Communal Constructivism: An appropriate pedagogy for use in Multi-User Virtual Environments

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

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Abstract

As users shift their interest from so called 'Web 2.0' applications such as wikis and blogs towards the distinct Multi-User Virtual Environment (MUVE), educators are faced with the challenge as to how this new technology may be used for learning. Early research has focused on the replication of existing practices such as distance learning through the recreaction of lecture theatres using synchronous voice communication or embedding webcasts to deliver lectures (Rothfarb et al, 2006).

Communal Constructivism is identified as a pedagogy which could leverage the full affordances of this technology. We therefore pose the research question: **How affective is Communal Constructivism within a MUVE?** In order to answer this question a learning experience within a MUVE, Second Life, is created according to the principals of the pedagogy through the affordances of Second Life.

Research within the area of Social Constructivism relies upon research participants' views (Creswell, 2007), thus a qualitative research method is employed. As each iteration of a Communal Constructivist learning experience is different from the last, a multiple case study approach is adopted. During the activity, chat logs, observations and artefacts are collected, followed by a post-activity semi-structured interview.

Through detailed analysis of the data, Communal Constructivism is found to be an affective pedagogy within the MUVE. The study has also revealed unexpectedly findings which provide a greater understanding of Communal Constructivism. However these can not be generalised outside of MUVEs

prompting the need for further research.

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1 Introduction

Over the past ten years internet useage has shifted from the retrieval of information and text based synchronous communication towards web-based communities through what has become known as 'Web 2.0'. Recently Web 2.0 technologies such as wikis, blogs and social-networking sites have become pervasive in our culture allowing users to generate and share content. Now there is a shift towards a new distinct technology which is not browser based, such as Massively Multiplayer Online Games, and non-game-based Multi-User Virtual Environments (MUVEs).

Education regularly faces the challenge of how to use new technologies for learning. As new technologies emerge, early adopters recreate what has gone before in these new environments, for example early television recreated radio with images and computer programmes automated drill and practice (Winn, 2005). Current technologies have been shown to support Constructivist pedagogies, in particular Social Constructivist learning through communication affordances.

MUVEs are fundamentally different to what has come before as pervasive, 3D, virtual environments with avatars, communication and building tools. Whilst a lot has been written on the educational use of games, current research in non-game-based MUVEs has focused on replication. It is therefore timely to conduct exploratory research into an appropriate pedagogy which leverages the affordances of this new technology.

Through an analysis of MUVEs and Constructivist pedagogies, in the following chapter, Communal Constructivism is identified as a Social

Constructivist pedagogy closely aligned with the features of MUVEs.

1.1 Research Question

The following research questions will be used to guide the rest of this work.

- How affective is Communal Constructivism within a MUVE?

In order to answer this question a learning experience designed to Communal Constructivist principles is created and the following sub-questions are posed:

- Were the key features of the Communal Constructivism evident during the learning experience?
- What were the learners' perceptions of the learning experience?
- Was there evidence of learning?

1.2 Roadmap

This is an exploratory study looking at how we might leverage the affordances of MUVEs whilst using existing pedagogy. In order to achieve this, a review of current research into this technology and analysis of its affordances is conducted, followed by the identification of a pedagogy which is most appropriately aligned

The design chapter identifies the design requirements that emerged from the literature and the tools and affordances of the chosen MUVE which can

be leveraged to meet these requirements. Following this an overview and walk through of the learning experience is provided.

In order to answer the research question a qualitative, multiple-case study approach is described in the methodology chapter. The case procedure is outlined followed by the data collection and data analysis methods used. Findings from the data analysis are presented followed by a discussion of these findings in answer to the sub-questions.

Finally the conclusion seeks to answer the principal research question, discusses the limitations of this study and presents unexpected findings and recommendations for future research.

2 Literature Review

The purpose of this literature review is to identify an appropriate pedagogy for use in Multi-User Virtual Environments (MUVEs). To achieve this an understanding of the technology and analysis of potential pedagogies is necessary.

A traditional literature review would begin with an indepth analysis of existing educational theories. For clarity, this literature review first analyses the technology and then the theory, to identify the pedagogy most appropriately aligned to this new technology.

2.1 Method

To facilitate this review, online journals were accessed through the Trinity College, Dublin library service and Google scholar. The following search terms were used to identify suitable book and journal articles: multi-user; virtual; online; world; avatar; community; communication; role-play game; Social Constructionism; Communal Constructivism; Constructionism; knowledge building. Due to the exploratory nature of early research it is challenging to find existing peer reviewed research into specific areas and so more general searches were required.

2.2 Multi-User Virtual Environments (MUVEs)

2.2.1 Description

MUVEs are persistent (Herman et al, 2006), 3D, online and virtual environments which multiple users can connect to, create and communicate in and engage with. MUVEs developed from the late 1970, text based multi-user domains (MUDs). They can now be considered to incorporate the sub-categories of: massively-multiplayer online role-playing games (MMORPGs); massively-multiplayer online games (MMOGs); MUDs; and non-game-based virtual environments.

Dickey (2005) identifies three main features of MUVEs: they are 3D; use avatars; and have communication modes. Whilst considering the educational opportunities that MUVEs present it is important to consider new and emerging MUVEs which currently facilitate building in various forms. To supplement this, Cross et al (2007) pick out specific 'sensibilities' of these environments: a sense of self and presence in real time through the use of an avatar; they are persistent; without distance; encourage social groups to form; allow for collaboration in creation and through this collaborative learning; augment reality and in doing so, enrich real experiences.

While each MUVE has a range of features, these can be subcategorised under three headings: avatar use; communication; building. It is these features that provide the educational potential of MUVEs.

Avatar use

Avatars are used to represent the user within the environment and may be viewed in the first or third person. This 'embodiment' of the user creates

a sense of presence, immersing the user within the environment (Kemp and Livingstone, 2006). The avatar denotes the presense of a user within an environment and can therefore lead to seredipidous encounters between users.

Communication

MUVEs may provide a variety of ways for users to communicate with each other, including non-verbal gestures, text and voice. These may provide opportunity for synchronous and asynchronous, public and private communication between individuals or with groups. Speech, as described by Vygotsky (1986), embodies thought and provides opportunity for collaboration.

Building

Building is a feature of some but not all MUVEs. This provides an opportunity for users to generate content, as is common in many 'Web 2.0' technologies. As MUVEs are 3D environments, the creation of content may require knowledge of geometry or the use of external programmes.

2.2.2 Types of MUVEs

While MUVEs are characterised as being pervasive, 3D, avatar based environments with communication and building affordances, there are a range of MUVEs each with distinct features. These features can be identified on sliding scales between the following extremes: role-play - non-role-play; linear path - non-linear path. For example, World of Warcraft, currently the most popular MUVE with 8.5 million subscribers worldwide (Snow, 2007), is

heavily role-play based with a non-linear path. As such, World of Warcraft would typically be described as a Massively Multiplayer Online Game.

Existing education experiences based around MUVEs such as Quest Atlantis and Whyville are typically highly role-play based with moderately linear paths. These MUVEs are specifically created for use by children and provide a game based, role-playing environment designed to immerse learners in educational tasks.

At the other end of the scale are non-role-play, non-linear MUVEs. Typically these are not game-based and are therefore not restricted by 'game grammars', a term defined by Gee (2003) which relates to the structured syntax of the game design. This flexibility results in an environment which can be fully manipulated by both learner and facilitator, particularly when building. Examples of such environments include 'Second Life' and 'There'. It is these MUVEs which are of interest to this study.

2.2.3 Relevance

Statistical data from a range of sources provides indications that the number of users of MUVEs are in the millions. Their pervasiveness into modern culture can be seen in other forms, beyond statistics, through the crossing of mediums. For example, MUVEs have been an integral part of popular television programmes 'South Park' and 'CSI:NY'.

As the barrier between MUVEs and real life blurs, companies are realising economic opportunities in these environments (Castronova, 2005). Whilst early efforts by companies to exploit advertising opportunities are yet to yield any significant rewards, they are beginning to consider the possibilities

of using these environments for collaboration and learning (Clark, 2008).

2.2.4 Current Educational Uses

Educational uses of MUVEs vary. Presented here is an overview of initiatives that have been reported in academic papers.

Replication

A relatively common educational use of MUVEs is in recreation of existing learning experiences. For example the replication of university campuses including lecture theatres (Bruckman and Resnick, 1996) to provide lectures to students at a distance.

Early adopters of new technologies repeatedly recreate what has gone before in the new medium. For example early television programmes recreated radio broadcasts but with pictures. As per Winn's (2005) discussion on Virtual Reality systems we now need to move beyond considering MUVEs in terms of what they can replace and consider their unique characteristics and potential.

Immersion

Spatial immersion, as described by Björk and Holocaine (2004), occurs when a person believes the simulated world to look and feel 'real' creating a sensation of being in the simulated world. This is a more accurate description of a phenomena often referred to in the literature as simply 'immersion'.

It is reported that the sensation of being in the simulated world is made more real in MUVEs through the use of an avatar. As described above,

the embodiment of the user through the use of an avatar creates a sense of presence, immersing the user within the environment (Kemp and Livingstone, 2006).

