Irish language identity of players. Participants will be asked to fill out a questionnaire about their attitudes towards the Irish language. They will then play a virtual reality game developed by the researchers here at DIT. Finally, they will complete a post-test questionnaire about their experience in the game. The whole process should take approximately one hour per participant.

The researchers will perform a screen capture, record the audio experience and collect analytics from the gameplay experience. All data and information provided by the participants will be anonymised. There will be no way to identify participants after this process therefore their privacy will be protected. The results of the study will be published in international conferences and journals in order to disseminate the results of the work.

The study will give participants the opportunity to try out cutting-edge virtual reality applications, be immersed in a virtual Irish language experience, and also to question and think about their identification with the Irish language.

I will meet participants for the study in aungier street at their chosen time and will respond in email to clarify this. If there is a case of a double booking I will email the participant and we can work out a new time.

1. Email address *

2. Choose a time that suits you best
Mark only one oval per row.

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D.3 Questionnaires
Irish Learner Questionnaire

This survey is conducted by DIT by a research student interested in understanding the thoughts and beliefs of learners of Irish. Please read each instruction and write your answers. This is not a test so there are no “right” or “wrong” answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much.

*Required

1. I study Irish because close friends of mine think it is important *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

2. My family believes I must study Irish to be an educated person *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

3. Studying Irish is important to me because I think it will be useful in getting a good job and/or making money *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

4. I have to study Irish because I don’t want to get bad marks in it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
5/5/2019 Irish Learner Questionnaire

5. I would like to spend lots of time studying Irish *
   
   Mark only one oval.
   
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

6. I can imagine myself speaking Irish fluently *
   
   Mark only one oval.
   
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

7. If I fail to learn Irish, I’ll be letting other people down *
   
   Mark only one oval.
   
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

8. Studying Irish is important to me in order to make my family proud *
   
   Mark only one oval.
   
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

9. Studying Irish is important to me because Irish proficiency is necessary for promotion in the future *
   
   Mark only one oval.
   
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree
10. I am sure I will be able to write in Irish comfortably if I continue studying *
   (Mark only one oval.)
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

11. I have to learn Irish because without passing an Irish course I cannot get my degree *
    (Mark only one oval.)
    ○ Strongly disagree
    ○ Disagree
    ○ Neutral
    ○ Agree
    ○ Strongly Agree

12. I am prepared to expend a lot of effort in learning Irish *
    (Mark only one oval.)
    ○ Strongly disagree
    ○ Disagree
    ○ Neutral
    ○ Agree
    ○ Strongly Agree

13. I can imagine myself speaking Irish with friends and family in the future *
    (Mark only one oval.)
    ○ Strongly disagree
    ○ Disagree
    ○ Neutral
    ○ Agree
    ○ Strongly Agree

14. I consider learning Irish important because the people I respect think I should do it *
    (Mark only one oval.)
    ○ Strongly disagree
    ○ Disagree
    ○ Neutral
    ○ Agree
    ○ Strongly Agree
15. Being successful in Irish is important to me so that I can please my family *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

16. Studying Irish is important to me because I think I’ll need it for further studies *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

17. If I make more effort, I am sure I will be able to master Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

18. I have to study Irish; otherwise, I think I cannot be successful in my future career *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

19. I would like to concentrate on studying Irish more than any other topic *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
20. I can imagine myself interacting with others in Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

21. Studying Irish is important to me in order to gain the approval of my peers/teachers/family/boss *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

22. My family puts a lot of pressure on me to study Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

23. Studying Irish is important to me in order to achieve a special goal (e.g. to get a degree or a scholarship) *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

24. Studying Irish is important to me because, if I don't have knowledge of Irish, I'll be considered a weak learner *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
25. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

26. If an Irish course was offered in the future, I would like to take it *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

27. Learning Irish is necessary because people around me expect me to do so *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

28. My family encourages me to practice my Irish as much as possible *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

29. Studying Irish is necessary for me because I don't want to fail an exam *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree
30. I am sure I have a good ability to learn Irish *
   Mark only one oval.
   - Strongly Disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

31. If my teacher would give the class an optional assignment in Irish, I would certainly
    volunteer to do it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

32. I can imagine myself writing Irish e-mails/letters fluently *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

33. I have to learn Irish because I don’t want to fail at an Irish course *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

34. Studying Irish is important to me because other people will respect me more if I have a
    knowledge of Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
35. I have to study Irish, because, if I don’t my family will be disappointed in me *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

36. Studying Irish is important to me, because I would feel ashamed if I got bad grades in Irish *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

37. I would like to study Irish even if I were not required *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

38. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

39. Studying Irish is important to me because I don’t like to be considered a poorly educated person *

Mark only one oval.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
40. Do you like the atmosphere of your Irish classes? *
   *Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

41. How tense would you get if you were asked to give directions in Irish? *
   *Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

42. How much would you like to become similar to the people who speak Irish? *
   *Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

43. Do you like the Irish music? *
   *Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

44. Do you like the people who live in the Gaeltacht? *
   *Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much
45. Do you find learning Irish really interesting? *  
Mark only one oval.  
- Not at all  
- Not so much  
- Neutral  
- Quite a lot  
- Very much  

46. How uneasy would you feel speaking Irish with a native speaker? *  
Mark only one oval.  
- Not at all  
- Not so much  
- Neutral  
- Quite a lot  
- Very much  

47. Do you like Irish language films? *  
Mark only one oval.  
- Not at all  
- Not so much  
- Neutral  
- Quite a lot  
- Very much  

48. Do you like meeting people from the Gaeltacht? *  
Mark only one oval.  
- Not at all  
- Not so much  
- Neutral  
- Quite a lot  
- Very much  

49. Do you think time passes faster when studying Irish? *  
Mark only one oval.  
- Not at all  
- Not so much  
- Neutral  
- Quite a lot  
- Very much
50. How nervous and confused do you get when you are speaking in an Irish class? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

51. Do you like TV programmes made for TG4? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

52. Do you like to travel to the Gaeltacht? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

53. Do you look forward to Irish classes? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

54. How afraid are you of sounding stupid in Irish because of the mistakes you make? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
55. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

56. Would you like to know more about people from Irish speaking areas? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

57. Would you like to have more Irish lessons? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

58. How worried are you that other speakers of Irish would find your Irish strange? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

59. How much do you like Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
60. Do you like Irish magazines, newspapers or books? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

61. Do you really enjoy learning Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

62. How afraid are you that other students will laugh at you when you speak Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

63. Gender *
   Mark only one oval.
   - Female
   - Male
   - Prefer not to say
   - Other: ______________________

64. Nationality *
   Mark only one oval.
   - Irish
   - Non-Irish

65. Age *

66. What is your employment status?: *
   Mark only one oval.
   - University student
   - Working professional
67. Have you ever had or do you have a native Irish-speaking teacher? *
Mark only one oval.
☐ Yes
☐ No

68. Have you spent at least three months in total in the Gaeltacht? *
Mark only one oval.
☐ Yes
☐ No

69. Where are you studying Irish at the moment? *
Mark only one oval.
☐ At a private institution
☐ At my school
☐ At university
☐ With a private tutor
☐ On my own

70. Irish ability: Please rate your current overall proficiency in Irish by ticking one: *
Mark only one oval.
☐ Upper Intermediate level and over- Able to converse about general matters of daily life and topics of one’s specialty and grasp the gist of lecturers and broadcasts. Able to read high-level matters such as newspapers and write about personal ideas
☐ Intermediate level- Able to converse about general matters of daily life. Able to read general materials related to daily life and write simple passages
☐ Lower Intermediate level- Able to converse about familiar topics. Able to read materials about familiar everyday topics and write simple letters
☐ Post- Beginner level- Able to hold a simple conversation such as greeting and introducing someone. Able to read simple materials and write a simple passage in elementary Irish
☐ Beginner level- Able to give simple greetings using set words and phrases. Able to read simple sentences, grasp the gist of short passages, and to write a simple sentence in basic Irish
Irish language game attitudes

This survey is conducted by DIT by a research student interested in understanding the thoughts and beliefs of learners of Irish after using virtual reality technology. Please read each instruction and write your answers. This is not a test so there are no "right" or "wrong" answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much.

*Required

1. If I make more effort, I am sure I will be able to master Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

2. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

3. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

4. I am sure I will be able to write in Irish comfortably if I continue to study it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
5. I can imagine myself as someone who could speak Irish fluently *
Mark only one oval.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree

6. I can imagine myself speaking Irish with friends and family in the future *
Mark only one oval.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

7. I can imagine myself as someone who can interact with others in Irish *
Mark only one oval.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

8. I can imagine myself writing Irish emails/letters fluently *
Mark only one oval.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly Agree

9. I am sure I have a good ability to learn Irish *
Mark only one oval.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree
10. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

11. How much do you like Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

12. Did you like the atmosphere in the experience for learning Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

13. How tense would you get if you were asked to give directions in Irish in an experience similar to what you just played? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

14. How much would you like to become similar to the people who speak Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
15. Did time pass faster while studying Irish in the experience? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

16. Would you look forward to trying the Irish language experience again? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

17. Did you find learning in the Irish language experience really interesting? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

18. How uneasy did you feel interacting in Irish with a native speaker in the experience? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

19. How nervous and confused did you get when you were interacting with Irish in the experience? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
20. How afraid were you of sounding stupid in Irish because of the mistakes you made in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

21. How worried were you that others would find your Irish strange in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

22. Did enjoy learning Irish in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

23. How afraid were you that others would laugh at you when you spoke Irish in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

24. Do you think this experience helped with your Irish language ability, how? *

__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
__________________________________________________________________________________________
25. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

26. Would you use virtual reality to learn Irish again, why? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

27. What was the hardest part of the experience, why? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

28. What was the best part of the experience, why? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

29. Did you enjoy learning Irish in a virtual environment, why? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

30. If you could change anything about the experience what would you change? *

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
## Presence Questionnaire

Characterize your experience in the environment, by using the slider to mark the appropriate number in the 7-point scale, in accordance with the question content and descriptive labels. Please consider the entire scale when making your responses, as the intermediate levels may apply. Answer the questions independently in the order that they appear. Do not skip questions or return to a previous question to change your answer.

*Required

1. How much were you able to control events? *  
   *Mark only one oval.*

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<td>Not at all</td>
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<td>Completely</td>
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2. How responsive was the environment to actions that you initiated (or preformed)? *  
   *Mark only one oval.*

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<td>Not Responsive</td>
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<td>Completely Responsive</td>
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3. How natural did your interactions with the environment seem? *  
   *Mark only one oval.*

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<td>Extremely artificial</td>
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<td>Completely natural</td>
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4. How much did the visual aspects of the environment involve you? *  
   *Mark only one oval.*

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5. How natural was the mechanism which controlled movement through the environment? *  
   *Mark only one oval.*

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<td>Extremely artificial</td>
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6. How compelling was your sense of objects moving through space? *  
*Mark only one oval.

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7. How much did your experiences in the virtual environment seem consistent with your real world experiences *  
*Mark only one oval.

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8. Were you able to anticipate what would happen next in response to the actions that you preformed *  
*Mark only one oval.

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9. How completely were you able to actively survey or search the environment using vision? *  
*Mark only one oval.

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10. How compelling was your sense of moving around inside the virtual environment *  
*Mark only one oval.

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11. How closely were you able to examine objects? *  
*Mark only one oval.

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12. How well could you examine objects from multiple viewpoints? *  
*Mark only one oval.

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</table>
13. How involved were you in the virtual environment experience? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not involved [ ] [ ] [ ] [ ] [ ] [ ] [ ] Completely engrossed [ ] [ ] [ ] [ ] [ ] [ ]

14. How much delay did you experience between your actions and expected outcomes? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   No delays [ ] [ ] [ ] [ ] [ ] [ ] [ ] Long delays [ ] [ ] [ ] [ ] [ ] [ ]

15. How quickly did you adjust to the virtual environment experience? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not at all [ ] [ ] [ ] [ ] [ ] [ ] [ ] Less than one minute [ ] [ ] [ ] [ ] [ ] [ ]

16. How proficient in moving and interacting with the virtual environment did you feel at the end of the experience? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not proficient [ ] [ ] [ ] [ ] [ ] [ ] [ ] Very proficient [ ] [ ] [ ] [ ] [ ] [ ]

17. How much did the visual display quality interfere distract you from performing assigned tasks or required activities? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not at all [ ] [ ] [ ] [ ] [ ] [ ] [ ] Prevented task performance [ ] [ ] [ ] [ ] [ ] [ ]

18. How much did the control devices interfere with the performance of assigned tasks or with other activities? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not at all [ ] [ ] [ ] [ ] [ ] [ ] [ ] Interfered greatly [ ] [ ] [ ] [ ] [ ] [ ]

19. How well could you concentrate on the assigned tasks or required activities rather than on the mechanisms used to perform those tasks or activities? *
   Mark only one oval.
   
   1  2  3  4  5  6  7
   Not at all [ ] [ ] [ ] [ ] [ ] [ ] [ ] Completely [ ] [ ] [ ] [ ] [ ] [ ]
20. How much did the auditory aspects of the environment involve you? *
   Mark only one oval.
   Not at all | | | | | | | Completely

21. How well could you identify sounds? *
   Mark only one oval.
   Not at all | | | | | | | Completely

22. How well could you localize sounds? *
   Mark only one oval.
   Not at all | | | | | | | Completely

23. How well could you actively survey or search the virtual environment using touch? *
   Mark only one oval.
   Not at all | | | | | | | Completely

24. How well could you move or manipulate objects in the virtual environment? *
   Mark only one oval.
   Not at all | | | | | | | Extensively
Simulator sickness questionnaire
Mark how each symptom below is affecting you right now

*Required

1. General discomfort *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

2. Fatigue *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

3. Headache *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

4. Eye strain *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

5. Difficulty focusing *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe
6. Salivation increasing *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

7. Sweating *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

8. Nausea *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

9. Difficulty concentrating *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

10. Fullness of the head *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

11. Blurred vision *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe
12. Dizziness with eyes open *
   Mark only one oval.
   None
   Slight
   Moderate
   Severe

13. Dizziness with eyes closed *
   Mark only one oval.
   None
   Slight
   Moderate
   Severe

14. Vertigo *
   Mark only one oval.
   None
   Slight
   Moderate
   Severe

15. Stomach awareness *
    Mark only one oval.
    None
    Slight
    Moderate
    Severe

16. Burping *
    Mark only one oval.
    None
    Slight
    Moderate
    Severe
D.4 Open-Ended Responses Second Case Study

1. Do you think this experience helped with your Irish language ability, how?

(a) Yes. I think if I experience this often I will speak Irish like a native speaker.