There is a body of literature encompassing several disciplines which looks into identify issues that may result through the use of avatars. However the role of identity will not be investigated within this study except to acknowledge avatars are central to the immersion of the user within the environment (Taylor, 2002).

Whilst immersive learning experiences have proven popular within the MUVE, Second Life, the communication affordances of the environment are often overlooked or regarded as 'obvious'. Alternatively the MUVE may be viewed as a technical rather than social tool (Sanchez, 2007).

Role-play

Another popular educational use of MUVEs is within role-play game-based MUVEs, such as Quest Atlantis. Cognitive and emotional immersion (Björk and Holocaine, 2004) may take place during role-play activities both in and out of MUVEs. Combined with spatial immersion in a MUVE, another level of immersion is added through using role-plays in MUVEs.

Designed to create a constructionist environment for 9-12 year olds to develop research skills by solving problems in a role-playing virtual environment (Barab et al, 2007), Quest Atlantis has a strong emphasis on reflection, action and the individual with the community (Barab et al, 2005). It requires completion of in-world and real-world tasks (Barab et al, 2005) and uses story line narrative and 'game grammar' (term as used by Gee,

2003). It is highly structured with explicit aims. The virtual environment is supplemented by real life face-to-face meetings (Barab et al, 2007) and affords communication, collaboration and building (Barab et al, 2007).

Simulation

The use of MUVEs as places for simulation of real-life experiences often rely heavily on role-play and may aim to replicate or expand existing computer based simulations (Harvey, Monahan & Ullberg, 2007). Unfortunately, few learning activities have leveraged the building affordances of MUVEs and those that have neglect to discuss the role of the avatar or communication tools within the experience, such as the fashion design simulation described by Polvinen (2007).

2.3 An appropriate theoretical framework

ICTs are used by proponents of a range of learning theories to recreate traditional activities in a digital format. For example, computer games based on behaviorist pedagogies reward success (gaining points) and punish failure (loss of life) and may be repeated ad infinitum to train in home, school and military education settings (Prensky, 2001).

However the ICT revolution has resulted in culturally pervasive technologies with a range of affordances, many of which are closely aligned to constructivist principles. Constructivism, which gained prominence largely due to the work of Jean Piaget (1967), does not prescribe one pedagogy but rather how learning should take place. There is variability between specific Constructivist pedagogies in their focus, but in general they promote: the

learner as active centre of learning activities; dynamic interaction between learner and learning objects; and collaboration.

Whilst from the outset MUVEs appear closely aligned to Constructivist principles, it is important to uncover the specific constructivist pedagogies most appropriate aligned to the main features of these environments: avatar use, communication and building.

2.3.1 Constructionism

Constructionism requires the building and rebuilding of explicit objects as a support for the building of constructions in the head (Papert,1980). On first glance, Constructionism appears to be the obvious pedagogy for use in MUVEs that are persistent and afford building. However, programming languages in MUVEs are typically 'high-floor' as opposed to Papert's (1980) 'low-floor, high-ceiling' model (Sargent et al, 1996). Papert's 'objects-to-think-with' could be recreated by designers in-world and then manipulated by learners to 'think with', through the use of on-screen input displays and re-arranging of parts. While the build and rebuild opportunities are infinite within certain MUVEs, their lack of structure may lead to a 'tyranny of freedom' (Schwartz, 2000).

MUVEs, through avatar and communication tools, provide an ideal setting for communities (Childress and Braswell, 2006). Therefore recreating constructionist learning experiences within MUVEs leverages the building features of MUVEs, without considering the social features MUVEs (avatar and communication).

2.3.2 Community

Vygotsky (1986) believed that speech embodied thought and that learners achieve more within a community than in isolation. Building on this, according to Mercer (2000), knowledge is the sum of what is known by all people in a group. Primarily this is viewed as existing in spoken and written language, the 'mediating tools' (Wertsch, 1991) of the communities. Therefore communities could be described as being inseparable from communication.

When researching two game based MUVEs, Whyville and River City, Kao et al (2005) found preferences for communication with real people rather than AI and the importance of identity in creation and modification of avatars.

Online communities are described as inseparable from either community or technology (Mynatt et al, 1997). Communities take time to build and have several stages of development (Robson and Foster, 1989). Pre-established groups, for example students from the same classroom, will already be further through these stages when introduced to a learning activity in a MUVE and may therefore be expected to be more successful as a community. However one of the advantages of MUVEs is that non-established groups of learners can come together and form or join communities. The communication and immersive, 3D, avatar features of MUVEs can facilitate community building in these situations.

Communities can be either top-down, focusing on the community as a whole; or bottom-up, focusing on the individual within the community. As previously described, Constructionism focuses on the individual within

the community. However MUVEs, it may be argued, facilitate community learning over that of the individual. The avatar and communication affordances provide opportunity to represent community knowledge in a variety of forms including language and culture. Therefore the following discussion focuses on top-down community pedagogies.

2.3.3 Social Constructivism

The earlier work of Vygotsky only came to prominence after the work of Piaget was published. Whilst largely agreeing with the work of Piaget, Vygotsky placed greater emphasis on the social context of the learner. 'Tools', as described by Wertsch (1991) are required as a 'mediational means' for learning to occur. For Vygotsky (1986), the most important of these tools is speech, which he described as embodying thought.

Through language, communication and social interaction are key features of Social Constructivist pedagogy. Through the use of avatars and communication, MUVEs can be considered to be particularly closely aligned to Social Constructivist learning experiences. The context in which the learning takes place is also important. MUVEs provide an opportunity to create immersive environments, allowing social interaction through the use of avatars and provide multiple communication channels.

2.3.4 Knowledge Building

Knowledge Building is a Social Constructivist learning theory which focuses on the collaboration of individuals to advance the knowledge of the learning community of which they are a part. It can therefore be described as taking

a top-down focus on communities.

Within Knowledge Building, the aim is to build knowledge for the community as a whole (Zhang et al, 2007), individual learning is viewed as a by-product (Scardamalia and Bereiter, 2003). It is based on the use of authentic problems, self-organisation, monitoring and correction, collective responsibility, discourse and the creation of artefacts to advance the collective knowledge (Scardamalia, 2002, Scardamalia and Bereiter, 2006). While there is structure there is also freedom to pursue individual lines of enquiry, thus avoiding the tyranny of freedom previously discussed.

Knowledge Building views knowledge as only existing in and through discourse. The individual contributes to the knowledge of the community by questioning, researching and working with others to build community knowledge, this process involves several iterations. At the end of the Knowledge Building process the community creates a final artefact to represent the advancement of the community knowledge which represents the creation of newer knowledge (Scardamalia and Bereiter, 2006).

From the literature reviewed, most research in this area has been conducted with primary school age children within purpose built Knowledge Building environments, although they are also described as being used successfully with adults in both education and professional environments (Scardamalia and Bereiter, 2003).

Purpose Built Environments

"A [Knowledge Building Environment] should be distinguishable [...] by virtue of its focus on process of knowledge creation and idea improvement

and by virtue of its ability to represent the resulting community knowledge" (Scardamalia and Bereiter, 2003 p5).

Whilst acknowledging that discourse is central to Knowledge Building theory, purpose built Knowledge Building Environments such as Computer-Supported Intentional Learning Environment and Knowledge Forum provide limited modes of communication. Within the environment synchronous communication is not possible. Asynchronous communication is only provided for through the use of notecards placed on the work of others to provide comment. While initial research has been carried out on the use of Knowledge Building Environments within individual classrooms, discourse within these classrooms has not been analysed.

While MUVEs may provide the communication tools that purpose built Knowledge Building Environments typically lack, there are additional unique characteristics of MUVEs such as persistence which may, in the opinion of the author, have more potential than could be exploited through the use of Knowledge Building.

2.3.5 Communal Constructivism

Communal Constructivism builds upon the social constructivist model described earlier. As with Knowledge Building, the emphasis is on the influence of the student within the learning context and the advancement of communal knowledge. Knowledge Building and Communal Constructivism follow similar pedagogical paths in which the role of knowledge of the community is seen as top-down and discourse is central. However Communal Constructivism promotes the leveraging of existing technologies to provide

the learning environments (Holmes et al, 2001).

While Knowledge Building addresses the Communal Constructivist problem of complying with current individual assessment practices, the wider focus of Communal Constructivism is some what different to that of Knowledge Building. Knowledge Building within a school environment encourages several iterations with the same group of learners over time, so as to advance the knowledge of that community. However, within the literature reviewed there is no discussion of future learners using past learners Knowledge Building artefacts as starting points for their own knowledge building or on how an individual may enter an established group. Communal Constructivism, on the other hand, emphasises the use of past learners and their artefacts to influence the learning experience of and for future communities of learners (Holmes et al, 2001). Iterations focus on new groups of learners, thus new individuals may enter at any stage.

Communal Constructivism encourages products of learning to be fed back into subsequent iterations of the learning task. New communities of learners are able to take part in similar activities, providing context to the product, and use the product to improve their own learning experience with the aim of extending the community knowledge. Each new community is therefore joined to subsequent communities and it is possible for a larger community to emerge from these smaller parts.

One apparent disadvantage of existing Knowledge Building Environments is that published views do not easily show a newcomer the underlying knowledge of the community used to create the published 'view'. MUVEs can be used to create a learning experience for all participant groups, to provide

a similar 'starting point' for knowledge construction. Before leaving the learning experience participant groups can create an 'artefact' to represent their communal knowledge. Through the persistent nature of MUVEs, this artefact can be preserved for subsequent groups to build upon, which is in line with Communal Constructivist aims.

Core Features

Through an analysis of the seminal work of Holmes et al (2001) and subsequent literature, six core features of Communal Constructivist pedagogy have been identified: interaction with the environment to construct knowledge; active collaboration; engagement in knowledge construction; publishing of knowledge; transfer of knowledge between groups; and a dynamic and adaptive course.

Avatars and communication tools provide opportunity for interaction with both other learners and the learning environment created within a MUVE, they also support active collaboration and knowledge construction within the group. Through using the building tools within a MUVE learners can publish the knowledge constructed by the group and the persistent nature of MUVEs provides opportunity for transfer of knowledge to take place between groups. The ability to build and rapidly rebuild, combined with the persistent nature of MUVEs allows for courses to be dynamic and adaptive both through the actions of learners and teachers.

As previously discussed each group of learners taking part in a Communal Constructivist learning activity takes part in similar activities to previous groups which provides context to the published artefacts of these groups.

Due to the persistent nature of MUVEs it is possible not just to recreate the learning environment of previous learners but to keep it constant, except for the adaptations that take place due to the nature of Communal Constructivism. In this way MUVEs may provide an opportunity to Communal Constructivism unavailable in previous technologies such as Virtual Learning Environments (VLEs).

2.4 Summary

This chapter has presented a review of available literature into the use of MUVEs in education and suitable Constructivist pedagogies for use in this new technology. From this, Communal Constructivism emerges as a pedagogy which can leverage the unique combination of features of MUVEs, which in turn provide opportunities to the pedagogy unavailable within previous technologies. The design implications emerging from this literature are explored in the following chapter.

3 Design Chapter

The aim of this chapter is to describe the learning experience designed to answer the principal research question. First the wider context within which the study takes place is presented followed by a description of the specific MUVE employed in the study. This is followed by the design implications emerging from Communal Constructivism and describes how they can be met through the affordances of the chosen MUVE, Second Life. The resulting learning experience is then described by providing an overview of the learning environment and a walk-through of the learning activity.

3.1 Wider Context

The opportunity to complete this study occurs through access to a Second Life island, 'Murias', provided through an Irish Aid research project, principal investigator Timothy Savage, Trinity College Dublin. Therefore the learning experience must focus on an area of development education.

"New technologies, especially the Internet, offer much potential as vehicles for intercultural collaborative inquiry, allowing us to develop global perspectives on local issues and to find complex approaches to complex problems." (Barab et al, 2005, p104).

Within a constructivist paradigm, learning is thought to be affected by context and the beliefs and attitudes of the learners with a focus on authentic problems. A precise definition of Development Education is difficult to pin

down. Osler (1994) points out that Development Education differs from country to country. A brief look at the history of Development Education shows us that it is closely tied to the prevailing attitudes of the time, for example the move from the 1960s focus on poverty and hunger to the 1970s view that women are central to development to the 1980s focus on sustainable development to the 1990s focus on security (Osler, 1994). However, human rights has remained at its core. As likely as MUVEs are to develop in both small and extraordinary ways, so will Development Education.

In relation to the specific pedagogy proposed in this study, Development Education is a community based perspective and while individuals are important in the process it is the change that occurs within the community that is important. Therefore a top-down perspective on community is essential. In addition, the Communal Constructivist philosophy of groups publishing their knowledge for transfer to others and for future groups to build upon this in their knowledge construction would fit within the aims of Development Education.

3.2 Second Life

As a non-role-play MUVE without a linear path, Second Life (Linden Labs) provides for the full features of MUVEs. According to statistics from Linden Labs, upwards of 60,000 users may be online at any one time, with over one million unique avatars logging in over the last 60 days.

Due to the reported numbers of people in Second Life, there has been noticeable corporate interest with various real life companies involved in

a range of advertising activities within the environment (LaPlante, 2007; Castronova, 2005). This ranges from building shops with items for sale to advertising hoardings. However, whilst in early April, Virtual Worlds 2008 focused on the marketing and legal issues surrounding selling in MUVEs, The Wall Street Journal described companies changing focus towards collaboration and learning (Clark, 2008).

As with corporate companies, initial interest from educators and the research community was a result of its large number of users. This has resulted in research examining the use of specific technologies such as embedded webcasts (Rothfarb et al, 2006); immersive environments (Cochrane, 2006; Doherty and Rothfarb, 2006); the role of avatars (Doherty and Rothfarb, 2006); and the blending of Second Life and other web based technologies (Kemp and Livingstone, 2006).

Whilst there are other non-role-play, non-linear MUVEs available for use, such as 'There' they do not provide the flexibility available through Second Life. For example, 'There' requires all content generated by users to be submitted for approval. This would significantly hinder a Communal Constructivist learning experience.

Tools and affordances

In order to explore the educational potential of a new technology we must first describe its tools and their affordances. Within the literature reviewed, Research focused on the MUVE Second Life has listed features, often mixing tools and affordances or described affordances as activities but negated to describe the tool. The framework for the identification of these tools and

affordances has also been missing from the literature.

At this point it is necessary to identify the tools and affordances of Second Life. The tools and affordances of Second Life are identified in Appendix A according to Gibson's (1979) definition of 'affordance' with an example provided below. The table presented may not be exhaustive and as Second Life evolves as an environment, will require alteration.

Tool	**Affordance**
Text chat	Public, text based, synchronous communication
Voice chat	Public, aural, synchronous communication
Instant Messaging through text	Private, text based, synchronous and semi-asynchronous communication
One-to-one voice chat	Private, aural, synchronous communication
Chat logging	Recording of text based chat Recording of instant messages

Table 1: Example of tools and affordances of Second Life interface

The affordances of the MUVE Second Life provide the opportunity for the design implications of Communal Constructivism to be met.

3.3 Design implications

3.3.1 Communal Constructivist features

From the seminal work of Holmes et al (2001) on Communal Constructivism and subsequent literature reviewed in the previous chapter, six core features of the pedagogy have been identified. This section presents a brief description of the relevant features and identifies their design implications. This is followed by the affordances within the MUVE Second Life which provide opportunity for these implications to be met.

Interaction with environment to construct knowledge

The roots of Communal Constructivism are within Social Constructivism. As such knowledge is constructed through the interaction with the learning environment. This includes interaction with both people and their surroundings. Social Constructivism would see language as key to the interaction between people.

The design implication of this for the learning experience is that it must require interaction between people through language and interaction with their surrounding environment to for learners to be successful.

Tools within Second Life that afford interaction between people include avatars, and text and voice communication tools, as demonstrated in the 'Second Life tools and affordances' table (Appendix A). Interaction with the environment may take place through the use of scripts which afford a range of interactions and the non-physical touching of an object afforded by the avatar.

Active collaboration and engagement in knowledge construction

Active collaboration and engagement in knowledge construction are essential aspects of Communal Constructivist pedagogy. This is not something a teacher can expect their students to do without direction. The design implications of this are the need for scaffolding of the activity and the use of success criteria.

The affordances of Second Life that allow us to meet these implications include communication, the viewing of objects and creation within the environment.

Publishing to transfer knowledge to future groups

Communal Constructivist pedagogy states that learning should be constructed for the wider community. It is suggested by Holmes et al (2001) that this is through the publication of knowledge. The design implication of this is that groups must publish the knowledge they have constructed in a form which may be used by future learners and must therefore remain in-world.

Building tools, scripting, Heads-Up Displays (HUDs), camera tools and uploading provide a range of affordances which may be used to meet this design implication, in combination with the persistent nature of MUVEs.

Dynamic and adaptive course

A Communal Constructivist learning activity should be dynamic and adaptive (Holmes 2001). The design implication of this relates to both the learners' actions and teacher's role. Learners should have a direct impact on the course although this may be facilitated by the teacher.

The affordances of Second Life allow for rapid adaptation of the course between participating groups of learners by the teacher. In addition due to the persistent nature of Second Life and the publication by learners in-world, each course is adapted directly by the learners.

3.3.2 WebQuests

As an exploratory piece of research investigating a new technology with a relatively new pedagogy, an existing and structured learning model was needed. The WebQuest model is one enquiry-based learning model that

provides a consistent structure across ages and subjects, with critical an non-critical attributes (Dodge, 1997). Although the WebQuest model is designed to use websites, Dodge (2001) states that it is not limited to this medium. What is important in a WebQuest is that the technology is leveraged to exploit its unique characteristics to increase the potential learning opportunities.

As per the features of Communal Constructivism, WebQuests require active collaboration through communication and engagement in knowledge construction to succeed in the task. Whilst other enquiry orientated learning models are available there is particular emphasis within the WebQuest on construction of an artifact to demonstrate group knowledge. This makes the WebQuest model particularly relevant to Communal Constructivist pedagogy which furthers the experience by taking the artifact and publishing it for future learners.

The use of HUDs, uploading, textures and communication tools within Second Life all provide opportunity to meet the design requirements of the WebQuest Model.