(b) This made me really think out the words I have learnt in Irish and I had to focus to understand the speakers at the counter and the security guard - which were great learning experiences. I found the whole experience really enjoyable.

(c) Yes. Learning more about the different dialects.

(d) Yes - it was highly immersive and let me concentrate on the task at hand with no distractions.

(e) A little, from a confidence perspective.

(f) nil

(g) no

(h) not really

(i) Yes - having to apply Irish to a real-life situation

(j) I think an extensive exercise in this environment would be very beneficial

(k) Yes

(l) Its nice to try new ways of learning

2. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?

(a) Yes. But it will be a bit different because in the virtual environment there are no interaction with real people. so, I was able to try what I wanted freely. But in a classroom interacting with human being will be different. They can’t be as patient as the virtual people.
Appendix Second Case Study

(b) No. The classroom environment lends a pressure from (unconscious/conscious) thoughts about how other learners might view one’s attempts. Having taken the VR experience just now, I found had no concerns at all and just focused on my own ability and knowledge. The only concern I had at the start was to remember not to physically move around so much - but that just shows that I got totally immersed in the experience.

(c) Yes. It could be acted out but being able to try out hearing the objects being said is helpful.

(d) No - I think the virtual reality suspends other people’s judgement of you and enables you to focus on the task

(e) No, because I feel more pressure interacting face to face with other students

(f) yes

(g) yes

(h) yes. less distraction with the controls

(i) Not so much- not practical to try to do a physical classroom version of this.

(j) B’fheidir - tríd comhrá

(k) Not really as it’s not practical to deliver the same experience without the technology

(l) Yes I think kids would love it

3. Would you use virtual reality to learn Irish again, why?

(a) Yes! Of course. Because its the best way to learn things for me

(b) Absolutely. It’s fun, it doesn’t feel like 'learning', there doesn’t seem to be as much pressure and there is no 'time limit' or 'time factor'.

(c) Yes. It is much more fun interacting. You feel frustrated if you get it wrong so you want to try again to "win" instead of giving up.
(d) Yes - it was highly enjoyable and time flew by while in the simulation

(e) Yes, because it removes the distraction of worrying about other peoples reactions to my ability level

(f) yes

(g) yes

(h) maybe

(i) yes - real life situations work your whole body and muscle memory which makes it stick better.

(j) Cinnte - tá sé an siúmúil

(k) Yes - thought it was a fun engaging way to learn

(l) Its a novel and immersive way of learning

4. What was the hardest part of the experience, why?

(a) Understanding words. I think that’s because I am a beginner.

(b) Remembering not to physically move around! I haven’t used VR before so I got absorbed and initially forgot that I wasn’t really in the room I was seeing.

(c) Hearing and understanding the security guard.

(d) Trying to understand the mechanisms, but it came after a while

(e) Getting used to the visual aspect, difference between where I saw my hands and where I expected my hands to be

(f) getting use to the controls

(g) hearing the irish

(h) the controls. too many buttons.

(i) The real-time task of juggling trying to use VR for the first time, hear the instructions correctly, and complete the task which also had tricks in
it. The task would have been confusing even without the Irish but only because it was my first time doing it.

(j) Orientation

(k) Adjusting to the VR Goggles and the connemara accent and my own ability

(l) Just took a minute to learn the VR

5. What was the best part of the experience, why?

(a) Being able to teleport myself in the environment.

(b) Finding the items. Picking them up wasn’t so much fun - I ended up wreaking the shop arrangement.

(c) Being able to move around, no limits to how many times you can do something, no restrictions, no time limits - until you got it right.

(d) The immersiveness of it - really felt like I was in a shop fetching items for someone who requested it through Irish

(e) Moving around the shop to collect the items

(f) stepping into the reality

(g) the virtual reality

(h) novelty. never did this before.

(i) The good quality of the VR

(j) I had never experience virtual space before -very interesting

(k) Novelty, but also being in a really engaging experience

(l) Learning the VR

6. Did you enjoy learning Irish in a virtual environment, why?

(a) Yes. The environment was very well defined and the exercise was very useful to learn new words. When we started the emulation there was no Irish word in my brain. Now I can’t stop thinking about them.
(b) This was absolutely enjoyable. I felt no learning pressure, no time pressure and my brain was really forced to work on what I have already learnt.

(c) Yes, more fun and interesting hearing how the words are pronounced by different people and dialects.

(d) I did - again due to the immersiveness of it, it really transforms you out of current situation into a new one.

(e) Yes, because it is maybe a little more engaging than a classroom environment, especially taking into account the way in which Irish is taught in schools for the most part.

(f) yes

(g) yes

(h) not much. i only learned one word.

(i) Yes

(j) The experience was very short - but I could see the benefits

(k) Yes - I thought it was fun and is a great way to learn

(l) Just better than books and rote learning

7. If you could change anything about the experience what would you change?

(a) The design could be better, but I think the essentials are already there.

(b) Longer wire! Just till I remember I am not physically in the shop. I kept getting trapped in the wire from the headset, having forgotten I wasn’t supposed to walk around as much but rather ‘teleport’ - for want of a better word.

(c) Maybe a clue at counter - eg. You have 4 items correct

(d) Nothing - I think if I was to do it again I would be more prepped for the VR experience having had my first try of it

(e) Maybe make it a bit more complicated for different levels of proficiency
(f) more items to collect

(g) shop large so didn’t know where to go, items closer

(h) less complicated storyline.

(i) Volume of the instructions. Thought 'madra' was 'dog food' as I was in a supermarket and just couldn’t hear the end.

(j) It would be interesting to try different dialects.

(k) Maybe have a choice of accents, and pace, also didn’t make sense that a security guard would ask for things in a shop, also the layout was more like a modern museum and perhaps would be more realistic if a siopa beag in Donegal. The items didn’t appear in the bag either - I was disappointed with that. Also, it’s not realistic to put a massive table in a small bag. Maybe an interaction with the person giving instructions in a more natural way and for a more genuine reason.

(l) Would have liked a second challenge
Appendix E

Appendix Third Case Study

E.1 Ethics Third Case Study

Goal of the study: This research is concerned with identifying changes in a user’s language identity through interaction in a situated Irish language VR environment. It is the intention of the work to create a framework of design principles for designers and researchers to utilize when creating VR experiences with the aim of eliciting vocabulary language gains and positive attitude changes in Irish language learners to aid their motivation for Irish language learning.

The project is utilizing a design based research methodology to examine whether there is a self-identified change in language identity when users interact in a virtual reality based gaming context. This is a mixed methods study informed by designed based research procedure. Therefore, there will be two trials of the experiment. An initial pilot trial followed by a larger second trial informed by the pilot. The pilot was conducted in TU Dublin in the ViRAL lab with ethical approval given through Research Ethics and Integrity Committee TU Dublin. Participants were gathered through the Irish Languages Classes in TU Dublin. Students from Marino Institute of Education learning Irish are the intended context group for the second iteration of the study. The research is concerned with discovering and incorporating best design methodology for Irish language learning in VR. The experiment is specifically targeting students in Marino Institute of Education as they undergo consistent Irish
language classes over the four years. Therefore, they represent a real context group as Irish language learners. During the dissemination phase we will reference prior research concerning student teachers and their Irish language skills and add to the state of the art in this research area.

Participants will play a virtual reality experience developed by the researcher. The objective of the game is to listen to the items asked for by the shopkeeper and to pick them up in the shop put them in their bag and give them to the shopkeeper. The player will hear the sound of each item in the shop when they interact with them and the game will end when the player picks up all the items they need.

Participants will play the game using an Oculus Rift headset and controls. The experiment will take place in a wide space with enough room for participants to freely move around in while they play the game. The experiment will take place in an empty classroom in Marino Institute of Education. Only the researcher(s) and participants will be in the room during each experiment. For the duration of each gaming session audio, video and analytics data on their gameplay will be captured. These recordings will be taken to observe how people interact in the virtual world as well as observe how long people interact in the virtual world for. During each gaming session, the participants will be asked to familiarize themselves with the game controls by playing a trial game for 2 minutes. Subsequently, the participants will be asked to restart the game and the recording of the gaming session will start. Each gaming session will last between 5-10 minutes or until the end of the game’s level.

A control group is also envisioned for the study. This is to ensure rigor in the experiment.

They will be given the opportunity to engage in a flashcard teaching activity to learn the vocabulary included in the game the same number of times as participants have had opportunities with the game.

The participants will be asked to engage with the learning experience once a fortnight for a period eight weeks in a classroom in the Marino Institute of Education campus. In total each participant will spend approximately two - two and a half hours interacting with the experiment over the course of the two months. Half hour
for questionnaires pre-test and post-test. And three 10 - 15 minute interactions in
the virtual environment/ flash card activity and finally a half hour focus group where
they will be scheduled with a specific time and therefore, will not be waiting for other
groups to finish.

The study will gather audio, video and analytics of the gameplay (captured using
screen recording software and unity analytics) along with questionnaire data. These
recordings will be taken to observe how people interact in the virtual world as well
as observe how long people interact in the virtual world for.

No identifying information will be in the audio: if any is present in the audio
recorded (names, personal details etc.) it will be removed.

Pre-test questionnaires: Before beginning the experiment, each participant in the
control and VR group will fill out a questionnaire to ascertain their personal attitudes,
and identity to the Irish language.

Before each session both groups will complete a pre-test of Irish vocabulary words
included in the game.

Post-test questionnaires: After the experiment each group will complete a
questionnaire on Irish language attitudes after interaction with the game/flashcard
activity. (Appendix 9.3)

After each session both groups will complete a post-test of Irish vocabulary words
included in the game.

The VR group will also complete a presence questionnaire and a simulation
sickness questionnaire after each session.

Finally there will be a post-test focus group interview with participants who
interacted with the virtual reality experience with questions based on the post-test
attitudes questionnaire to gain a deeper analysis and understanding of players
changing identity and attitudes from the experiment. The interview will be recorded
and transcribed. No identifying information will be present in the interview recordings
or transcriptions. Names and other personal details will not be revealed and all data
will be confidential. The data will be kept confidential by using codes to refer to each
participant e.g. P1A, P1B etc.
Appendix Third Case Study

No identifying information will be in the audio: if any is present in the audio recorded (names, personal details etc.) it will be removed.

The results of the attitudes and identity changes from the game will then be compared to the pre-test information and the presence and simulation sickness questionnaires to determine if a relationship exists between the data.

Could any aspect of the research give rise to any form of harm to participants, including the researcher(s)?

Simulator sickness is a common aliment associated with prolonged VR interaction. It is associated with minor feelings of nausea similar to car sickness.

The Oculus Rift the VR equipment being utilized for the experiment is compliant with the European medical device directive 93/42/ECC. This means the device is deemed suitable for consumer usage in Ireland.

The study is upholding top ethical conduct for research in VR with specific cautions taken into account sourced from up to date published research in the field (Brooks et al., 2010)

A certificate from an expert in the field of virtual reality Dr. Brian Vaughan head of the VR interaction lab in TU Dublin is included in the appendix 9.7. stating that it is safe for college students to participate. Data from the first trial of the experiment displaying little to no simulator sickness felt among participants has also been included appendix 9.8. This offers evidence that this specific VR experience will not lead to any simulator sickness among participants. Procedures have been put in place to safeguard participants who may experience any feelings of nausea or sickness. These procedures are: each session is monitored and guided by the researcher, sick bags, towels, and water are available for all participants.

Participants will be recruited by the researcher going to the Irish language classes in Marino Institute of Education and informing them of the study, giving out an information sheet to all potential participants which will contain a contact email and phone number to get in contact with Naoise Collins the lead researcher in the project. Permission to enter these classes has been given by Aodán Mac Suibhne the head of Irish in the Institute. An email will be sent out to the 2nd and 3rd year
Irish classes by Aodán Mac Suibhne informing students of the study and allowing them to sign up a week before the researcher comes to the class. There will be a total of 30 participants, 15 in each group between control and intervention. If there is an over subscription of numbers, participants will be chosen through a blind randomisation process. Participants names will be assigned a number and a random number generator from an online application will be used to sort them into the two groups: control and test.

Students will be recruited from year 2 and 3 of their undergraduate degree ensuring all participants are over the age of 18. Participants for the control group will be recruited using the same procedure as the intervention group. The groups will be chosen through a blind randomization process after participants have volunteered and consent has been given. Participants will be informed that this placement will be randomized. The experiment has been designed independently of Marino Institute of Education Irish language courses. It will not take place during any lecture time and is independent of any classes of Marino Institute of Education. The experiment is also on a volunteer basis therefore no student is being advantaged/ disadvantaged by their engagement with the study in relation to their education with Marino Institute of Education. The control group will be given the opportunity to try out the simulation once the data has been collected and the focus interviews are completed.

There will be no incentives used with participants they will be participating out of their own free will. There is no power dynamics between the researcher and the students. It will not interrupt or take place or be part of their classes in Marino Institute of Education. The experiment will be timetabled so it does not interrupt their regular attendance of class. All emails and phone numbers collected during the period of recruitment will follow GDPR guidelines.

Data Minimisation: Only the minimum amount of personal data will be retained from subjects. Retention: Contact information for the participants will only be retained for the duration of the experiment.

Security: The email and phone numbers will be kept confidential and password protected with only the researcher having access to them.
The research will take place on location in Marino Institute of Education. An empty classroom will be the designated space organised by Aodán McSuibhne. This space will be organised to be used by the researcher every Tuesday and Wednesday from 12 – 2 when the students have no lectures or classes.

Participants will be over the age of 18. Students will be recruited from year 2 and 3 of their undergraduate degree ensuring all participants are over the age of 18

Letter of consent is in the appendix 9.1. Includes consent for all procedures for both the control and intervention groups

Informed consent is required in all studies and research using human participants. The consent to participate should clearly outline the purpose of the study and what the information gathered will be used for. This study clearly outlines its goals and purposes in the information sheet (Appendix 9.2) given to the participants during the recruitment phase. All participants will be required to sign and agree to the consent form (Appendix 9.1) before engaging in the study which also outlines these goals and purposes.