3.3.3 ARCS

Whilst the WebQuest model makes reference to a 'doable and interesting' task (Dodge, 1997), it makes no specific reference to motivation. To ensure motivation in a learning activity is an almost impossible task and is not intrinsic in pedagogical designs. However, Keller's (1987) ARCS Model of Motivational Design identifies four essential areas for motivation: Attention, Relevance, Confidence and Satisfaction. Each of these is discussed below and

affordances of the MUVE Second Life which support the design implications of these features.

Attention

The first step of the ARCS model is in gaining the attention of the learner through perceptual arousal and variability. Through the Second Life client a representation of a 3D environment is presented to the learner. The use of HUDs, textures and scripts provide us with the opportunity to create a variety of visually stimulating objects within a learning environment. Scripts also provide opportunity to vary the types of interactions with such objects.

Relevance

Learners should be involved in an activity which is relevant to them (Kahn and O'Rourke, 2005). Within the ARCS model the use of concrete examples from the learner's own experiences to help them integrate new knowledge within existing schema is important. Uploading, which affords the creation of in-world textures, allows images from outside of Second Life to be integrated within the environment.

Confidence

Learner confidence is the third feature identified by the ARCS model as essential to learner motivation. Learners need to know what they must do to be successful and feel that they are able to achieve this. The design implications of this are in the building of an artefact to be published. As described above, the tools of Second Life afford a variety of ways to create within the environment thus providing multiple levels to access success.

Satisfaction

To experience satisfaction the learner should be provided with an opportunity to use their new knowledge (Keller, 2000). The creation of the artefact within the WebQuest model provides this and the knowledge that this will be used by future learners provides relevance.

3.4 Learning Experience

This section provides an overall description of the learning environment, followed by a walk-though of the learning activity from the perspective of a user. The design implications from the literature and their integration with technology are described in each sub-section.

3.4.1 Overview of experience

Context

Keeping in line with the theme of development education, a WebQuest was designed on the topic of North-South Interdependence. The banana trade was used as an illustrative example of some of the issues surrounding this topic. A typical WebQuest would be created as a website with pages outlining the introduction, task, process, resources, evaluation and conclusion. The WebQuest format was recreated using a THiNC book which provided the user with a Heads-Up Display (HUD).

Heads-Up Display (HUD)

Whilst the majority of tools within MUVEs have common real life cues that allow us to understand them, HUDs are somewhat different and it is therefore important to describe them in detail at this point.

Figure 1: WebQuest THiNC book as worn by an avatar.

HUDs are 'worn' by their owners (see Figure 1). The resulting image on the users screen varies from HUD to HUD, however the following featres are consistent across HUDs. The owner of a HUD may choose the position the HUD will appear on their screen. The resulting image appears in the foreground of the picture, blocking (unless transparent) the third or first person view of that section of the user's screen. There are also no external signs of the avatar wearing the HUD, to a third party.

In real life HUDs are used by fighter pilots. These HUDs allow pilots to monitor their instruments whilst maintaining eye contact with an enemy plane.

Overview

Figure 2: Sky platform at 300 meters above Murias

A 50 x 80 meter sky platform was built 300 meters above Murias in the North East corner of the island (http://slurl.com/secondlife/Murias/220/200/300) (see Figure 2). The platform consists of a 30 x 60 meter flat map of the world with a 10 meter boarder surrounding it, created using textures and building tools.

Objects

To provide variability for motivation and active interaction with their surroundings a range of objects were created on the sky platform using Second Life tools.

Figure 3: Posters showing pictures from real life.

Objects showing pictures from real life, which had been uploaded in advance, were placed around the boarder of the map as posters (Figure 3). The pictures represented the content contained within the object which was given to the avatar through the use of non-physical touch and scripts.

Sculpted objects made to look like bananas were placed on the map according to country location. Each contained scripts which gave notecards to avatars on non-physical touch by the avatar, as well as floating the name of the country above the banana (see Figure 4).

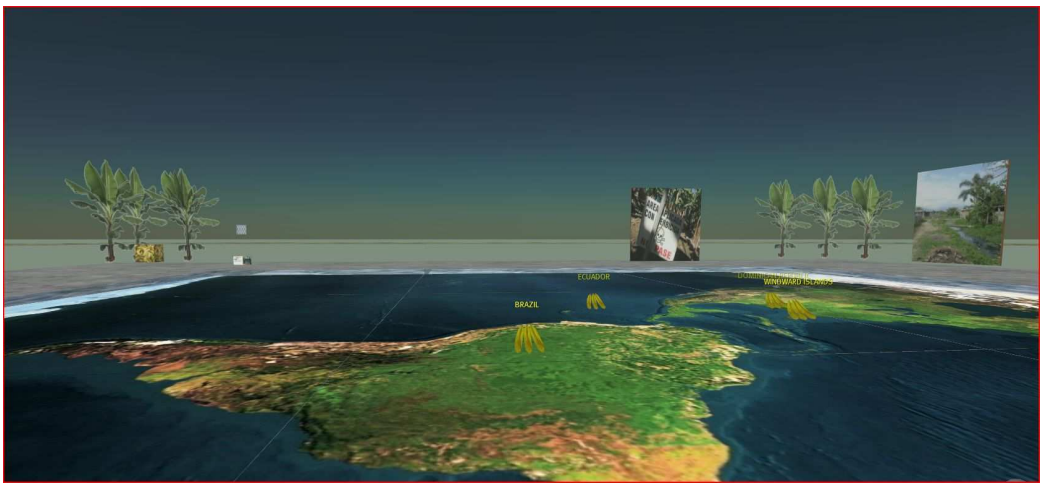

Figure 4: Sculpted bananas with floating text.

Boxes placed around the edge of the map were textured with images and contained textures and notecards. Scripts were included in the objects to provide basic information about the content of the box, give the content to the avatar on non-physical touch and in some cases rotate the box.

A slide show presentation object was used to present a series of photographs from real life illustrating the Fairtrade banana production process. The presentation was timed and by pressing on the backward and forward arrows the pictures could be changed. Next to this a rotating, textured box gave information to avatars on non-physical touch (see Figure 5).

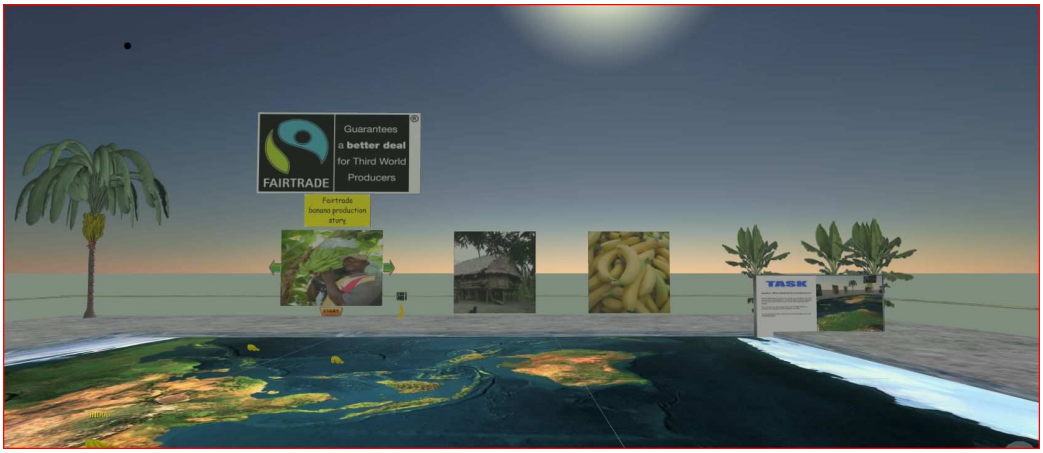

Figure 5: Fairtrade slide show with rotating box.

The final type of object was textured as transparent and so could not be seen or interacted with through the use of camera controls alone (see Figure 6). Each contained a notecard and texture. A single script within the object acted as a sensor for avatars within a certain range. When an avatar is identified by the sensor the script is activated and gives notecards and textures to the avatar sensed as well as speaking in text chat which appears

Figure 6: Yellow outline of sensor normally invisible.

on the user's screen

THiNC Books

THiNC books, created by Toneless Tomba (avatar name) provide a way of creating a book based artefact. The pages for the book are made up of in-world photographs or textures. The printing process encodes the images, limiting the ability of others to copy the book. The printed book can be copied but not modified by the owner. The owner can then change whether the book can be copied by others or bought. Users of THiNC books can rez them in-world or wear them as HUDs. By wearing a THiNC book as a HUD only the wearer can move through the pages and no additional camera skills are required to view the pages.

It was decided to create the WebQuest as a THiNC book because of ease of use for the learner. The pages of the THiNC book were created individually

in Publisher, saved as .jpeg and uploaded into Second Life as textures. Using a THiNC Book and THiNC printing press the textures were transformed into a copyable but non-modifiable book for learners which could be worn as a HUD.

THiNC books provide a high quality final artefact for learners to create using the THiNC book WebQuest as a model. These virtual, persitant books, once completed, are displayed on one side of the boarder for future groups to view (see Figure 7). This requires the use of camera controls to view, although future learners can be provided with individual copies of the books to be worn as HUDs for ease of use.

Figure 7: Books by previous groups on display for future groups.