There will be no punishment for participation or possible punishment for a response as the researcher has no position of power or connection to the participants. The participants will also be informed that their identity will remain confidential so they will be able to be identified from their responses to the study.

All data will be stored on an encrypted hard drive stored in a locked press in TU Dublin Aungier Street. The encrypted hard drive containing the data will be reformatted, wiping it of all information and then it will be destroyed once the data is no longer needed for this study. This will be after the work has been disseminated through papers and the PhD is completed and evaluated. This means the data will be retained for these purposes for the next three years.
E.2 Call for Third Case Study

Information Sheet

My name is Naoise Collins I’m a PhD. researcher in TU Dublin studying the effects of immersive situated gaming experiences on Irish language learning.

We have developed a virtual reality Irish language learning game and we are currently interested in finding participants for a study into how Irish language virtual reality experiences effect the Irish language identity of players. We are specifically examining the adult Irish language learner context.

Only 30 places are available, if more than 30 people wish to participate the participants will be chosen through a blind randomisation process where their names will be assigned a number and a random number generator from an online application will be used to sort them into two groups: control and intervention.

Participants will be asked to fill out a questionnaire about their attitudes towards the Irish language. The participants will be able to respond in Irish or English to the questionnaire. The control group will engage in a flashcard teaching activity taking about 10 minutes. The intervention group will play a virtual reality game developed by the researchers here in TU Dublin taking about 10 minutes. This will be repeated three times over the course of two months.

Finally, they will complete a post-test questionnaire about their experience in the game and a vocabulary test with the vocabulary included in the game. The participants who engaged with the flash card activity will complete a vocabulary test once the 3 sessions are completed. The participants will be able to respond in Irish or English to the questionnaire.

The study includes very minor possible risks to the participant including feelings of nausea and vertigo from interaction with Virtual Reality equipment. Only a limited number of people are affected by these feelings when interacting with VR and the researchers have optimised the design of the game to avoid these feelings of nausea and vertigo. The effects are only very temporary and tend to last only 20 minutes at a maximum. The flash card activity will not contain any nausea or vertigo risks.

The Oculus Rift the VR equipment being utilized for the experiment is compliant with the European medical device directive 93/42/ECC. This means the device is deemed suitable for consumer usage in Ireland.
Each session is monitored and guided by the researcher, sick bags, towels, and water will be available for all participants.

No compensation will be providing for anyone who experiences these symptoms. We will be performing a screen capture, recording the audio experience and collecting analytics from their gameplay experience. There will be no recordings or capture of the flash card activity group.

After these experiments are completed participants will be gathered to engage in a focus group to comment on their experiences of the virtual reality environment. The study is interested in:

1. Measurable vocabulary learning outcomes
2. Motivation and Irish language identity and
3. Usability and design features of the game

The focus group questions will only be focused along these themes and no personal or identifiable questions will be asked of participants. We expect the focus groups to last around 30 minutes. The participants will be able to respond in Irish or English to the focus group.

The flash card participants will not have to engage in the focus group activity.

All data and information provided by the participants will be confidential. The data will be kept on an encrypted hard drive and kept locked in a secure drawer by the lead researcher.

The results of the study will be published in international conferences and journals in order to disseminate the results of the work.

The study will give participants the opportunity to try out cutting-edge virtual reality applications, be immersed in a virtual Irish language experience, question and think about their identification with the Irish language.

To volunteer for this study please contact Naoise on D15123239@mydit.ie or 0852717266

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**Background information**

This research project will examine how immersive, gaming based, situated learning environments can be used to teach Irish language skills.
It will focus on the player's identity as an Irish language speaker and how digital experiences can be utilised to transfer the learning of Irish language, culture, and knowledge through an immersed experience.

Language is a powerful tool, facilitating all thought and communication; when a learner is learning a second language they must conceptualise their actions and thoughts in a new way to forge a new identity. To become proficient, a speaker must be able to convey their thoughts accurately to be understood within the wider community of speakers. The Irish Language is intimately bound with issues of Irish identity and culture: for the learner to be recognised as proficient, their new language skills must be embedded within the broader context of this identity and culture.

Immersing the learner in a situated environment allows them to use their second language to carry out a number of simple objectives e.g. ordering food, and a number of more complex tasks; e.g. asking questions, giving answers, and listening to conversations in the Irish language. By completing and engaging with these, the user becomes a more proficient learner, embedding their experiences in practical situations and scenarios. This is a similar approach to the total immersion ideology of Gaelscoils, where the learner is immersed in the language. This project takes a similar approach to its methodologies

This study aims to use cutting-edge technology and game development tools and methods, alongside virtual reality hardware (VIVE, Oculus Rift, Unity3d) to create virtual reality experiences where the user is completely immersed in an Irish language setting and can contextualise their thoughts and actions in Irish through the digital experience.

*Background Information on the researcher*
Naoise trained as a primary school teacher in Marino Institute of Education. He was a primary school teacher for five years and taught in a huge variety of environments: disadvantaged schools, gael scoils, gaeltacht schools, Educate Together schools, summer camps etc. He went on to complete his masters in DIT in creative digital media where he developed digital games to teach computer programming. He holds a Teaching English as a foreign language (TEFL) cert and has taught English in Spain for four summers in a row giving him a deep interest and understanding of language and culture. He was the senior educational consultant with Edanu: a IT training company for the Irish education sector. He left Wicklow at the age of 9 and moved to Connemara to a fully immersive Irish language environment. Within a year, he was fluent in the language. He grew a passion for language and a deep interest into further developing language acquisition skills. He won an award for his outstanding contribution to developing Irish within the college Marino Institute of Education (2012) and was the Irish officer on the student union in the college. He is currently lecturing game development and board game design in CTYI (centre for talented youth) and is a part time lecturer in game design in TU Dublin. He is a core member of the ViRAL research lab. An AR/VR software development and research lab in DIT. He is a Government of Ireland Postgraduate Scholarship Programme awardee and this research project is funded by the Irish Research Council.
E.3 Consent Form Third Case Study

Consent form
Researchers: Naoise Collins (PhD student/lead researcher), Dr. Brian Vaughan (research supervisor), Dr. Keith Gardiner, Dr. Charlie Cullen (research supervisor)

You are invited to participate in this research project, which is being carried out, by the named researchers, in TU Dublin. Your participation is voluntary. Even if you agree to participate now, you can withdraw at any time without any consequences of any kind.

The study is to investigate situated immersive Irish language learning environments

If you agree to participate, your participation will involve your gameplay being recorded (audio, video) while playing a virtual reality game. The gameplay will be recorded using Nvidia Shadowplay screen capture recording software. We are only capturing what you see in the virtual environment. These recordings will be taken to observe how people interact in the virtual world and to observe how long people interact in the virtual world for. This includes observing how long the task takes to complete, how long each object took for the participants to find and which objects the participants chose to pick up. If you are part of the control group, you are agreeing to engage in a flashcard teaching activity. Your participation will also include answering some pre and post-test questionnaires and a focus group interview in relation to your experience playing the game. This focus group interview will be recorded. It will be carried out in a sensitive and non-stressful manner, and you the right to cease participation at any time and without the need to provide a reason. Any information or data, which is obtained from you during this research, will be treated confidentially. No identifying information will be held or made available. The researcher will remove any identifying audio and imagery using premiere pro and audition software, so no participant will be identifiable from their participation in the study. You cannot be identified from the results of the analysis that will be carried out. Your name and other personal details will not be revealed, and all data will be confidential. The data will be kept confidential by using codes to refer to each participant e.g. P1A, P1B etc.

You will not benefit directly from participating in this research other than to help by taking part in recordings for subsequent analysis, the results of which will form part of an academic paper and possible future papers. The analysis results will contribute to a wider understanding about how Irish language learners learn Irish in VR environments.

Interaction in a VR environment carries the minor risk of simulator sickness. This is a common aliment associated with prolonged VR interaction. It is associated with minor feelings of nausea similar to car sickness. The Oculus Rift the VR equipment being utilized for the experiment is compliant with the European medical device directive 93/42/ECC. This means the device is deemed suitable for consumer usage in Ireland. Each session is monitored and guided by the researcher, sick bags, towels, and water will be available for all participants.
The data will be securely kept in the DMC (Digital Media Centre). You will be able to listen and watch any part of the recordings. You can withdraw consent to use the recordings at any time.

All data will be stored on an encrypted hard drive stored in a locked press in TU Dublin Aungier Street. All data will be stored on an encrypted hard drive stored in a locked press in TU Dublin Aungier Street. The encrypted hard drive containing the data will be reformatted, wiping it of all information and then it will be destroyed once the data is no longer needed for this study. This will be after the work has been disseminated through papers have been published and the PhD. This means the data will be retained for these purposes for the next three years.

Your details will be kept confidential and this information will in no way be linked to the recordings. Only the researchers named above will have any knowledge of the identity of the people taking part and they are precluded from discussing this with anyone but themselves. The recordings will not contain any identifying information.

If you have any questions about this research you can contact Naoise Collins (D15123239@mydit.ie, 0852717266).

**Statement of Consent:**

Please read the questions below and indicate whether or not you would be willing to participate in the study as described.

- Do you consent to participate in the study by completing the questionnaires described above? Yes No
- Do you consent to be interviewed based on your questionnaire answers and to have the interview audiotaped? Yes No
- Do you consent to participate playing the VR experience? Yes No
- Do you consent to participate having the audio recorded during the VR experience? Yes No
- Do you consent to having the video recorded during the VR experience? Yes No
- Do you consent to engaging in a flashcard teaching activity? Yes No

Signed _____________________
E.4 Questionnaires
Irish Learner Questionnaire

This survey is conducted by a TUDublin research student interested in understanding the thoughts and beliefs of learners of Irish. Please read each instruction and write your answers. This is not a test so there are no "right" or "wrong" answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much

*Required

1. I study Irish because close friends of mine think it is important *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

2. My family believes I must study Irish to be an educated person *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

3. Studying Irish is important to me because I think it will be useful in getting a good job and/or making money *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

4. I have to study Irish because I don't want to get bad marks in it *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
5. I would like to spend lots of time studying Irish *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

6. I can imagine myself speaking Irish fluently *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

7. If I fail to learn Irish, I’ll be letting other people down *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

8. Studying Irish is important to me in order to make my family proud *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

9. Studying Irish is important to me because Irish proficiency is necessary for promotion in the future *
   *Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
10. I am sure I will be able to write in Irish comfortably if I continue studying *  
Mark only one oval.  
- Strongly disagree  
- Disagree  
- Neutral  
- Agree  
- Strongly agree

11. I have to learn Irish because without passing an Irish course I cannot get my degree *  
Mark only one oval.  
- Strongly disagree  
- Disagree  
- Neutral  
- Agree  
- Strongly Agree

12. I am prepared to expend a lot of effort in learning Irish *  
Mark only one oval.  
- Strongly disagree  
- Disagree  
- Neutral  
- Agree  
- Strongly Agree

13. I can imagine myself speaking Irish with friends and family in the future *  
Mark only one oval.  
- Strongly disagree  
- Disagree  
- Neutral  
- Agree  
- Strongly Agree

14. I consider learning Irish important because the people I respect think I should do it *  
Mark only one oval.  
- Strongly disagree  
- Disagree  
- Neutral  
- Agree  
- Strongly Agree
15. Being successful in Irish is important to me so that I can please my family *

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

16. Studying Irish is important to me because I think I’ll need it for further studies *

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

17. If I make more effort, I am sure I will be able to master Irish *

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

18. I have to study Irish; otherwise, I think I cannot be successful in my future career *

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

19. I would like to concentrate on studying Irish more than any other topic *

Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree
20. I can imagine myself interacting with others in Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

21. Studying Irish is important to me in order to gain the approval of my peers/teachers/family/boss *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

22. My family puts a lot of pressure on me to study Irish *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

23. Studying Irish is important to me in order to achieve a special goal (e.g. to get a degree or a scholarship) *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

24. Studying Irish is important to me because, if I don’t have knowledge of Irish, I’ll be considered a weak learner *
   Mark only one oval.
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree
25. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

26. If an Irish course was offered in the future, I would like to take it *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

27. Learning Irish is necessary because people around me expect me to do so *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

28. My family encourages me to practice my Irish as much as possible *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

29. Studying Irish is necessary for me because I don't want to fail an exam *
Mark only one oval.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree
30. I am sure I have a good ability to learn Irish *
   *Mark only one oval.*
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Neutral
   - [ ] Agree
   - [ ] Strongly Agree

31. If my teacher would give the class an optional assignment in Irish, I would certainly volunteer to do it *
   *Mark only one oval.*
   - [ ] Strongly disagree
   - [ ] Disagree
   - [ ] Neutral
   - [ ] Agree
   - [ ] Strongly agree

32. I can imagine myself writing Irish e-mails/letters fluently *
   *Mark only one oval.*
   - [ ] Strongly disagree
   - [ ] Disagree
   - [ ] Neutral
   - [ ] Agree
   - [ ] Strongly agree

33. I have to learn Irish because I don’t want to fail at an Irish course *
   *Mark only one oval.*
   - [ ] Strongly disagree
   - [ ] Disagree
   - [ ] Neutral
   - [ ] Agree
   - [ ] Strongly Agree

34. Studying Irish is important to me because other people will respect me more if I have a knowledge of Irish *
   *Mark only one oval.*
   - [ ] Strongly disagree
   - [ ] Disagree
   - [ ] Neutral
   - [ ] Agree
   - [ ] Strongly Agree
35. I have to study Irish, because, if I don’t my family will be disappointed in me *
   Mark only one oval.
   □ Strongly disagree
   □ Disagree
   □ Neutral
   □ Agree
   □ Strongly Agree

36. Studying Irish is important to me, because I would feel ashamed if I got bad grades in Irish *
   Mark only one oval.
   □ Strongly disagree
   □ Disagree
   □ Neutral
   □ Agree
   □ Strongly Agree

37. I would like to study Irish even if I were not required *
   Mark only one oval.
   □ Strongly disagree
   □ Disagree
   □ Neutral
   □ Agree
   □ Strongly agree

38. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *
   Mark only one oval.
   □ Strongly disagree
   □ Disagree
   □ Neutral
   □ Agree
   □ Strongly Agree

39. Studying Irish is important to me because I don’t like to be considered a poorly educated person *
   Mark only one oval.
   □ Strongly disagree
   □ Disagree
   □ Neutral
   □ Agree
   □ Strongly Agree
40. Do you like the atmosphere of your Irish classes? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

41. How tense would you get if you were asked to give directions in Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

42. How much would you like to become similar to the people who speak Irish? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

43. Do you like the Irish music? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much

44. Do you like the people who live in the Gaeltacht? *
Mark only one oval.
- Not at all
- Not so much
- Neutral
- Quite a lot
- Very much
45. Do you find learning Irish really interesting? *
   *Mark only one oval.*
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

46. How uneasy would you feel speaking Irish with a native speaker? *
   *Mark only one oval.*
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

47. Do you like Irish language films? *
   *Mark only one oval.*
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

48. Do you like meeting people from the Gaeltacht? *
   *Mark only one oval.*
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

49. Do you think time passes faster when studying Irish? *
   *Mark only one oval.*
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
50. How nervous and confused do you get when you are speaking in an Irish class? *

Mark only one oval.