3.4.2 Walk through of activity

This section provides a walk through of the learning activity. Learners are first provided with access and teleported to the central meeting area on Murias where they meet for the first time and are provided with information

about the study and ethics. They then teleport to the sky platform, which provides the starting point to this walk through.

Before teleportation learners are informed that this is a group based learning activity that will require communication. Second Life affords communication through the use of aural and text based tools. However, to use 'voice' tools, all participants would require access to microphone and speakers or headphones. In addition, if participants were accessing Second Life through a firewall, 'voice' may require the opening of additional ports. So as to reduce the technical requirements for participation in the activity learners are told that communication should take place through text based tools only.

THiNC book HUD

On arrival at the sky platform each learner is given a THiNC book and instructed on how to wear it as a HUD. The THiNC book provides each of the WebQuest steps from introduction to conclusion and learners are encouraged to read all of this before beginning the process.

The THiNC book HUD provides a means of gaining attention and demonstrating the relevance of the activity to the learners. The process section clearly outlines the interactions that need to take place with the environment and between learners to complete the task and suggests a course of action through collaboration to actively engage in knowledge construction. The final section of the process describes how the learners will create their own THiNC book to demonstrate their knowledge and to pass this on to future learners.

Interaction

After reading the THiNC book HUD and agreeing a course of action, learners explore their surroundings. The THiNC book HUD encourages learners to move about and click on interesting objects.

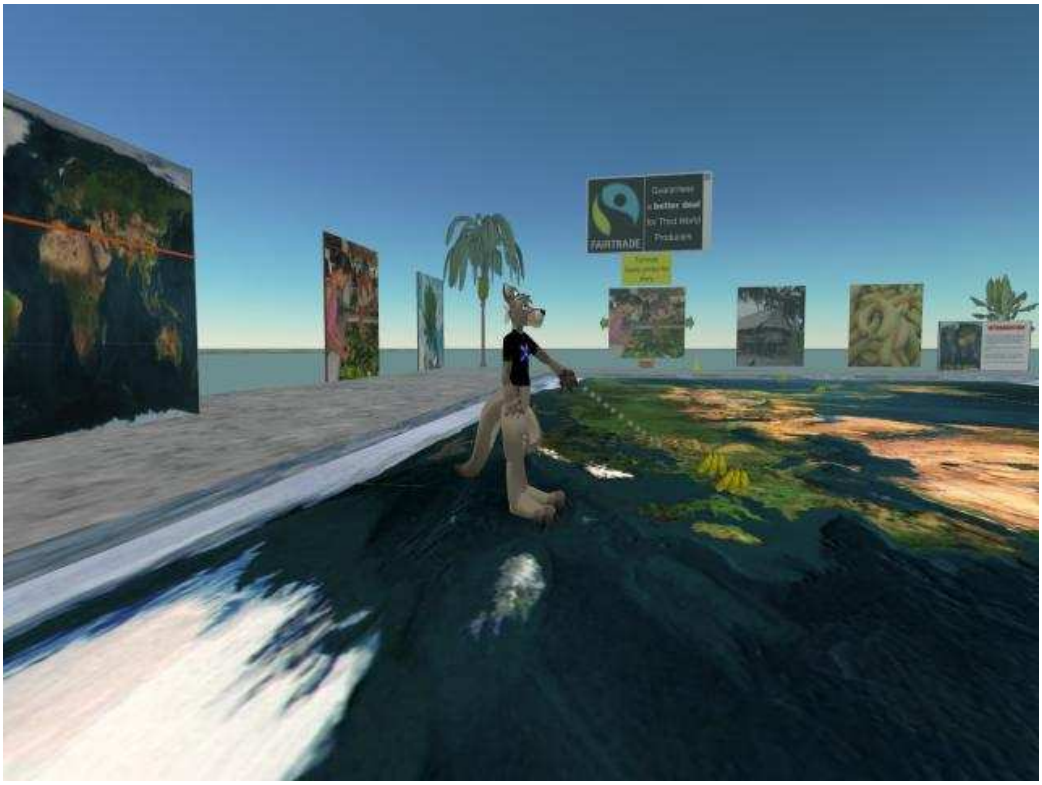

Figure 8: Avatar interacts with banana through non-physical touch.

As learners travel across the sky platform they use non-physical touch to gain information from posters, boxes and bananas. By travelling across the map they trigger unseen sensors placed around the map and receive notecards and textures whilst the sensors whisper information into the chat on their screen. As they interact with their surroundings, learners are able to communicate with other learners through the text based communication

tools available in Second Life and give notecards and textures to each other via their avatars.

Engagement

To engage in knowledge construction, learners return to their group after reviewing the information they have found to begin discussions. The THiNC book HUD suggests questions for the learners to discuss as well as a reminder of the task they must complete. The information gained from interacting with their surroundings does not provide the learners with the answers to these questions, instead learners are encouraged to use this and their existing knowledge to construct the knowledge of the group.

Figure 9: Group discussion after interaction with environment.

Creation

To complete the task each learner must create a page for inclusion in a group THiNC book. As the creation of THiNC book pages takes place using any programme which allows the document to be saved as a .jpeg, it was decided that the creation of a THiNC book would be an appropriate way for learners to publish their knowledge. This allows learners to use any programme with which they feel already comfortable to help maintain motivation through confidence. These pages are then uploaded following the instructions within the process section of the WebQuest.

Figure 10: Group collaborating to create their book.

Discussion

Following the creation of individual pages each group constructs a final page, to be the first page of their THiNC book, in answer to the question set out in the task. To create this page the group must actively collaborate and engage in the construction of their answer, through discussion.

Construction

Once the learners have uploaded their .jpegs to create textures they follow the instructions in the THiNC book HUD to combine these textures into the group's own THiNC book. This requires the giving and receiving of textures between avatars

Publishing

When the group is happy with their final product it is given to the teacher who prints the books using a THiNC book printing press. A copy of the book is given to each member of the group with a final copy placed on the sky platform for future groups to use.

3.5 Summary

The design implications emerging from the literature and how they may be met by the affordances of the tools in Second Life were presented at the beginning of this chapter. Resulting from this, the designed learning experience was presented providing an overview and walk though.

4 Methodology

The previous chapter described the artefact and learning experience design. This chapter outlines the research design, data collection and data analysis methods used in this study. The aim is to provide sufficient detail to allow replicability (Yin, 2003).

4.1 Research Design

4.1.1 Social Constructivism and Qualitative research

Social Constructivist learning takes place through interactions with the learner's environment. Research in this area relies upon research participants' views which are formed through these interactions and their cultural and historical backgrounds (Creswell, 2007).

To be able to study the views of participants, a qualitative research methodology is employed. Qualitative research focuses on understanding the meaning of participants, rather than the ideas of the researcher or past literature. The researcher interprets the data and aims to produce a holistic account, identifying complex interactions. Research takes place in a natural setting and uses the researcher to gather data from multiple sources (Creswell, 2007).

4.1.2 Multiple Case Study

A multiple case study approach to research was identified as the most appropriate qualitative research approach to answering the research question:

Is Communal Constructivism an appropriate pedagogy for use in MUVEs?

As Communal Constructivism is based upon advancing community knowledge through the leaving of artefacts for future learners to build upon, several iterations of the study would be required to establish whether Communal Constructivism takes place. Each iteration would be different to the last as the course should be adaptive and the artefact of the previous group would be available to future groups. Therefore a multiple case study approach was adopted, as described by Creswell (2007). This allows for replicability of procedure for each case (Yin, 2003), however it is not the intention of the researcher to do this to enable generalisation between cases as suggested by Creswell, as the learning experience will develop upon each iteration, thus creating a new case.

Case study methodology requires detailed and in-depth data collection, with a detailed description of the cases through rich analysis of the data (Creswell, 2007). This is discussed further in the data collection and data analysis sub-sections below.

4.2 Procedure

4.2.1 Participants

Participants of the study formed an opportunistic random sample from within an identified group. The group identified were educators with existing experience of the MUVE Second Life. Contact was made through mailing

lists and Instant Messaging of members within interest groups for educators in Second Life. From those that volunteered for the study, groups were created based on availability of participants. This is a process that was repeated as participants were required. As members of these groups and mailing lists the researcher was assured participants with an interest in education and with some experience of Second Life.

4.2.2 Location

Participants lived in a range of countries around the world. Each of the participants took part in the study from a location of their choosing (office or home). Within Second Life, each participant was provided with access to the island where the artefact was created and teleported by the research before the start of the study. Initial teleportation was to a central meeting area on the island so participants could teleport to the artefact together, where the learning experience would begin.

4.2.3 Pilot

A pilot of the study was run using a preliminary group of participants. This allowed for refinement of the learning experience, protocol and data collection procedures for the study (Yin, 2003).

4.2.4 Timing

As participants were not co-located and groups consisted of people in more than one country, time-zones was an important factor in the creation of groups. Volunteers were sent a list of times from which they indicated their

availability. It was found from the prototype that two x two hour sessions were needed to complete individual case studies. To reduce confusion across time-zones, the same start time was used on both days for each case. Between cases different start times were used ranging between 0900 GMT to 2100 GMT and individual participants with a group could be taking part in the morning, afternoon, evening or night time depending on their time-zone.

4.2.5 Protocol

The use of a protocol for the study increases validity (Cohen, Manion and Morrison, 2007).