☐ Not at all
☐ Not so much
☐ Neutral
☐ Quite a lot
☐ Very much

51. Do you like TV programmes made for TG4? *

Mark only one oval.

☐ Not at all
☐ Not so much
☐ Neutral
☐ Quite a lot
☐ Very much

52. Do you like to travel to the Gaeltacht? *

Mark only one oval.

☐ Not at all
☐ Not so much
☐ Neutral
☐ Quite a lot
☐ Very much

53. Do you look forward to Irish classes? *

Mark only one oval.

☐ Not at all
☐ Not so much
☐ Neutral
☐ Quite a lot
☐ Very much

54. How afraid are you of sounding stupid in Irish because of the mistakes you make? *

Mark only one oval.

☐ Not at all
☐ Not so much
☐ Neutral
☐ Quite a lot
☐ Very much
55. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

56. Would you like to know more about people from Irish speaking areas? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

57. Would you like to have more Irish lessons? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

58. How worried are you that other speakers of Irish would find your Irish strange? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

59. How much do you like Irish? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much
60. Do you like Irish magazines, newspapers or books? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

61. Do you really enjoy learning Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

62. How afraid are you that other students will laugh at you when you speak Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

63. Gender *
   Mark only one oval.
   - Female
   - Male
   - Prefer not to say
   - Other: ____________________________

64. Nationality *
   Mark only one oval.
   - Irish
   - Non-Irish

65. Age *

66. What is your employment status? *
   Mark only one oval.
   - University student
   - Working professional
67. Have you ever had or do you have a native Irish-speaking teacher? *
   *Mark only one oval.
   - Yes
   - No

68. Have you spent at least three months in total in the Gaeltacht? *
   *Mark only one oval.
   - Yes
   - No

69. Where are you studying Irish at the moment? *
   *Mark only one oval.
   - At a private institution
   - At my school
   - At university
   - With a private tutor
   - On my own

70. Irish ability: Please rate your current overall proficiency in Irish by ticking one: *
   *Mark only one oval.
   - Upper Intermediate level and over- Able to converse about general matters of daily life and topics of one's specialty and grasp the gist of lecturers and broadcasts. Able to read high-level matters such as newspapers and write about personal ideas
   - Intermediate level- Able to converse about general matters of daily life. Able to read general materials related to daily life and write simple passages
   - Lower Intermediate level- Able to converse about familiar topics. Able to read materials about familiar everyday topics and write simple letters
   - Post- Beginner level- Able to hold a simple conversation such as greeting and introducing someone. Able to read simple materials and write a simple passage in elementary Irish
   - Beginner level- Able to give simple greetings using set words and phrases. Able to read simple sentences, grasp the gist of short passages, and to write a simple sentence in basic Irish
Marino Game Irish language attitudes

This survey is conducted by a TUDublin research student interested in understanding the thoughts and beliefs of learners of Irish after using virtual reality technology. Please read each instruction and write your answers. This is not a test so there are no "right" or "wrong" answers. This results of this survey will be used only for research purposes so please answer sincerely. Thank you very much

*Required

1. If I make more effort, I am sure I will be able to master Irish *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

2. I believe that I will be capable of reading and understanding most texts in Irish if I keep studying it *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree

3. I can imagine myself living in the Gaeltacht and using Irish effectively for communicating with the locals *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly Agree

4. I am sure I will be able to write in Irish comfortably if I continue to study it *
   Mark only one oval.
   ○ Strongly disagree
   ○ Disagree
   ○ Neutral
   ○ Agree
   ○ Strongly agree
5. I can imagine myself as someone who could speak Irish fluently *
   
   Mark only one oval.
   
   [ ] Strongly disagree
   [ ] Disagree
   [ ] Neutral
   [ ] Agree
   [ ] Strongly agree

6. I can imagine myself speaking Irish with friends and family in the future *
   
   Mark only one oval.
   
   [ ] Strongly disagree
   [ ] Disagree
   [ ] Neutral
   [ ] Agree
   [ ] Strongly agree

7. I can imagine myself as someone who can interact with others in Irish *
   
   Mark only one oval.
   
   [ ] Strongly disagree
   [ ] Disagree
   [ ] Neutral
   [ ] Agree
   [ ] Strongly agree

8. I can imagine myself writing Irish emails/letters fluently *
   
   Mark only one oval.
   
   [ ] Strongly disagree
   [ ] Disagree
   [ ] Neutral
   [ ] Agree
   [ ] Strongly agree

9. I am sure I have a good ability to learn Irish *
   
   Mark only one oval.
   
   [ ] Strongly disagree
   [ ] Disagree
   [ ] Neutral
   [ ] Agree
   [ ] Strongly agree
10. How important do you think learning Irish is in order to learn more about the culture and art of its speakers? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

11. How much do you like Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

12. Did you like the atmosphere in the experience for learning Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

13. How tense would you get if you were asked to give directions in Irish in an experience similar to what you just played? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

14. How much would you like to become similar to the people who speak Irish? *
   Mark only one oval.
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
15. Did time pass faster while studying Irish in the experience? *
   
   Mark only one oval.
   
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

16. Would you look forward to trying the Irish language experience again? *
   
   Mark only one oval.
   
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

17. Did you find learning in the Irish language experience really interesting? *
   
   Mark only one oval.
   
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

18. How uneasy did you feel interacting in Irish with a native speaker in the experience? *
   
   Mark only one oval.
   
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much

19. How nervous and confused did you get when you were interacting with Irish in the experience? *
   
   Mark only one oval.
   
   - Not at all
   - Not so much
   - Neutral
   - Quite a lot
   - Very much
20. How afraid were you of sounding stupid in Irish because of the mistakes you made in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

21. How worried were you that others would find your Irish strange in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

22. Did enjoy learning Irish in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

23. How afraid were you that others would laugh at you when you spoke Irish in the experience? *
   Mark only one oval.
   ○ Not at all
   ○ Not so much
   ○ Neutral
   ○ Quite a lot
   ○ Very much

24. Do you think this experience helped with your Irish language ability, how? *

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
25. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why? *

26. Would you use virtual reality to learn Irish again, why? *

27. What was the hardest part of the experience, why? *

28. What was the best part of the experience, why? *

29. Did you enjoy learning Irish in a virtual environment, why? *

30. If you could change anything about the experience what would you change? *
## Presence Questionnaire Third Case Study

8/20/2019

### Presence Questionnaire

Characterize your experience in the environment, by using the slider to mark the appropriate number in the 7-point scale, in accordance with the question content and descriptive labels. Please consider the entire scale when making your responses, as the intermediate levels may apply. Answer the questions independently in the order that they appear. Do not skip questions or return to a previous question to change your answer.

*Required*

1. **How much were you able to control events?**
   *Mark only one oval.*

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<th>4</th>
<th>5</th>
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<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely</td>
</tr>
</tbody>
</table>

2. **How responsive was the environment to actions that you initiated (or preformed)?**
   *Mark only one oval.*

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<thead>
<tr>
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<th>4</th>
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<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Responsive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely Responsive</td>
</tr>
</tbody>
</table>

3. **How natural did your interactions with the environment seem?**
   *Mark only one oval.*

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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely artificial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely natural</td>
</tr>
</tbody>
</table>

4. **How much did the visual aspects of the environment involve you?**
   *Mark only one oval.*

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<tr>
<th>1</th>
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<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely</td>
</tr>
</tbody>
</table>

5. **How natural was the mechanism which controlled movement through the environment?**
   *Mark only one oval.*

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</tr>
</thead>
<tbody>
<tr>
<td>Extremely artificial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely natural</td>
</tr>
</tbody>
</table>
6. How compelling was your sense of objects moving through space? *
Mark only one oval.

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<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very compelling</td>
</tr>
</tbody>
</table>

7. How much did your experiences in the virtual environment seem consistent with your real world experiences *
Mark only one oval.

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</tr>
</thead>
<tbody>
<tr>
<td>Not consistent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very consistent</td>
</tr>
</tbody>
</table>

8. Were you able to anticipate what would happen next in response to the actions that you preformed *
Mark only one oval.

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<thead>
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<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely</td>
</tr>
</tbody>
</table>

9. How completely were you able to actively survey or search the environment using vision? *
Mark only one oval.

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<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Completely</td>
</tr>
</tbody>
</table>

10. How compelling was your sense of moving around inside the virtual environment *
Mark only one oval.

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</thead>
<tbody>
<tr>
<td>Not compelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very compelling</td>
</tr>
</tbody>
</table>

11. How closely were you able to examine objects? *
Mark only one oval.

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</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Very closely</td>
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</table>

12. How well could you examine objects from multiple viewpoints? *
Mark only one oval.

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</thead>
<tbody>
<tr>
<td>Not at all</td>
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<td></td>
<td></td>
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<td>Extensively</td>
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</tbody>
</table>
### Presence Questionnaire

13. How involved were you in the virtual environment experience? *  
*Mark only one oval.*

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</thead>
<tbody>
<tr>
<td>Not involved</td>
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14. How much delay did you experience between your actions and expected outcomes? *  
*Mark only one oval.*

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<tbody>
<tr>
<td>No delays</td>
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15. How quickly did you adjust to the virtual environment experience? *  
*Mark only one oval.*

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<tr>
<td>Not at all</td>
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16. How proficient in moving and interacting with the virtual environment did you feel at the end of the experience? *  
*Mark only one oval.*

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<tr>
<td>Not proficient</td>
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17. How much did the visual display quality interfere distract you from performing assigned tasks or required activities? *  
*Mark only one oval.*

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<tr>
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18. How much did the control devices interfere with the performance of assigned tasks or with other activities? *  
*Mark only one oval.*

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19. How well could you concentrate on the assigned tasks or required activities rather than on the mechanisms used to perform those tasks or activities? *  
*Mark only one oval.*

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</table>
20. How much did the auditory aspects the environment involve you? *
   *Mark only one oval.*

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21. How well could you identify sounds? *
   *Mark only one oval.*

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22. How well could you localize sounds? *
   *Mark only one oval.*

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23. How well could you actively survey or search the virtual environment using touch? *
   *Mark only one oval.*

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</table>

24. How well could you move or manipulate objects in the virtual environment? *
   *Mark only one oval.*

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<tr>
<td>Extensively</td>
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</table>
Simulator sickness questionnaire

Mark how each symptom below is affecting you right now

*Required

1. General discomfort *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

2. Fatigue *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

3. Headache *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

4. Eye strain *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

5. Difficulty focusing *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe
6. Salivation increasing *
   Mark only one oval.
   - None
   - Slight
   - Moderate
   - Severe

7. Sweating *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

8. Nausea *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

9. Difficulty concentrating *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

10. Fullness of the head *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

11. Blurred vision *
    Mark only one oval.
    - None
    - Slight
    - Moderate
    - Severe

https://docs.google.com/forms/d/1yol_rGbUlqAX4Vx6bmnru9Q_hkGmGJlB7x3h6EUY/edit
12. **Dizziness with eyes open** *
   *Mark only one oval.*
   - None
   - Slight
   - Moderate
   - Severe

13. **Dizziness with eyes closed** *
   *Mark only one oval.*
   - None
   - Slight
   - Moderate
   - Severe

14. **Vertigo** *
   *Mark only one oval.*
   - None
   - Slight
   - Moderate
   - Severe

15. **Stomach awareness** *
   *Mark only one oval.*
   - None
   - Slight
   - Moderate
   - Severe

16. **Burping** *
   *Mark only one oval.*
   - None
   - Slight
   - Moderate
   - Severe
Vocabulary Post test

This is a post test vocabulary questionnaire to measure how many words you already know included in the teaching activity you are about to undertake. This is not a reflection of your ability and the data within will be kept confidential. You will not be able to be identified by your test. Spelling is not an issue for the post test just make your best possible approximation.

1. Céard é seo?

2. Céard é seo?

3. Céard é seo?
4. Céard é seo? *

https://docs.google.com/forms/d/1NZuJzJHw43miLQ9HHrEutQvtPxBlaGmY8ENHqi4JvE/edit

5. Céard é seo? *

6. Céard é seo? *
7. Céard é seo? *

8. Céard é seo? *

9. Céard é seo? *
10. Céard é seo? *

[Image of a six-pack of beer]

11. Céard é seo? *

[Image of a sausage]

12. Céard é seo? *

[Image of a baseball]
13. Céard é seo? *

![Image of a coffee can]

14. Céard é seo? *

![Image of a meat slice]

15. Céard é seo? *

![Image of a yogurt container]
16. Céard é seo? *

17. Céard é seo? *

18. Céard é seo? *
19. Céard é seo?

20. Céard é seo?

21. Céard é seo?
22. Céard é seo? *

23. Céard é seo? *

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43. Céard é seo? *

44. Céard é seo? *

45. Céard é seo? *
46. Céard é seo? *

47. Céard é seo? *

48. Céard é seo? *
49. Céard é seo? *

50. Céard é seo? *

51. Céard é seo? *
52. Céard é seo?

![Image of a yogurt container with "Nature" written on it.](https://docs.google.com/forms/d/1NZuJzJHw43mLOq9HHrUEutQPvBlaGmY8ENHqiy4JvE/edit)

53. Céard é seo?

![Image of a melon.](https://docs.google.com/forms/d/1NZuJzJHw43mLOq9HHrUEutQPvBlaGmY8ENHqiy4JvE/edit)

54. Céard é seo?

![Image of a knife.](https://docs.google.com/forms/d/1NZuJzJHw43mLOq9HHrUEutQPvBlaGmY8ENHqiy4JvE/edit)

55. Céard é seo?

![Image of a tulip.](https://docs.google.com/forms/d/1NZuJzJHw43mLOq9HHrUEutQPvBlaGmY8ENHqiy4JvE/edit)
56. Céard é seo? *

57. Céard é seo? *

58. Céard é seo? *
59. Céard é seo? *

60. Céard é seo? *

61. Céard é seo? *

62. Céard é seo? *
63. Céard é seo? *

![Image of toilet paper]

64. Céard é seo? *

![Image of garlic]

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E.5 Open-Ended Responses Third Case Study

1. Do you think this experience helped with your Irish language ability, how?

(a) Yes. When language learning is changed into something fun and interactive, it takes fear out of wrong answers because in games you try again and you have motivation to get to the next level.

(b) More confident understanding spoken Irish.

(c) Yes. I learned words that I did not know before.

(d) Yes. It was very engaging.

(e) Yes, I learned some new vocab

(f) yes

(g) I think the experience helped with my Irish as i was repeatedly seeing different objects and experiencing them at the same time as hearing the word associated with them.

(h) I think that it showed me how Irish could be implemented in a more natural setting and then would make it a less stressful environment.

(i) I think it did as I now know words as gaeilge that I wouldn’t have known before taking part in the experience.

(j) I learned new words

2. Do you think you could have this same kind of experience in an Irish classroom without the virtual reality elements, why?

(a) No. Virtual reality is something becoming increasingly more prevalent in today’s technology and we should adapt classes to the technology age. We must accept people learn in all different ways, not just by direct teaching. VR allows you to leave the class environment and work individually in your time on your abilities.

(b) Yes you could replicate it with roleplay
(c) Yes. If adults got so involved and excited about it, I’m sure children will be even more cooperative and their learning will improve.

(d) Yes by incorporating drama and roleplay into lessons.

(e) Yes, it looks like a useful tool but it might be difficult to incorporate because only one student could use it at a time.

(f) Yes as it is a different way of being immersed in the language.

(g) It could be improved in the classroom to become similar to this, however this made using the language very life like and positioned the user in a way that was useful to their lives and they saw the context in which the language was used.

(h) Probably not to the same extent. In a classroom environment you’re more aware of your mistakes and lack of knowledge rather than just enjoying the games.

(i) I do to a certain degree as a shop could be set up in the classroom and real life products could be used. The main difference would be that the words will not be spoken as they pick up the objects which I thought was a good addition.

(j) No because it wouldn’t be as interactive

3. Would you use virtual reality to learn Irish again, why?

(a) If the opportunity arises I would definitely use it for language learning.

(b) Yes as it is very immersive and fun

(c) Yes. It was really fun!

(d) Yes. It was engaging and a fun means of learning.

(e) Yes, it was an interesting experience and a bit of variety is good too

(f) Yes as it is a good method of immersion in the language

(g) Yes
(h) Definitely, it showed Irish in a different context than what I had become accustomed to in College.

(i) I would as it is an inginuative way and a very modern way of learning Irish and I think that it is a way that can excite people to learn Irish.

(j) Yes, it was enjoyable

4. What was the hardest part of the experience, why?

(a) Adjusting to the VR experience did take time for me as it initially made me nauseous and nervous. However with practice I began to improve.

(b) Trying to understand new vocabulary

(c) Remembering that I was in Virtual Reality and did not actually need to move.

(d) Sometimes, I did not understand what the assistant was asking for and in order to figure out, I had to keep picking up random things until I recognised the word.

(e) I didn’t really find it hard at all.

(f) Using the headset

(g) Understanding what some of the objects I had to find in the last level

(h) Adjusting to the headgear was hard at first.

(i) The hardest part was trying to remeber all of the items that I had to find

(j) Understanding the different accents

5. What was the best part of the experience, why?

(a) Seeing my development of skill both in gameplay functions and in Irish literacy over the weeks was encouraging. I was able to remember more items and navigate the shop.

(b) Accomplishing the tasks
(c) The last level - kind of put everything I had learned into perspective.

(d) I love shopping and it was a very real experience of shopping in an Irish supermarket.

(e) It was good to get a go of Virtual Reality, it was something new. trying something very new seeing how detailed all of the objects were and how lifelike it was

(f) The VR aspect of it. You had to become so much more involved in the learning.

(g) Being able to have the experience of picking up the items and putting them in my basket and also being told the name of each item as I picked them up

(h) It was creative.

6. Did you enjoy learning Irish in a virtual environment, why?

(a) It was extremely fun to try a new learning experience and solidifies my thinking that learning is not one way. We must promote Irish for the new age and not ruin it for them like our teachers may have in the past.

(b) It was enjoyable

(c) Yeah. It was different but fun.

(d) Yes. It was fun and much less tedious than just studying a worksheet.

(e) Yes, It was something new.

(f) Yes as it was very different to what I have experienced

(g) I did as it was rewarding when I knew a word and was able to find it in the shop

(h) Yes I did, it was something other than the usual repeat this word after me.

(i) I did as it was an interactive way of doing it and thus the words were repeated to me which helped me to remember the words
Appendix Third Case Study

(j) Yes, it was very different and new

7. If you could change anything about the experience what would you change?

(a) Possibly one session entirely dedicated to the training and accuracy as I was dizzy and then had to begin to remember Irish words? But this was still brilliant well done!

(b) I would make it more oral based

(c) Nothing

(d) I would have incorporated a few easy and hard words into each level as opposed to having some easy rounds and some tough rounds. For the easy rounds, I knew exactly what I was looking for and so I didn’t pick up other items and thus I didn’t encounter new vocab for the easy rounds.

(e) A couple of the products were labelled wrong. maybe the sound of the people in the game speaking to be less robotic

(f) Maybe the layout of the shop, some of the items could be placed differently such as the mayonnaise together with the other sauces like the chocolate sauce

(g) Possibly some more interact with the new words. But that could have been a fault on my part just as much.

(h) I would have sign postage of specific sections of the shop e.g áit na glásraí

(i) and and and I would improve the graphics
E.5.1 Debriefing Session Questions Third Case Study

Debriefing Session Questions:

Introduction Question

1. Did you enjoy learning in the experience, what do you think made it fun?

Design Improvements

2. What was the best part about the experience?
3. What was the hardest part about the experience?
4. If you could change anything about the experience what would you change?
5. How did you find the moving around and picking up items in the experience?

Scaffolding

6. How useful was the audio and the text when you touched a word in the experience?
7. Did you feel like the game was too easy or too challenging?

Presence

8. Did you feel like you were really in a shop?
9. What aspects helped this feeling of being there?

Simulation Sickness

10. Did you have any feeling of motion sickness or dizziness interacting with the virtual reality experience?

Anxiety

11. Did you feel anxious about your Irish language ability in the experience?
12. How anxious did you feel in the VR environment compared to a Irish classroom or speaking in the Gaeltacht?

Motivation

13. Did you feel motivated to keep going in the experience? Why?
14. How did this experience effect your motivation for learning Irish?
Identity

15. Has the experience improved your attitudes and ability at Irish how?

16. Could you see yourself interacting with other Gaeltacht speakers more confidently in the future after interacting in this experience?

17. Did you notice the different dialects in the experience? How did you find them?

Vocabulary Retention

18. Did you feel like you learnt many new words using this experience?

19. Was it easier to remember words learnt in the experience why?

Task-based learning

20. Do you think the virtual reality environment created a greater sense of purpose for the tasks you were asked to complete how?
E.5.2 Debriefing Session Transcripts Group 1

[00:00:01.200] - Researcher
Ammm.. so hi everyone and did you enjoy the learning experience and what do you think made it fun?

[00:00:06.600] - Participant 1
Ammm I really enjoyed it because I think it was like a more innovative way of learning rather than just sitting reading and writing

[00:00:12.270] - Participant 3
Yeah

[00:00:23.850] - Participant 3
Remembering again.

[00:00:04.920] - Participant 2
Yeah I like a great time doing it because yeah like what they were saying. Like you it didn't feel totally like learning because when you think of learning Irish you think of looking at a picture with words underneath it whereas this is kind of you picking up the objects it made a lot more interactive and a lot more meaningful.

[00:00:09.010] - Researcher
Cool Anyone else have anything?

[00:00:14.830] - Participant 3
You know I liked it it just didn't feel like we were learning Irish kinda it just felt more like we were... We were really involved in the game so it didn't even feel like we were learning new vocabulary and stuff.

[00:00:20.040] - Participant 3
Yeah I like a great time doing it because yeah like what they were saying. Like you it didn't feel totally like learning because when you think of learning Irish you think of looking at a picture with words underneath it whereas this is kind of you picking up the objects it made a lot more interactive and a lot more meaningful.

[00:00:25.720] - Participant 1
I thought it was really realistic like. It actually was like what you do in a shop like it just made it more fun like that so realistic

[00:00:30.940] - Participant 2
Yeah I also think it was realistic and I liked the fact that like you could pick things up and like and like check what they were and like could go back because I had kept having to go back and like ask them again.

[00:00:36.040] - Researcher
Cool yeah and what was the best thing you found about the experience?

[00:00:41.240] - Participant 3
Actually getting to kind of you know go around the shop and like pick up each object and stuff and you know it called out what the object was whenever you're picking it up and I thought that was really good.

[00:00:46.040] - Participant 1
I thought it was really realistic like. It actually was like what you do in a shop like it just made it more fun like that so realistic

[00:00:51.240] - Participant 2
Yeah I also think it was realistic and I liked the fact that like you could pick things up and like and like check what they were and like could go back because I had kept having to go back and like ask them again.

[00:00:56.040] - Researcher
Cool yeah and what was the hardest part about the experience?

[00:00:01:04.920] - Participant 2
Yeah I also think it was realistic and I liked the fact that like you could pick things up and like and like check what they were and like could go back because I had kept having to go back and like ask them again.

[00:00:01:16.040] - Researcher
Remembering what they asked you to get.

[00:00:01:21.240] - Participant 3
Remembering what they asked you to get.

[00:00:01:24.960] - Researcher
Yeah

[00:00:01:25.200] - Participant 3
Cause they give you a list of like four or five things and I'd only ever remember say three at any one time so you have to go back and ask them again. Or not even again not knowing what something was and kind of having to make a guess as well.

[00:00:01:30.240] - Participant 2
Yeah I also think it was realistic and I liked the fact that like you could pick things up and like and like check what they were and like could go back because I had kept having to go back and like ask them again.

[00:00:01:35.650] - Researcher
Perfect yeah?

[00:00:01:40.690] - Participant 1
Yeah I'd say the same probably just like by the time you got the first two you'd forget what the last two were so you'd have go back and check again.
Yeah yeah

Yeah I agree and also the fact that like the accents or whatever I had to sometimes I had to like go around and literally test everything out.

Yeah Perfect. And if there's anything you could change about the whole experience what would you change?

I think the graphics could have been a bit better it was kinda distracting a tiny bit

I would probably say yeah maybe the graphics and eh maybe there's more like signage for the stuff so you'd have to actually go and pick up everything and see what it was.

Ok yep

Yeah like I would kind of have a layout of what's in each section so say you know glasraí is over this side amm anything for like bathrooms or whatever over this side of the shop.

Yeah cool that makes sense and um how do you feel about... you kind of answered this already but how do you feel about moving around and picking up items in the experience so how did that whole thing of actually interacting with everything feel?

I thought it was really like natural like if you picked up the thing like you could actually look at it and eh like it was very lifelike.

Cool yeah.

Yeah I agree and especially the fact that I couldn't reach something on the top and then I just use the basket so I could like bring it down so I think that was very realistic.

Cool yeah.

Yeah again like you know it is really realistic like you know you had to get on your tippy toes to reach some things and bend and get other things is like what you would actually do in an actual shop like you wouldn't just be on eye level the whole time you'd have to reach up and you'd have to reach down.

Perfect yep and how useful was the audio in the text when you touch the word for your own ability at Irish?
[00:03:17.840] - Participant 1
Yeah i told it was really useful when.. how do i.. when the word was said aloud when I picked it up because sometimes when the person who is buying the stuff said it I wasn't actually sure if it was the same thing because their accent was difficult to hear..

[00:03:29.180] - Researcher
Yeah yeah

[00:03:30.080] - Participant 2
Yeah I think it was very important as well because I don't think I would have been able to do it if like they didn't say the word when I picked it up.

[00:03:35.030] - Researcher
Okay.

[00:03:35.890] - Participant 3
Yeah. It was very very beneficial.

[00:03:37.910] - Researcher
Yeah and did you feel like the game was too easy or too challenging or where did it kind of lie or how do you feel about it?

[00:03:45.410] - Participant 3
I think it kind of depended on what level you were doing.

[00:03:47.870] - Researcher
Okay.

[00:03:48.350] - Participant 3
Cause with some of the kinda accents you were getting they were saying completely different things to what you were kind of picking up like say with pratai you were getting phratai sometimes.

[00:03:58.220] - Researcher
Yeah.

[00:03:58.810] - Participant 3
So that kind of threw me off little bit.

[00:04:01.750] - Researcher
Yeah yeah.

[00:04:02.490] - Participant 1
I just think some of the words obviously were challenging if you hadn't encountered them before.

[00:04:07.810] - Researcher
Yeah

[00:04:09.700] - Participant 2
Yeah I agree I think some of them where like really easy like oh I don't like stuff that you just know like pratai or whatever but ones that are like really difficult like I felt they should have like there was no way that I would be able to get it I literally was just guessing.

[00:04:22.880] - Researcher
So yeah yeah yeah I understand that. Yeah. And did you feel like you were really in a shop?

[00:04:29.590] - everyone
Yeah yeah Yeah

[00:04:30.360] - Researcher
I don't know about.... Everyone felt that way yeah? And em.. anyone have any aspects like what helped you make you feel like that. It's kind of tough to define like explain but...

[00:04:41.830] - Participant 1
Even just the the layout of the shop like its very.. like it has you know oh like the meat section, the fish section the kind of vegetables are altogether that kinda stuff like it was kind of laid out exactly like how a supermarket would be.

[00:04:51.810] - Researcher
Yeah.

[00:04:52.500] - Participant 2
Yeah I agree and like the like when you'd go to the ammm.. like the butchers and all and when they would like ask you what you want kinda thing.