As described above, prior to the start of the learning experience, each participant was provided with access to the island where the artefact was created. Shortly before the agreed start time, each participant was offered a teleport to the researcher's location on the island. The location was a central meeting area rather than to the artefact so as to not distract participants from the initial phase of the study.

Once all participants had arrived they were provided with a note card with details of the study from the researcher. This was followed by a notecard covering ethical issues, which are described below. A request was also made for participant real life and Second Life details. Finally, before teleportation to the artefact, each participant was asked to record their own text based chat.

On arrival at the artefact participants were given the WebQuest style THiNC book with instructions on use. From this point the researcher became participant-observer (Cohen, Manion and Morrison, 2007) and took on the

role of teacher/facilitator.

On the second day, participants teleported directly to the artefact and continued with the learning experience. Before the end of the second day, the group's THiNC book creation was returned to the researcher in the role of teacher, to print copies for each of the participants and to leave a copy for future learners within the artefact.

4.3 Ethics

Participants were provided with note cards providing details about the study. Following this, a note card was sent to them outlining the ethical issues relevant to the study. The ethical considerations were drawn up from the British Psychological Association's guidelines and Cohen, Manion and Morrison (2007). As to reveal the pedagogy underlying the study or the research questions may have skewed the responses of participants, reasonably informed consent was sought from each participant, outlining the learning activity and data collection procedures. Participants were promised confidentiality through the anonymising of data before analysis, and told that they may withdraw from the study at anytime without prejudice.

Before beginning the learning experience, participants were encouraged to ask the researcher any questions they may have and were informed of ways to contact the researcher within Second Life and through email.

Although some may consider that the use of avatars provides anonymity to the users of MUVEs it was decided that the use of all participant avatar names would be anonymised within the data, either on a first or full name

basis.

4.4 Data Collection

Data was collected from a number of sources as recommended by Yin (2003). This provides rigour to the study by collecting extensive data and provides opportunity to validate the accuracy of analysis through triangulation (Creswell, 2007; Cohen, Manion and Morrison, 2007).

4.4.1 Chat Logs

Conversations between participants as they took part in the learning activity were recorded to provide data in answer of the research question.

To ensure that all conversations between participants during the learning experience were recorded, each participant was asked at the start of the study to record their chat logs with time stamps. In addition, the researcher recorded their own chat log. Therefore for each group that took part in the learning activity, each participant created a chat log for each day as did the researcher.

Due to the nature of Second Life, when some one talks in open chat (text based), it can only be 'heard' by Second Life residents within 20meters. As the artefact was 50meters by 80 meters, it was necessary for each participant and the researcher to record their own chat logs through the chat recording tool in Second Life. In addition, in the event of a participant losing connection to the Second Life servers due to computer crash, their chat logs may be lost. Recording chat logs from all participants including

the researcher reduced the possibility of losing any data.

After completion of the case study, each log was aggregated into a Master log for the day and anonymised in preparation for analysis.

4.4.2 Researcher Observations

During the learning experiences the researcher, as participant-observer, kept a log of observations. The time of each observation was noted so it could be used during analysis in conjunction with the activity chat logs. This provided another data source on the actions of participants during the learning experience.

4.4.3 Artefacts

In order to answer the second sub-question and to provide triangulation, images of each of the THiNC book pages created by each of the groups were captured using screen capture software. This provided a record of the content and layout of each artefact created by the groups in completion of the 'Task'.

4.4.4 Interviews

Following the completion of the learning experience, a semi-structured interview was conducted with each group. The chat logs of the researcher were recorded and in the event of a crash, the local chat log a participant could be requested.

Creswell (2007) suggests that the location for the interview should be free from distraction. To facilitate this, participants were taken to a

third enclosed location on the Second Life island with a suitable seating arrangement.

Semi-structured interviews were used to allow two-way communication with the researcher posing a question, listening to answers and modifying subsequent questions dependent upon the answers to the questions (Holstein and Gubrium, 2004). By using open ended questions in a semi-structured interview the researcher was able to be flexible exploring themes that may emerge whilst maintaining the focus of the interview through the use of an interview protocol (Rubin and Rubin, 1995).

Following the interview, the chat log was anonymised in advance of analysis.

4.5 Data Analysis

Prior to analysis all chat logs from the learning experience and semi-structured interview were aggregated into three master documents for each case studied: Day one of experience; day two of experience; and interview.

In order to answer the research question three distinct phases of analysis took place. The first analysed data from the artefacts, chat logs and observations to identify the features of Communal Constructivism within the experience. The second analysed the structured interviews to identify the learners' perceptions of the experience. Finally the third phase analysed the findings of the first phase, the *in vivo* codes of the second and the original artefacts, as three data sets to identify evidence of learning. See diagram below.

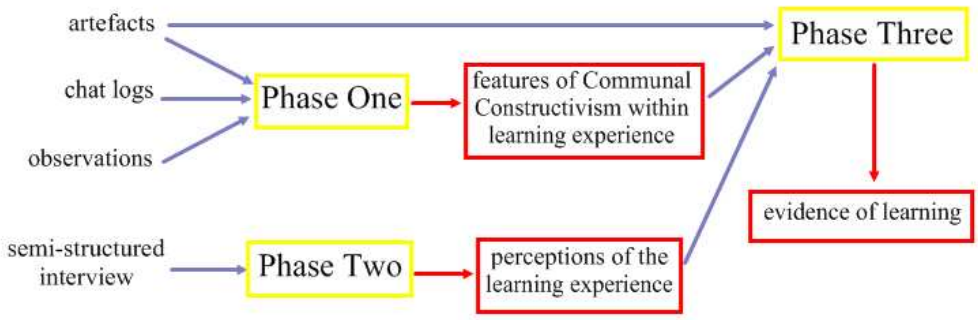

Figure 11: Diagram of data analysis.

4.5.1 Phase One

The initial phase of data analysis focused on answering the first sub-question of the research study:

Were the key features of Communal Constructivism evident during the learning experience?

To assess this a rubric was constructed, listing each of the six features of Communal Constructivism identified in the literature: Interaction with the environment to construct knowledge; active engagement in knowledge construction; active collaboration; publishing for future groups; transfer of knowledge between groups; and a dynamic and adaptive course (Holmes et al, 2001). Interaction with the environment was split into interaction with other members of the group and interaction with the surrounding environment, as designed for in the artefact described in the previous chapter.

As this question focuses on the activity of the learning experience, the chat

logs from each day of the learning experience, researcher observations and the completed artefacts (THiNC books) were analysed and provide triangulation to demonstrate concurrent validity (Cohen, Manion and Morrison, 2007). The first step was for the researcher to immerse themselves in the data by reading each day of the learning experience and looking at the completed artefacts for each case.

After an initial review of the data it was decided to split the 'transfer of knowledge between groups' feature into whether the groups looks at past groups' books and whether there was evidence of them building upon these. This decision was taken as the researcher saw early indications that the first may occur but not the latter.

The researcher then focused on each case (or group) on an individual basis. First the chat logs were analysed for evidence of features of Communal Constructivism. The researcher first read each chat log in order, the chat logs were then re-read with notes of features in the margin. This was repeated allowing the researcher to reassess the data, allowing for construct validity, posing the question "Am I seeing what I think I'm seeing?" (Cohen, Manion and Morrison, 2007). Following this an analysis of the artefact took place, again looking for evidence of the features.

This was repeated for each case and the results are presented in Table 2. This data presented a third data set and was analysed to asses whether each feature of Communal Constructivism was or was not present in each case. The results table created is presented in the Results Chapter below (Table 2).

4.5.2 Phase Two

Social Constructivist case study research typically focuses on the views and opinions of research participants. Phase two of the data analysis focuses on the views and opinions expressed in the semi-structured interviews that took place after the learning experience, through content analysis. The aim of this is to answer the second sub-question: **What were the learners' perceptions of the learning experience?**

The researcher first immersed themselves in the data by reading through the interviews, the text was divided into segments to which *in vivo* codes were applied (see Appendix B for examples). These codes were reduced by removing overlap and redundancy between codes. A spreadsheet was used to support this process. These codes were then collapsed into main themes which emerged from the data. This process was then repeated until the researcher believed they had reached saturation (Creswell, 2007).

This process was repeated for each case individually providing a within-case analysis. Following this a thematic analysis across cases was conducted, providing a cross-case analysis (Creswell, 2007). Each of these is presented in the following chapter.

4.5.3 Phase Three

In order to answer the third sub-question, findings from Phase One and the *in vivo* codes from Phase Two became data, which along with the completed artefacts were analysed looking specifically for evidence of learning. Triangulation is provided through using three data sets and each case was analysed

individually.

4.6 Summary

This chapter has presented the research design, data collection tools and data analysis conducted within the study. The following chapter presents the results of the data analysis. Findings

The methodology chapter outlined the multiple case study design, data collection and data analysis. The data was analysed in two phases, the findings of which are presented below.

5 Findings

The methodology chapter outlined the multiple case study design, data collection and data analysis. The data was analysed in three phases, the findings of which are presented below.

5.1 Phase One: Communal Constructivism within the environment

As described in the previous chapter, the initial phase of data analysis focused on answering the first sub-question: **Are the features of Communal Constructivism present in the learning experience?**

To answer this question a rubric was constructed which was used to analyse the chat logs made during the learning experience, researcher observations and the completed books of each case.. As a multiple case study was used, the findings from each case are presented in Table 2.