[00:05:00.310] - Researcher
Yeah.

[00:05:00.540] - Participant 3
Yeah and having the cashiers there as well so you could go to them you could pull all the different objects on it as if you were going to pay for them.

[00:05:08.790] - Researcher
Brilliant yeah and did you have any feelings of motion sickness or dizziness when you were using the experience?

[00:05:14.820] - everyone
No no no.

[00:05:16.010] - Researcher
Nobody. No?

[00:05:17.620] - Researcher
And did you feel anxious by your Irish language ability in the experience.

[00:05:23.230] - Participant 2
I did a little bit like when they'd say a word that I just had no idea. It's like I dunno what to do

[00:05:28.330] - Researcher
Yeah.

[00:05:28.890] - Participant 1
I didn't it didn't really feel like it was any pressure on me like it was just kind of a game. So it didn't feel like really intense whereas it might in a classroom or somewhere like that

[00:05:37.020] - Participant 3
Yeah I wasn't overly worried about it you know having the different pronunciations things actually kind of made me think little bit more about it which I kind of liked in a way because you know it's a new way of hearing things. I'm so used to hearing say pratai one way and hearing phratai threw me off a bit but then now I know two different ways of saying it.

[00:05:55.890] - Researcher
Yep. Yep cool and how anxious did you feel in the VR environment compared to you kind of answered this already but compared to if you were actually in a classroom or if you're in the Gaeltacht talking to
people like would there be any comparisons you’d see there?

[00:06:09.330] - Participant 2
I felt a lot less anxious cause its not like someone’s there or like your not in a whole class of judging you or whatever but also the fact that like in a classroom like you could ask for clarification like even when you go back like you didn’t hear what they said or you don’t get it It’s just like if they had if there was a different accent whatever like every time you go back there it would’ve been more helpful

[00:06:28.420] - Participant 1
I just think that it was a lot less nerve wracking because there was no like immediate need. Like if you're in a conversation you kind of need to know the right way but actually a time to process like prataí, phrataí like and actually then understand what they said.

[00:06:40.990] - Participant 3
Yeah.

[00:06:41.370] - Participant 3
I mean for me didn't really make too much of a difference because I would be kind of happy to have those kind of happy to have those one on one kind of conversations with someone in real life anyway. But I did see the benefit for people who may not be as confident in their Irish to do it that way.

[00:06:58.530] - Researcher
And did you feel motivated to keep going and the experience why was that did you feel?

[00:07:03.750] - Participant 2
I definitely did because I felt like a sense of accomplishment when I'd go up and like get all the things and liked wanted to keep doing because it was fun.

[00:07:11.280] - Researcher
Yeah yeah cool

[00:07:12.590] - Participant 1
Yeah I did and even when just say I picked up the wrong thing I'm still learning more words because if I got the wrong thing. I kinda wanted to find out all the ones I didn't know. Yes.

[00:07:21.010] - Participant 3
Yeah. Again that sense of accomplishment once you actually get everything right.

[00:07:25.510] - Researcher
Yep perfect. And how do you feel this experience affected your motivation for learning Irish. Did it affect it at all? Like more than just that experience would you feel any differently about actually learning Irish or having your motivated towards it?

[00:07:40.030] - Participant 2
I think you kind of showed me another way of like making it enjoyable.

[00:07:45.190] - Participant 1
It kind of motivated me a little bit more conversational Irish. It was just the way they were asking ya to get the things. It was easy kinda to understand even when the cashier talked and stuff so it'd be nice to be able to just have those little conversations in real life.

[00:07:58.850] - Researcher
Yeah.

[00:07:59.650] - Participant 3
Yeah. For me I'd like to look at more kind of obscure words should I say like you know I wouldn't have known what Whipped cream was before this. Or like those kind of other things like that or like you
know washing liquid of that kind of thing. I wouldn't have known that whereas I would know. So to kind of look at more of those kind of words.

[00:08:18.500] - Researcher
Perfect. And has this is a bit similar has the experience improved your attitudes and ability at Irish at all so how you feel about your own Irish ability?

[00:08:27.680] - Participant 1
Yeah again like it’s kind of just less seems less pressure in there because the only times I really learn Irish are in the classroom. And you need to learn it but I just seemed more like natural you know.

[00:08:38.140] - Researcher
Yeah

[00:08:39.340] - Participant 2
I agree. Yeah.

[00:08:40.590] - Participant 3
I mean it hasn't really changed my attitude towards it. I always felt like I had this not to sound big headed or anything but I did always have a good attitude towards Irish and I like I love learning it like I do it like nearly every day. It sounds so sad but I do it nearly everyday so its just for me like a new way of looking at it.

[00:08:58.510] - Researcher
Ok yeah. And could you see yourself interacting with other Gaeltacht speakers more confidently in the future after doing things like this so if you were to do this more often do you think it would help with like talking to others in Irish outside of VR experiences or what would you think?

[00:09:12.770] - Participant 2
I think it would yeah. Because especially because like the different accents everything. Yeah.

[00:09:17.260] - Participant 1
Yeah I think sometimes when people speak to me I kind of panic because like Yeah I don't know exactly what to say straight away but if I just gave myself a little bit of time like you had the opportunity to there.

[00:09:26.220] - Participant 3
Yeah exactly so yeah.

[00:09:29.540] - Researcher
And did you notice the different dialects? I know a few people kind of mentioned it. And how'd you find them. Do you have any comment on them?

[00:09:36.520] - Participant 3
Some of them were kind of hard enough like for me I’d struggle with Connemara accents a lot and I felt like I did kind of struggle a little bit but like hearing the different ways that they’d say it more so than any of the other accents.

[00:09:52.680] - Researcher
Yeah.

[00:09:52.900] - Participant 2
Having differentiate between them I know that I don't know them but I don't know what they are like. I do think it was difficult sometimes. But then again it might just because like I don't know the word anyway. I think I just think of it would be helpful if when you go back like not a different accent. Like if they could like say in a different way like slow it down. If there's that kinda option
[00:10:11.570] - Participant 1
Yeah I definitely thought it was beneficial to encounter like different ways of saying it cause you will come across it in life so it’s good to know like what the other ways of saying it are.

[00:10:20.550] - Researcher
We're nearly there now and so did you feel like you learned many new words words using the experience?

[00:10:25.520] - Participant 1
Yeah I definitely learnt a lot more vocabulary like I guess which is more focused on things you'd get in a shop like products and stuff but yeah I definitely learnt a lot of different things.

[00:10:33.920] - Participant 3
Yeah. I did as well yeah

[00:10:36.050] - Researcher
Yeah

[00:10:36.380] - Researcher
And do you think it’s easier to remember words used with VR than if that was a classroom where you were learning those words.

[00:10:42.860] - Participant 3
I think it depends on the context. If you are in a classroom you just have a picture of it you're not gonna remember it as much. Whereas you know in the VR your kind of you're picking it up and stuff. But if you're in a classroom and say you're trying to learn what ketchup is or whatever and you have an actual bottle of ketchup I say that is even slightly kind of the same thing because you know the children they can pick it up they can work with it like. So I think it's kind of similiar I thought.

[00:11:08.990] - Researcher
Yeah. It's just being able to actually interact with it.

[00:11:11.190] - Participant 3
Yes. Being able to interact with it I think makes it easier to learn the words.

[00:11:16.280] - Participant 2
I think you made it a lot easier because even if it’s just like obviously having the actual thing in front of you like in VR is very helpful. Also the fact that like you have to like say if I don’t remember the word for something then the next round I'm gonna have to test it again to see if it’s the same words like you do it multiple times so it kind of gets weird. Yeah.

[00:11:35.450] - Participant 1
I wouldn’t necessarily say it's more memorable but it’s something more enjoyable. Yeah. I wouldn’t say the president would like remembered words more than any other.

[00:11:43.280] - Researcher
Yeah. Yeah that makes sense. And last one did you feel like the virtual environment created a greater sense of purpose for the task you were asked to complete. And how was that?

[00:11:52.450] - Participant 2
I definitely get it because like it just made it more like it wasn't just like I need to learn these words. Its like I need to get these things to buy

[00:11:56.600] - Participant 1
Yeah its a practical purpose for what you're doing. It wasn't just learning for the sake of learning.

[00:12:04.170] - Researcher
Yeah. Yeah.

[00:12:04.570] - Participant 3
Like exactly what they were saying like if you're not just learning it you feel like your actually you're going shopping you have to pick these out and you have to get them to the cashier kind of thing.

[00:12:15.090] - Researcher
Perfect.
E.5.3 Debriefing Session Transcripts Group 2

[00:00:02.130] - Researcher
All right so guys so did you enjoy learning in the experience and what do you think made it fun?

[00:00:07.290] - Participant 4
Yeah I enjoyed learning in the experience it was different to normal and I was in a shopping shop? It was in a supermarket which was fun and different and just more engaging than normal. It's more hands on learning I suppose than just looking in worksheets.

[00:00:23.890] - Participant 5
I enjoyed because ammm the whole point of why so many people are sent to the Gaeltacht is to be immersed in the language and you got to be immersed in Irish. you didn't even have to go anywhere you could just literally stay in the classroom and yeah I found it very different.

[00:00:07.290] - Participant 4
Yeah. I've never done VR before so that was interesting.

[00:00:02.130] - Researcher
Amm.. I learnt... So what was the best part about the experience?

[00:00:07.290] - Participant 7
Seein how VR worked. Yeah like I said I've never had the mask on or the gloves or anything so that was cool.

[00:00:01:05.930] - Participant 6
Yeah I agree VR and then being so involved like you were in control of the whole thing.

[00:00:01:11.220] - Participant 5
Yeah. I've never done VR as well. So it was very different it kinda made it more fun because it was something so new.

[00:00:01:17.650] - Participant 4
Yeah I think same as that and it was just fun. You're playing the game. and just as a consequence learning words.

[00:00:01:22.530] - Researcher
What was the hardest part about the experience?

[00:00:01:30.020] - Participant 4
I found for the harder levels it was just... the words were hard. I didn't understand like three or four words for one level and just trying to go around shop and you have to go back and hear the words again and you didn't know what you're looking for you're trying remember three or four words when you don't know what your looking for. That was the hardest part for me.

[00:00:01:47.280] - Participant 5
Yeah. Sometimes when at the start what you're going to ask what you have to look for. Sometimes I struggled to hear what exactly they were saying. And then especially if I did know like what it was it kind of like it's just that I'd get confused but then I suppose you go into the shop to try them out even if it takes a while.

[00:00:02:05.280] - Participant 6
I kept forgetting that was a whole VR thing so I'd actually move around the classroom with the thing on my head. So I think just like drilling it in that it's actually like it is a virtual reality. You don't need to move.
[00:02:19.180] - Participant 7
Just a few words that I didn’t understand. Just had to kind of guess at them.

[00:02:24.570] - Researcher
Yes. And it could change anything about the experience. What would you change?

[00:02:28.960] - Participant 4
I’d just change the levels just like the beginning levels. I knew every word he is asking for. So there was no trial or error looking for words like I knew where the milk was and the bread and butter. I knew what they looked like in the shop. So that was easy words whereas the harder levels so I wasn’t learning new vocabulary for those levels because I knew what I was looking for whereas I’d put in a few hard words into each level. So there’s more trial and error.

[00:02:55.890] - Researcher
Yeah. So you kind of mix it up. So instead of it going from easy to hard kind of have some easy words and some hard ones in each one.

[00:03:04.610] - Participant 5
And the last time I did the VR I found my head got very sore because I didn’t have the head set on property and I kind of was too nervous to say it was too tight for my head. So probably I would just say here I need to change this.

[00:03:19.350] - Participant 6
I’m probably the same as participant 4 I have just different levels of ability kind of in each level like harder and difficult and maybe instead of like you know if you forget the words having somewhere closer to be able to go to instead of having to go back to the start of the shop. Something like that.

[00:03:36.630] - Participant 7
I found the whole thing very enjoyable but eh just a couple of the things maybe weren’t labeled exactly right like cling films was the wrong word so iron that out and it’d be great as far as I’m concerned.

[00:03:49.650] - Researcher
And how did you find actually moving around and picking up items in the experience and that whole thing?

[00:03:54.630] - Participant 4
Really fun. I like the way they fell out of the basket. If you swung the basket too much it’d fall out which made it more real again.

[00:04:02.220] - Participant 5
It was very easy like if you went to pick up something it wouldn’t be a struggle to try get it. It would be pretty much when you reach for something. Once you have kind of logged onto it or whatever you’d call it. You pick it up and you’re able to kind of look around and you’re able to turn it around in your hand which I thought was cool.

[00:04:16.070] - Participant 6
Yeah. I thought it was cool too. You were able to do it as if you do it in actual shops.

[00:04:20.620] - Participant 7
Yep really really good.

[00:04:23.160] - Researcher
Cool and how useful was the audio in the text when you actually touched the words that you could hear what it was in the experience. How did people find that?

[00:04:32.670] - Participant 4

I thought yeah it was really good and when you go to put it on the belt as well it says the same word again. So just hearing the words. The more times you hear it the more times you remember it.

[00:04:41.320] - Participant 5
Yeah and even when you're picking up something if you let go and pick it up again you can hear it as many times as you want ammm one thing I thought maybe if we got like... if we had in our basket like a shopping list or something. So you could see the word as well. But I'm not sure if that would be favorable or I dunno.

[00:05:00.450] - Participant 6
I found it kind of reassuring like even if you didn't know what the word was and you're just testing out some things it came up and it told you if you're right or if you're wrong it was just handy to have.

[00:05:10.750] - Participant 7
It was grand just some of longer words and less usual words became more poignant. Like how Irish is actually spelt with the silent elements and stuff like that as well.

[00:05:20.920] - Researcher
Yeah. And did you feel like... we kind of glossed over this little bit... but did you feel like game was too easy or too challenging or where was it kind of for you?

[00:05:31.380] - Participant 5
I thought it was grand I thought it was just a good like good level like I wouldn't have made it any more challenging I just would agree and say maybe put in some of the hard and not have it easy a bit harder than... like kind of mix it up a bit but other than that I wouldn't change the actual game itself.

[00:05:51.040] - Participant 4
Yeah same as that just some of the beginning levels I knew exactly what the words were so I just was looking for what it would look like rather than picking up other words so am.. yeah.