Analysis of the data from the first case identified features of Social Constructivist learning taking place. Whilst features of Communal Constructivism were present, as this case presented the first group to take part in the learning experience there were no books created by previous groups for them to gain knowledge from.

The second case presented the first opportunity for a group to build on the knowledge of past groups. Whilst there was evidence of Social Constructivism, the publishing of knowledge for future groups and a dynamic course, the full features of Communal Constructivism were not present. This was also true for case 3.

	Communal Constructivism features	Case				
		1	2	3	4	5
1.0	Interaction with the environment to construct knowledge	✓	✓	✓	✓	✓
1.1	interaction with members of group	✓	✓	✓	✓	✓
1.2	interaction with learing experience	✓	✓	✓	✓	✓
2.0	Active engagement in knowledge construction	✓	✓	✓	✓	✓
3.0	Active collaboration	✓	✓	✓	✓	✓
4.0	Publishing of knowledge between groups	✓	✓	✓	✓	✓
5.0	Transfer on knowledge between groups	✓	✓	✓	✓	✓
5.1	Did group look at the past groups books?	N/A	✓	✓	✓	✓
5.2	Evidence of group using books to build knowledge	N/A	-	-	✓	✓
6.0	Dynamic and adaptive course	✓	✓	✓	✓	✓

Table 2: Communal Constructivist features found within cases

From analysis of the activity chat logs there was evidence of the participants of both case two and three viewing the books created by the past groups. However there was no evidence to show that they built upon this knowledge.

Analysis of the data identified that all features of Communal Constructivism were present in the fourth case. This was the first case which clearly presented evidence of the participants using the knowledge of books created by past groups to build knowledge.

Participants that took part in the fifth case had four books published by previous groups to build upon. Analysis of the data from this case presented the strongest evidence of Communal Constructivism taking place, with participants taking copies of one book for use between learning activity sessions.

The course was not adapted after this case as there were no immediate

future learners to take part in the learning experience, however the teacher provided additional time for completion of the activity as part of a dynamic learning experience.

5.2 Phase Two: Emergent themes

The opinions of participants were collected through the use of a semi-structured interview and analysed using content analysis to code and theme. A within-case analysis took place followed by a cross-case analysis. This section presents the findings of each of these analyses.

5.2.1 Within-case themes

Between three and seven codes emerged for each case. Due to the limitation of space, the main codes to emerge within cases are presented here.

Successful group

Cohesion and interaction between participants of the first case to create a 'successful group' was a significant theme to emerge from the data. Participants "came together" and "interacted" to produce group work that was "more successful than in RL" (real life).

This is of interest as participants within the group did not know each other prior to the learning activity and there were no specific group formation activities that took place prior to the learning experience. This is further explored in the discussion chapter which follows.

Frustration

'Frustration' emerged as a significant theme of the third case. The lack of experience within Second Life of some participants resulted in a frustration in not being able to "get on" with the activity quickly and need to stop and "ask for explanations". It was felt by one participant that this frustration would be a restriction to the knowledge building of the group.

Pressure

Within the fourth case 'pressure' was seen as both a positive and negative and came from a number of sources. One participant described the time pressure of the learning activity as "good", whilst another said that the success criteria "was difficult for the time allowed". One participant felt working as a team restraining whilst pressure also came from the publications of previous groups.

Creation

'Creation' was another important theme for the fourth case. Creation of a group through the completion of an activity, "engaging in construction" and enjoyment all emerged as positive aspects of the learning experience. However, in the discussion of the evaluation, tension between the desires to create and accomplish the rubric was expressed.

5.2.2 Cross-case themes

The early *in vivo* codes that emerged from the within-case analysis of the data were used as the starting point for the reduction of codes into themes for the cross-case analysis. The major themes of time; internal group dynamics;

and between group dynamics which emerged from the analysis are discussed followed by the four minor themes.

Time

'Time' was a theme that emerged as important over the duration of the study. For the first case no codes were reduced into the theme of 'time'. However with each subsequent case this theme became more and more prevalent. Time emerged as a theme in the within-case analysis for the forth and fifth cases, however through the cross-case analysis it was found to emerge from case three (see Appendix C).

With each new case a need for "more time" and the feeling of "pressure" from the time allowed for the learning experience was expressed. As this theme grew, so did the suggested time for the activity from participants, from two additional hours, suggested by participants of the third case, to eight, suggested by the fifth case.

Internal group dynamics

The dynamics of the group within cases proved to be a strong theme across cases. Codes such as "discussion", "cohesion", "support", "creation" and "learning" were all codes associated with the dynamics within groups.

The theme showed no significant change between groups, but only came through as a strong theme through the cross-case analysis. This theme and its underlying codes demonstrate that individual participants valued the interactions within the group for a variety of reasons. Groups were "created through discussion" and through the discussions "knowledge and group identity emerged".

Between group dynamics

As with the theme of 'time', the 'between group theme' only began to emerge in the interview from case three and became more significant to each subsequent group.

Codes such as "building", "pressure", "passing on" and "bettering" emerged from the data. The products of past groups were described as both intimidating and helpful to current groups. The importance of passing on knowledge to future groups was apparent in the forth case and a desire to improve on the knowledge presented by those that had gone before them was particularly strong in the fifth case.

Second Life skills

Across cases 'Second Life skills' emerged as a theme through the analysis. As discussed in the previous chapter, the participants were an opportunistic sample and pre-existing skills and experience in the MUVE were not measured. Therefore participants had a range of skills and experience. "Frustration" was felt by some whilst others "enjoyed learning" the skills necessary to take part in the learning activity.

Participants from the third case expressed a specific need for future participants to take part in a skills orientation prior to the learning experience. Although this was recommended to subsequent participants, there is no evidence of them taking part in the orientation suggested by the teacher. Some participants described how they learned 'Second Life skills' through the learning activity, for those that had difficulty with skills, "help" came from the teacher and other members of the participant's group.

Text versus voice

'Text versus voice' emerged as a theme from discussions during the semi-structured interviews of several groups. For one participant it was an issue of "accessibility", unrelated to any technical requirements. "Speed" was a common code which emerged from discussion on the advantages of text and voice. Text was seen as slow by many, although the "history" created through text chat provided opportunities for review not possible with voice.

Environment

The 'environment' in which the learning activity took place was an important theme across groups. The theme 'environment' did not include specific features of the MUVE but related specifically to the artefact created by the researcher.

"Visual" was a common code across groups and referred to the posters, map and "sense of space". The acts of "travelling" or "wandering" were also mentioned by several participants. Within these codes, participants spoke of an "interactive" experience and a feeling of immersion.

Whilst participants generally agreed that there was a possibility that the learning experience could be recreated outside of the MUVE, the impact of the experience would be lost and would feel contrived. This is further explored in the discussion which follows this chapter.

Evaluation

The evaluation of the completed books, was considered by most participants as unimportant or irrelevant. Most viewed the evaluation pages of

the WebQuest a "guide" to the activity and felt the evaluation process to be irrelevant as they were not enrolled on a formal course. Those that did consider the evaluation process relevant considered they had "fallen short" of the requirements.

5.3 Phase Three: Evidence of learning

The aim of the third phase of analysis, as described in the previous chapter, was to answer the third sub-question: **Was there evidence of learning?**

To answer this question the findings of the first phase, the *in vivo* codes of the second phase and the artefacts were analysed with the question in mind.

From the first phase of analysis and the artefacts, each case showed evidence of actively engaging in knowledge construction. However pages created in the first case's artefact by one participant and again in the second case were copied directly from the notecards or webpages and therefore do not provide evidence of individual learning for these participants.

The *in vivo* codes emerging from the second phase provide evidence of participants learning during the activity across cases. Participants described how they 'enjoyed learning' the specific Second Life skills required to take part in the learning experience as well as learning about the banana trade. They found the learning experience "fun". Within the internal group dynamics, participants described learning from as well as with each other.

5.4 Summary

The findings from phase one of the data analysis present an analysis of the learning activity and the books published within each case in relation to the identified features of Communal Constructivism. Phase two of the analysis identified themes which emerged through the views expressed by participants during the semi-structured interviews. Finally, findings from phase three provide evidence for learning occurring during the experience. Having outlined the main findings in this chapter, an in-depth discussion of these findings takes place in the following chapter.

6 Discussion

The previous chapter presents the findings from the data analysis. This chapter takes these findings and discusses them in greater depth.

6.1 The nature of Communal Constructivism within a MUVE

As presented in the previous chapter, there is evidence that Communal Constructivist features were present during the learning experience. Of particular interest is the evidence of cases two and three.

6.1.1 Transfer of knowledge between groups

While learners in both cases two and three looked at the published knowledge of previous groups, there was no evidence of them using these books in the construction of their own knowledge. From the evidence of subsequent cases neither the MUVE nor design of the learning experience prevent this from occurring.

Within the cross-case theme of 'between-group dynamics' that emerged from the data, the fourth group was the only one to mention the importance of passing on knowledge to future groups. For the fifth group a desire to improve on the knowledge presented by those that had gone before them was particularly strong. However others found the published knowledge of others created feelings of competition and pressure.