[00:06:01.970] - Participant 6
Ya no I'm the same as well

[00:06:04.220] - Participant 7
just a case of stuff is easy if you know the answer that's what its there for. If you learn more vocabulary it gets easier.

[00:06:11.080] - Researcher
Yep yep. And did you feel like you're really in a shop?

[00:06:14.250] - Everyone
Yeah yeah yeah.

[00:06:18.420] - Participant 4
But also like I knew I knew which section I was in like

[00:06:23.090] - Participant 5
Even the small bit of music in the background. It was very real and then like all the cash registers and your basket and like the detail was very good.

[00:06:31.920] - Participant 7
Except there was a teller at each of the registers you don't see that too often.

[00:06:35.030] - Researcher
Yeah yeah we needed an automated one and what aspects do you think actually help that feeling of being there in the shop. So what do you think made you feel like you're really there?
Participant 4: Just like you could pick things off the shelves and things would fall out your basket if you swung it too much and there was cashiers there and you could move throughout the level and if you weren't in the right one you couldn't just reach out to the next you have to move yourself into next aisle so it was very real.

Participant 6: When you went up to the fish place or the meat place and the people were actually talking to you asking you what you wanted so everyone was like engaging with one another.

Researcher: So did you have any feeling of motion sickness or dizziness interacting with VR?

Participant 4: I didn't initially. But after the first one I did actually feel like dizzy but then actually every time I put it on actually I just got straight into it then after. The first time. Not initially afterwards. Not straightaway afterwards but after a while I knew I was a bit like.

Participant 5: I was the same but then I remember I said it to you and it was a bit like when you explained it, it was a bit like... after being on a rollercoaster and then you come off of and then your like you know the kinda come down after because it was so new but the second and third time or whatever other times I did it. I didn't experience the same dizziness.

Participant 6: Yeah I was ok.

Participant 7: Nope, no dizziness.

Researcher: Ok cool and did you feel anxious about your Irish language ability while you were in the experience?

Participant 4: A couple times for the hard words yeah I was kind of annoyed I didn't recognise them because I asked him a few times and hope that I'd remember them and I didn't just yeah.

Participant 5: I suppose the same if I came across a hard word and I don't know what the man is saying and then like I suppose I was just kind of I would've liked to maybe like some sort of... to see it written somewhere or something just so I could kinda... maybe if that would help but yeah I used be getting annoyed at myself if I didn't. I suppose I was a bit embarrassed if I didn't know it but then what I found out what it was most of the stuff I was like "oh yeah". You know or you learnt what the new word is.

Participant 6: Yeah I was kinda the same way just the hard words your kinda like oh I should know it.

Participant 7: Yeah... Well I'm a nerd so after doing the first test any of the words I didn't know I went home and looked them up and then when they said them I didn't necessarily remember each word from looking it up. When they said them I knew what they were talking about so it was grand.

Researcher: Okay yep and how anxious did you feel in VR compared to being a classroom or talking to someone in the Gaeltacht if a similar conversation or words to come up?
[00:09:09.360] - Participant 4
I thought the VR was much much easier because you kind of felt like it was just you you forgot other people in the room so say in the classroom kids would be anxious or nervous talking to their teacher or even during the Gaeltacht I even get nervous enough or just afraid whereas in the VR you just feel like just you're on their own so you're not as kind of self-conscious if that makes sense.

[00:09:30.300] - Participant 4
Yeah I just get totally immersed in it then and just forget about everyone else and just your on a mission to get your food.

[00:09:35.960] - Participant 6
It's the same as participant 4 like once you go in and you just kind of forget where you are and you just do it.

[00:09:44.050] - Researcher
Totally immersed it was deadly!

[00:09:51.750] - Participant 4
Yeah you get really good at knowing where everything is in the shop I'm not even going to have to pick up other items. I'm going straight to the aisle cause I know where it is now.

[00:09:59.500] - Participant 5
During the first few levels I did because I knew most of the words or even the ones I kind of half knew or kind of had an idea but I remember one of the levels I knew nothing and I kind of well I'd be a bit like that if I don't know anything I can just give up so...

[00:10:11.580] - Researcher
And did you feel motivated keep going in the experience and why?

[00:10:13.770] - Participant 6
No I'm the same as participant 5 you just you're just ready to keep going because like you're just so engrossed in it and the time flew as well it didn't feel like we were doing that for 20 minutes like it just went so fast. So you kinda just wanna stay on doing it.

[00:10:26.030] - Participant 7
I say it’s like any game once your doing it you wanna win it you wanna finish it and win it like.

[00:10:31.560] - Researcher
And um how do you think like in a larger scale. Is there anyone who felt like it affected how they think about Irish and their actual motivation to learn Irish like did it help there at all like how you feel about learning Irish?

[00:10:43.680] - Participant 5
Yeah like you came... cause it was a shop situation there was loads of like things that I’d be used to seeing everyday do you know like cling film and I never would have thought before of like look at oh well unless your participant 7 you wouldn’t think of looking it up but like just to see everyday objects that it just kinda kind of felt like this would be what it would be like in real life you know so....

[00:11:05.370] - Participant 4
Yeah I... I really like Irish when I’m caught up in Irish when I’m in an Irish environment. It’s just it’s only when you’re in a room on your own and trying to study Irish and everyone around you is speaking English. It kinda feels like a waste but when you’re immersed in the whole Irish environment you do get.... it is nice like...
Yeah I enjoyed it like through Irish and stuff. It's something you do on the daily like a shopping environment and stuff on the daily you wouldn't really know the words in Irish so learning it I found it really interesting.

I'm about the same.

Yep and has the experience improved your attitudes and ability at Irish?

Yeah I know méara eisc now. Yeah I felt like a bit like you know... I just picked up some of the phrases and some of the words so just being in it you kind feel a bit more I don't know... I like Irish so I like being able to speak it. It's kind of one of those situations cause you're so immersed in it that you got a chance to feel like... Like I'd love to live in the Gaeltacht or something like that. So yeah I really liked it.

Yeah it improved my attitudes as well I think just towards Irish. Sometimes I find that kind of frustrating. Just I think when you alone trying to do it. No one else is doing it but when you kind of see that everyone can be doing it together. It can be pretty nice you know well... with your imaginary people or whatever in VR.

Yeah I'm pretty much the same it improved my attitude.

Yeah amm it improves. You learn more, learn more. It can be widened out definitely. There's no kinda limit to it. You just throw in more and more words then your learning more and more Irish.

Yup and could you see yourself interacting with other Gaeltacht speakers more confidently in the future with experiences like this so if you use stuff like this more often how do you think it would effect that?

Yeah definitely. Like just thinking back to the Gaeltacht. We went to the Gaeltacht there last Easter and I probably wouldn't have been as confident having a conversation with it.. with the person and they'd know that and they'd speak to you in English whereas now if you go in like knowing that you have the Irish for it it's much better and they'll speak to you back in Irish. So I think it does improve your... like standard and your confidence that way.

Yeah same as that just when your... when your immersed... when you have to do it like... you know when people are speaking to you in Irish you do it. It does come back to you when you do.

If you're speaking to someone who lives... like to tell them that you did the VR experiment. Yeah.... I did this.... I was specially chosen... for it...

I drifted off there... No I was gonna say something. You might be accused in the Gaeltacht of using book Irish if you use some of those translations... don't bother with them but yeah... No it's good you'll understand them and their natural Gaeilge as well.

Yeah and did you notice the different dialects and how did you find them?
Yeah I noticed them and they are grand I listen to radio na Gaeltachta all the time...

Yeah I think I did actually. But yeah because when the more I heard the word like I was kinda tryna translate it into my own Irish because I knew well... I dunno same words but...

I didn't notice a dialect. I just thought they were very easy to understand.

To be honest I didn't really notice any dialects. It wouldn't have been something that struck me.

Did you feel like you learned and many new words using the experience?

Yeah.

Yeah I did but just the only thing I would say it's just the beginning levels I wasn't really picking up words... Picking up as many objects because I know what I was looking for... but emm

If you had one in each level I think you'd remember it more

And then last question. Did you take the virtual reality environment created a greater sense of purpose for the tasks you were asked to complete?

Sense of purpose?

So the sense perhaps in yourself for what you were doing compared to maybe think of a classroom or something like that if you were learning those words or trying to learn in home.

Yeah. Oh yeah. Definitely

Yeah because it was just like being in the shops and your going shopping.

Yep yep yep yep.
E.5.4  Debriefing Session Transcripts Group 3

[00:00:01.650] - Researcher
So did you enjoy learning in the experience and what do you think made it fun?

[00:00:06.090] - Participant 8
I think the detail of all the objects you can actually look at them and see the writing and that...

[00:00:10.920] - Participant 9
Yeah its really realistic. Like Jesus I kept knocking everything over.

[00:00:16.530] - Participant 10
I think like the audio as well.

[00:00:19.500] - Participant 9
Yeah sometimes I had issues with the audio but like I have bad hearing so like that's me. Yeah. No I really enjoyed it. I don't know how much I personally learned. That's cause I dunno I kept getting lost

[00:00:31.170] - Researcher
Okay.

[00:00:31.990] - Participant 10
I think it’s good when like I don't have the best Irish vocabulary but like when you’re picking up things it told you what it was

[00:00:38.130] - Everyone
Yes.

[00:00:38.760] - Participant 10
Then you could be like Oh I thought it was this but then you go back and ask the person again and hear that.

[00:00:43.930] - Participant 9
Yeah it was nice being able to go back.

[00:00:45.420] - Participant 10
You were able to go back it wasn't like oh you have to remember it for the whole time. So that was nice.

[00:00:49.100] - Researcher
Perfect

[00:00:49.880] - Participant 9
That was my problem I didn't pick up everything I just looked around to see something that looked like what I thought it was.

[00:00:56.860] - Researcher
So what was the best part about the experience?

[00:01:01.670] - Participant 8
I liked when I knew.

[00:01:05.680] - Participant 9
I liked when I got it right.

[00:01:06.560] - Participant 8
And the satisfaction of going and getting it and then it said it was just satisfying

[00:01:10.330] - Participant 9
I just thought it was so class. I liked the actual virtual reality aspect of it. I thought it was so interesting.

[00:01:16.280] - Participant 8
Yeah it’s more realistic than I was expecting.

[00:01:18.200] - Everyone
Yeah yeah.

[00:01:19.310] - Participant 10
Like being in it and like in the shop I wasn’t expecting it but was like cool to be able to learn in a different way.

[00:01:27.380] - Participant 9
And the transporters worked way better than I thought they would. Yeah it took a while to get used to in the first session.

[00:01:31.560] - Participant 10
Yeah I was worried when we were doing the training the throwing things like I’m terrible at this I’m going to be.... but like it’s like you wanted to get to the next level.

[00:01:42.130] - Researcher
And what was the hardest part of the experience?

[00:01:45.950] - Participant 10
Adjusting to the VR for me because ammm... like the second week I wasn’t feeling well but even the first week I just got quite dizzy from it because like I’m not the best with like motion and all that but adjusting to that initially was a bit difficult but then it’s like I’m going to keep trying it and then when I kept working on it then I could more focus on the actual game. Then how my head was feeling.

[00:02:12.230] - Participant 9
For me it was kind of like just making sure I could understand the pronunciation of the words the person was saying. So like sometimes I would completely like mistake what they’d said so I’d have to go back quite a bit and it’d slow me down. So it’s just kind of like here hearing the word if that makes sense.

[00:02:29.170] - Participant 8
For me the hardest part was if I didn’t know a word just going around and figuring out what it was or at the beginning this was my fault but I it was I had too low on my face and everything was blurry so I couldn’t... There was a time I was kept picking up a pepper when I was looking for an apple. All I had to do was just lift it up but that was it.

[00:02:53.780] - Researcher
And if could change anything about the experience what would you change?

[00:03:01.850] - Participant 10
I don't know. Like I was thinking just with how I was with adjusting to it. Like I don't know if everyone would be like that but I feel like maybe the training module should have been a bit longer just to adjust the actual idea of being in VR. And maybe like doing a training round like in the shop if you know what I mean. That was just like really simple like just one word or something and be like OK I can do this I'm fine. Just to adjust to it for like for one session and then moving on to...

[00:03:29.140] - Researcher
Mm hmm.

[00:03:30.320] - Participant 9
I think if there was maybe like posters in the shop and stuff like some like photos of something and
then you know just be like oh it's an offer or something but just so that you see the vocab as well rather than having to pick it all up every time cause I'm stubborn and I didn't do that

[00:03:46.690] - Participant 8
I think maybe the layout. Some of the things could be put together that was similar. Yeah there was one.... the peanut butter, the tuna

[00:03:58.460] - Participant 9
Oh yeah I was like why is this here?

[00:04:00.800] - Participant 8
The mayonnaise and then like the..

[00:04:04.040] - Participant 10
the mustard mayonnaise and then we like the other one was like...

[00:04:25.490] - Participant 10
Maybe like section places like I know it's like oh that's the vegetable area but like there's vegetable area and that was obvious because you know like fruit and vegetable but like when you go into an actual shop there'd be like oh this is the toiletries and this is the thing you could have a sign of like toiletries and like a picture of a bath or something I don't know like where it could be sections of a shop.

[00:04:46.130] - Participant 9
That could help the vocab too you could see it too like.

[00:04:46.150] - Participant 10
Cause I'd be thinking of like when you'd be going around tesco like and they'd see oh I haveta go and find the milk so I go to the dairy aisle and then I go to the....

[00:05:04.620] - Participant 8
That was good I think after only a short time you figured out how to...

[00:05:09.890] - Participant 9
My first session I was really bad at transporting but then I was like zoom, zoom, zoom.

[00:05:14.000] - Participant 10
It's a lot easier when you had the two controllers. I had one controller the first week because the second one wasn't charged. Sad times

[00:05:30.760] - Participant 9
If you use it really good but if you're stubborn....

[00:05:34.270] - Participant 8
No. I think when you pick things up and it said the word that was really helpful because even if I wasn't looking for it at that time if I needed it on the next level I'd remember what it was. Yeah. Just
that was very good that I said it.

[00:05:46.850] - Participant 10
Yeah like a memory game you could come back to it. If you're in the right area you were like I know I need a certain item.

[00:05:59.870] - Researcher
And how did you feel about like the challenge in the game. Was it too easy too challenging and was it right How did you kind of feel about it?

[00:06:07.430] - Participant 9
It depends on what area of the country your from. We talked about this for like three days after what's fatai?

[00:06:14.600] - Participant 10
Yeah fatai was like pratai..

[00:06:15.650] - Participant 9
So I guess it just kind of depends on where you were and what kind of canuint you have. So like if you've traveled around like that Gaeltachty parts of Ireland a lot you'd be probably much better at it because you have more exposure to the different kinds of phrases. So it kind of depends.

[00:06:33.050] - Participant 8
I thought it was a good progression...

[00:06:35.130] - Everyone
Oh progression was good yeah!

[00:06:37.370] - Participant 8
Because the first one like you kinda got all of the words.

[00:06:38.420] - Participant 9
I struggled on the first one so much.

[00:06:42.440] - Participant 8
Yeah the last one..... harder and harder..

[00:06:43.940] - Participant 8
No I think the vocabulary for each one is good.

[00:06:47.950] - Participant 9
Yeah. It progressed nicely.

[00:06:51.520] - Researcher
And did you feel like you're really in a shop?

[00:06:55.070] - Participant 8
Yeah. No that was really good.

[00:06:57.980] - Participant 9
I think it's realistic.

[00:06:59.820] - Participant 8
And that gave you context you weren't just looking at a page with the word apple and you actually got to go around and find the apple.

[00:07:08.770] - Participant 9
That's good yeah.

[00:07:09.860] - Researcher
And what aspects like helped out making you feel like you're really there in the shop. What do you think was helping with that feeling of being there?

[00:07:16.940] - Participant 9
There's more than one cashier even though you'd only be using one. There was like a whole bunch of them and you'd have to go to one...

[00:07:21.650] - Participant 9
They're like the meat section... He's like what kind of fish do you want?

[00:07:26.410] - Participant 9
And I'm like hold on I'm just looking.

[00:07:30.600] - Participant 8
I'll come back here later.

[00:07:32.180] - Participant 10
Yeah I like the displays sort of the way the fruit was displayed was very nice. I think the layout is nice.

[00:07:37.580] - Researcher
And then so you have any motion sickness or dizziness. I know you were talking about it a little bit and how did you get on with that?

[00:07:44.970] - Participant 10
Well the second week was my own fault because I went in not feeling well anyway so that was kind of disregarded but the first week I definitely had difficulty like adjusting to it. I don't know. Amm because it was around my head I felt like it was a helmet.

[00:08:01.360] - Researcher
Yep.

[00:08:02.180] - Participant 10
So then and then I was like I'm in a different place. So I was trying to like balance myself even though like you know I was walking like a room in the college. It was like trying to readjust myself to like the new surroundings or whatever. By the end of the first day like when I kind of got through the first round I'd kind of been like OK this is what I'm doing. These are the controls and I was kind of I was trying to think of it more thinking about the controllers then the thing in my head. Yeah if that makes any sense like I was trying to refocus to like this is the game. That's what I'm doing. Then like feeling like my head feels weird.

[00:08:36.630] - Researcher
Yeah yeah I understand

[00:08:37.780] - Participant 10
I was encapsulated by this thing

[00:08:40.410] - Researcher
And any sickness feelings dizziness?

[00:08:43.460] - Participant 9
I was fine for most it though the week I forgot my glasses though was like yeah my own fault. So like I dunno I was on my face differently than what I used to cause my glasses were like a barrier and stuff. So I dunno that that was just me forgetting my stuff.
No I didn't really.

OK. And did you feel anxious by your Irish language ability when you're in the experience?

Before I started it I was because we had no idea what it was going to be. Yeah I found I thought I would be using my Irish lot more than what was like you know.

Yeah yeah. I didn't think you would be listening to everyone's Irish. I thought I would have to use it more like maybe to... because we hadn't known what the game was yet. We did the vocabulary test. I was really bad at that. So yeah.

Only if I didn't know them then I was just wandering around I was like I have no idea other than that no.

I'd just go around in circles just like where am I going?

So how anxious did you feel in VR compared to like a classroom or if you're actually speaking to people in the Gaeltacht?

Oh completely different!

Much nicer!

You're more feeling like okay I gotta focus on the game and find the objects than oh teacher's going to ask me this.. to ask me what this is like im piseanna talun. Yeah I remember that one but no like teachers going to ask me that and I'm not going to know the answer and then’ that’s like a lot more like everyone's going to look at you. In VR you're not being looked at like really like you feel like you're in a different world or whatever.

And did you feel motivated to keep going in the experience and why was that?

To get to the final level.

See we were all were very competitive.

Just trying to get to the next level.

I think from one week to the next you're trying to improve you're trying to beat what you got the last week.
I think each time that you did it more you were more motivated because you were more used to the layout and the setting and where everything was because it didn't change each week.

I feel like the second week I was faster at getting it like I was able to remember more items like the first week I couldn't even remember one out of however many he was saying I had to keep going back and I was like well I didn't go back as many times this round so I'm getting better at it yeah.

I think just getting the items and your like right okay I have one more I need find.

It took me like two days to realise there was always four items!

And about like your motivation for learning Irish even bigger than that. Do you think it had any effect on how you feel about Irish or your motivation for actually learning Irish as a whole not just in VR?

I guess it's it made me think of just in general that we can look at how people learn that and people don't just learn in one way and a lot of the times with Irish anyway not with other languages. It's just you have to sit in the class and you have to learn this and it's part of our culture and we're Irish and we have to do it and it's more of a chore but like when you like kids..... like any anybody not even just kids like anybody of any age it's always going to respond to a game better than like just listing off like a bunch of words or like grammar terms or whatever so it's like thinking of OK you need to be hearing Irish in their environment they need to see it they need to experience it and they need to connect it to their lives at home and not just see it as Irish is something I have to do in school. It's like Irish is something I can bring everywhere I go.

The layout of the game made me more think about that the children or us learners were seeing it as useful and not this abstract thing but it was actually this is how it can be used we're actually in a shop using it. So I think the context and then in a classroom I think it's really good because of that.

It's not easy for a classroom though. Some schools can even get iPads or a decade old computers let alone like VR headsets for everyone in the class and jesus they'd knock into everything but em like in the classroom for myself not so much but like it definitely like it made me think about more how Irish should be just out in the environment more rather than just like the same posts on the road saying that in English an Irish like if it was in the shops if it had the two words and stuff I think it's just more exposure for people and would be a good support to their learning in school as well.

Because we were in the shop in the VR you couldn't really bring them to a shop in a classroom. So I think that's really good that you can bring them to places that they might not usually be able....
they don't get to see like every day in the class but you have to like sectioned off like have people in pairs be like yeah don't go out of the bubble yeah yeah.

[00:14:09.520] - Researcher
And do you think this experience has improved your attitudes or ability to Irish at all?

[00:14:15.150] - Participant 8
I just changed my perception about how to learn. Yeah. So I think I have quite a negative view of the way it's taught. I don't yeah I'm not a fan of the way it's taught and I think this is a nice different way to teach it where it's more experiential they are using it more

[00:14:32.200] - Participant 9
I don't think I would use that as like a body of the lesson though I would use it a recap of something and contextualization.

[00:14:38.690] - Participant 8
Stations?

[00:14:39.080] - Participant 9
Yeah

[00:14:39.520] - Participant 10
I felt like I was very deprived like the way we were learnt. The way that we were like taught Irish it was like very like you know it or you don't know it. And then I went into first year in secondary school and there was all these people who were fluent and they didn't know about the Gaelscoils and I didn't know any of those things people coming in with this like amazing level of Irish and you kind of felt like inferior or whatever being like oh I don't know that and then you kind of end up giving up on it because it's just continued to taught... be taught as an exam and just like you have to learn this so you can pass your leaving cert so you can go to do your leaving cert... junior cert and then your leaving cert and then like college it was never just like Irish is fun and it's something that we can like its life and all it's your heritage your life. It was never like... its a stepping stone to something else. It's not like a bit of fun but if you bring it to be fun then people are like people are more likely to want to learn it because it's just some like Oh people like Oh if we do Irish today we get to do all these like songs and games and things and instead being like oh this is the worst half hour of the school day.

[00:15:47.590] - Researcher
Yeah. And could you see yourself interacting with other Gaeltacht speakers more confidently in the future if you were to use experiences like this all the time?

[00:15:58.980] - Participant 8
All the time? Well yeah maybe. But....

[00:16:03.120] - Participant 10
In this in a shop situation?

[00:16:04.980] - Participant 8
In a very simple way...

[00:16:07.310] - Participant 9
I dunno I always feel entirely so so nervous when I talk to someone who is..

[00:16:10.880] - Participant 8
If it was academic language?

[00:16:10.880] - Participant 10
When we go to the Gaeltacht and its very like.. you can see hear their different like dialect and they're different and they're very very fluent they do it all the time but like if it was something where you
organize to like link up with a Gaelscoil or something and we're doing like a....

[00:16:28.650] - Participant 8
Very academic language you're talking about something very niche. I think I'd be much more nervous. Like something simple.

[00:16:36.420] - Participant 10
Like going to a shop and we know that thing but I don't think it should be pushed into we need to like link it into a talking to fluent speakers yet because it's like getting some... like it's like probably a bit too early for them to hear like...

[00:16:52.770] - Participant 9
Yeah I dunno I think I'm always just more self-conscious speaking to fluent people because like you tell them oh I'm doing teaching then immediately they go oh teachers are meant to have a really good level of Irish talk with me you're like you ahhhmmmmm no bye. It's like that course we were they were like oh you have a really good level of Irish and you're like oh do we now?

[00:17:11.630] - Participant 10
I learned French I went over to France. I made one error and they tend to point to it out and be like your wrong.

[00:17:17.340] - Participant 9
It's like whenever I speak because I know I know a lot of people that would be fluent in the language and stuff and if I ever speak with them it's like it's instinctive but if you say something wrong automatically in the next sentence they'll somehow of corrected you just it's so diminishing you're like oh

[00:17:33.090] - Participant 10
You just feel like if you're talking with somebody who is possibly I don't like if you're in an English class and you're reading books that aren't like way too hard for you but you're reading just above your level so you can fear what your next level of Irish should be or English should be. So it's like if you were talking to someone who's just a little bit better than you but not like completely fluent then you can hear like oh they've used this word and this word I'll use that next time instead of being like what was that whole spiel they went on with.

[00:18:02.480] - Researcher
So you talked about this a little before but did you notice the different dialects and how did you find all the different dialects?

[00:18:09.030] - Participant 10
It confused me.

[00:18:10.410] - Participant 8
Hard but it was nice once it was figured out.

[00:18:13.530] - Participant 9
Yeah it's satisfying.

[00:18:14.920] - Participant 8
Yeah then you had another way of saying it

[00:18:16.350] - Participant 10
It was like a puzzle yeah like figuring out like oh what could that be it sounds similar to this and then just trying to pick up the different things and be like is it this or is it that?

[00:18:25.650] - Participant 8
So I liked it I thought it's good.
[00:18:28.290] - Participant 9
I think I found it slightly with certain words easier to recognize that it's just a different dialects. I just have enough exposure to different areas of Irish in the country. But no I think it was good the exposure to it. It's frustrating when you don't know what your looking for but once you find it out!

[00:18:43.530] - Participant 10
But it's good for the later levels to be like okay this is a bit of an extra challenge or find something that you might not be as familiar with. But I think it's an important to be open like that they are like people have to be aware that there is different ways to say things. Cause that's kind of like any language like tomato tomato.

[00:18:59.640] - Participant 9
Yeah no it is very good especially for like later on when you're older and stuff and the lovely leaving cert comes up again you know all of the listening all of the different like dialects and stuff. So it's good it's a good way to start introducing the concepts and stuff without like drowning you in the deep end.

[00:19:18.280] - Researcher
Cool and just few questions left. So did you feel like you learned many new words using the experience?

[00:19:24.470] - Everyone
Yes yes yes.

[00:19:27.030] - Participant 9
My memory is bad but I know I did learn.

[00:19:30.320] - Researcher
And was it easier to remember words learned and experience than maybe in a classroom or different ways you've learned Irish before how did you feel about it?

[00:19:38.010] - Participant 9
It's hard to say because I didn't do the classroom situation as well for the same amount of words and stuff so like I can't say for sure Oh I definitely learnt it better this way because like I don't know but I'd say probably.

[00:19:51.450] - Participant 8
I think for words that I sort of heard heard before but I didn't use in my everyday language those ones I remembered much more easily. The ones that I had never heard before in my life. I now recognize them but I wouldn't be able to draw them back.

[00:20:07.560] - Participant 10
You would recognise them possibly if you heard them again. Or someone showed you like oh this is like... you would kind of have a slightly better like recognition of it but it's like working towards like remembering the difficult words but then for the kind of easy and like medium kind of words like you were able to kinda like.

[00:20:25.750] - Participant 8
Yeah it was very good

[00:20:36.310] - Researcher
Yeah yeah. And last question do you think the virtual reality created kind of a greater sense of purpose for what you asked to do and why do you think that is?
[00:20:36.930] - Participant 9
You weren't just told oh this is this word here's a picture of that word Let's all repeat the word again
blah blah blah going on again exactly like I know with all the things we do when we teach but like
when you're actually given a purpose I want you to go find these things when you're actively gone out
to do it you're thinking more about it you're trying to like... cos its not like you had a list in the game
like you had to actively think about it more and try and connect it to what you think it would have
been. So it was definitely better than what we would do in class.

[00:21:04.810] - Participant 10
Yeah definitely.

[00:21:04.920] - Participant 10
You haveta employ like a lot of skills to actually play the game because you have to... so you have to
like listen to the word you haveta try and remember what it kind of sounds like then you have to
actually go out go into an environment find the correct like section of the place you have to get it to
grab it you have to listen to it and then you have to put it into the basket and then it's like an
experience like and it's like having the experience as well. So it's like by the time you've gotten to the
checkout desk you've already probably heard that word a couple of times you know and it's a lot
better than just being told like flash cards like this is the word do you remember that one?

[00:21:45.080] - Researcher
Yeah ok thanks very much guys.
Appendix F

Game Builds

F.1 Link to First Case Study Build

https://gaeltechvr.ie/?page_id=177

F.2 Link To Second Case Study Build

https://gaeltechvr.ie/?page_id=179

F.3 Link To Third Case Study Build

https://gaeltechvr.ie/?page_id=181