While analysis of the data in phase one did not reveal any evidence of case three using the published books of past learners to build knowledge,

their interview transcript reveals that if they had had more time they felt they would have been able to use the knowledge of past groups in their own knowledge construction.

It may be that the published knowledge of these early groups did not add significantly to information available through interacting with the learning environment. It may also be that this feature of Communal Constructivist learning is only affective after several groups have passed through the course. It is not possible from the data available in this study to make assumptions on this matter, thus pointing to a need for further study.

6.1.2 Individual learning

The aim of the third phase of analysis was to answer the sub-question **Was there evidence of learning?** While strong evidence of learning taking place on a group level was found, of particular interest is the evidence of no learning taking place.

Communal Constructivism, as described in Chapter 2, leverages the view of a top-down community, focusing on the learning that takes place within the community as a whole. It was also argued that through the features of avatar and communication, MUVEs would appear aligned to top-down communities.

Two participants, through their completed artefacts, showed no evidence of learning taking place. While other participants with these and other cases did demonstrate learning, these two participants are of particular interest. This would show that while MUVEs and Communal Constructivism appear to facilitate learning on a group level, this can not be presumed on

an individual level. However it is also important to note that there were differences in the opportunities for these individuals to learn as they either had no or only one book published by previous groups to learn from.

As with the transfer of knowledge between groups, it may be that individual learning for some may only be affective after several groups have taken part in earning experience. There is insufficient evidence from this study to draw any conclusions from this and would require further studies.

6.1.3 Time

Time emerged as a major theme in the cross-case analysis of the interview data. This theme is of particular interest as it is not present for cases one and two and grows through cases three, four and five in turn.

As mentioned above, case three felt they would have been able to use the published knowledge of past groups in their knowledge construction had they had more time. Case four had a mixed response to the pressures of time. Whilst some found it useful for focus, others described the evaluation rubric as difficult within the time allowed. The general consensus of the group was that more time was required for the activity.

Due to the adaptive nature of Communal Constructivist pedagogy, as the time constraints of the learning experience became prohibitive to the fifth case, the teacher provided additional time for learners to meet and discuss and extended the overall time of the activity to allow for the publication of the group's knowledge. Learners within this case reported that whilst the time constraints "prompted quick focus" on the task, there was "too much to do" within the time allowed for "the complexity of the task".

6.1.4 Implications

From the findings of this study it would appear that as the number of published artefacts increases across cases, the amount of time required to complete the activity also needs to increase. Through the comments of cases three and five it would appear that this is due to the transfer of knowledge from previous groups and desire to improve the knowledge the community as a whole. As this is a core aim of Communal Constructivism it would appear necessary for each new case to be provided with additional time.

However the additional time requested by each case would be more than sufficient for participants to simply read the books created by past groups. The request for the addition of up to eight hours suggests that as more published artefacts are made available not only is additional time required to read these books but that these books have a significant impact on the time required for subsequent groups to build upon this knowledge.

The addition of time to a learning experience cannot go on infinitum. It is therefore expected that there will be a point of diminishing returns beyond which the addition of time will not improve the knowledge construction that occurs.

6.2 Evaluation

Through the cross-case analysis, 'evaluation' emerged as a significant theme. While some learners described it as irrelevant, others viewed it as a guide to the learning activity. Few learners wished to evaluate their publication against the rubric and those that did felt they had "fallen short'.

'Creation' emerged as a theme in the within case analysis of case four. Whilst creation of the group, engagement in construction and enjoyment were all codes within this theme, a tension between the desire to create and the evaluation rubric was expressed.

As an enquiry-based learning model, WebQuests should provide opportunity for learners to construct knowledge and move beyond the questions posed by the teacher. However the findings present evidence of the evaluation rubric potentially limiting knowledge construction which is at the core of Communal Constructivism and enquiry-based learning as Constructivist learning models.

6.3 Skills

Whilst frustration due to a lack of "SL skills" was evident in the findings of this study, due to the recruitment process of participants this was not unexpected. No minimum skills were required for participation in the project and whilst some found frustration others enjoyed the opportunity to learn these skills through completion of the activity.

6.4 Re-creation outside a MUVE

6.4.1 Environment

The environment that the learning experience took place in emerged as an important cross-case theme. Specific features, tools or affordances of the MUVE were not mentioned by learners in the semi-structured interview, however a feeling of spatial immersion can be identified in the comments

such as feeling "in" Second Life and Second Life feeling very real.

Specific features of the learning experience were referred to within the theme of 'environment'. A sensation of space and the act of travelling were all described in relation to the map. Interaction between the learner and their surroundings were important and generated interest. These interactions were created through the use of scripts which provide a range of affordances. These features were created in response to the design requirements emerging from the literature and matching them with the tools and affordances of Second Life.

Whilst participants generally agreed that there was a possibility that the learning experience could be recreated outside of the MUVE, the impact of the experience would be lost and would feel contrived. Suggestion on how this may be achieved included the use of fields to create a need for travelling and thus recreate the sensation of space and distance achieved by the map. Whilst interactions between learners would be easily recreated the interactions with the environment created within the learning experience would be difficult and feel contrived.

6.4.2 Existing Technologies

Whilst participants of the study did not refer to the recreation of the learning experience through the use of other technologies, Communal Constructivism promotes the leveraging of existing technologies to provide learning environments.

Communal Constructivism encourages products of learning to be fed back into subsequent iterations of the learning task. New communities of

learners are able to take part in similar activities thus providing context to the product. An implicit part of the learning experience was the persistent nature of MUVEs. This allowed for constructed knowledge to be passed between groups. Whilst this may be possible through the use of technologies such as VLEs which also provide various communication tools, a VLE cannot capture the learning experience of previous learners as accurately as a MUVE. The persistent nature of the MUVE Second Life, allowed for each case to go through a very similar learning experience by presenting them with the same environment and resources of past groups, except where the adaptive features of Communal Constructivism impacted on the experience.

6.5 Summary

This chapter has provided opportunity for a more indepth discussion of the findings presented in the previous chapter. This informs the resulting conclusion chapter which answers the research questions, discusses the limitations of the study and suggests areas for future research.

7 Conclusion

The previous chapter presented a discussion on the research findings resulting from the analysis of the data collected during the learning experience. In this chapter we seek to answer the principal research question which has been driving this research study. Following this the limitations of the study and directions for future research are discussed.

7.1 Research question

The principal research question stated in the introduction to this research paper is answered by first addressing the three sub-questions.

Were the key features of Communal Constructivism evident during the learning experience?

The aim of phase one of the data analysis was to answer this question. While it can be assumed that the features of Communal Constructivism would be present within the learning experience as they were designed for in Chapter 3, the manifestation of these features over time and the dynamics between groups could not have been presumed.

Only by the third case were all features of Communal Constructivism present during the learning experiences.

What were the learners' perceptions of the learning experience?

Learners enjoyed the interactions and learning that occurred within

the groups. They were challenged by the time constraints and published knowledge of previous groups. They enjoyed the creation of knowledge through the building of the artefact and found the environment in which they learnt stimulating and supportive.

Was there evidence of learning?

Through the analysis of the data there was strong evidence of learning taking place during the learning activity. However the discussion in the previous chapter highlights that while learning occurred across cases at a group level, not all participants demonstrated evidence of learning in their completed artefacts. In addition, the findings suggest that while topic specific learning took place, the necessary MUVE skills required to take part in the learning experience were also learnt.

How affective is Communal Constructivism within a MUVE?

The answers to the previous sub-questions leads to a conclusion that Communal Constructivism is an affective pedagogy for use in MUVEs. The design implications of the features of Communal Constructivist pedagogy were met through the persistent nature of the MUVE and the avatar, communication and building features. This provided opportunity for the features of the pedagogy to be present in the learning experience, which analysis of the data found positive evidence. The evidence from the study also demonstrates that learning took place through an enjoyable and stimulating

learning experience.

7.2 Unexpected Outcomes

The aim of this study was to identify an appropriate pedagogy for use in MUVEs and assess its affectiveness. However this study has presented a number of unexpected findings about Communal Constructivist theory.

Previous studies on Communal Constructivism have provided evidence in support of the theory. However this study provides us with a new understanding of the theory in practice. As discussed in the previous chapter, evidence from this study suggests that with each subsequent group that takes part in a learning experience, additional time is required by the group. It is suggested that this additional time is to facilitate not only the passive viewing of published artefacts but the active building of knowledge

As this study was conducted within a MUVE, the findings presented here are not generalisable outside of the technology. However they point to a need for further research to establish whether these findings are replicable in other technologies.

7.3 Limitations

The discussion highlights that for some learners the Second Life skill set that was required for participation in the activity was a barrier to active engagement in knowledge construction. Whilst participants for the study were recruited through groups of existing users of the MUVE, not all participants had the same skill set. While for some this may be due to their

relatively new presence within Second Life, these skills remained a problem for some more experienced users. If the study was to be repeated a more selective sample could be used, or an orientation activity introduced for all participants to take part in to provide opportunity for up-skilling prior to taking part.

Although Creswell (2007) states that the multiple-case study approach results in a less in-depth analysis of data, this study is limited by the extent to which it can generalise as only one overall learning experience was studied. To add validity to the study it may be necessary to repeat the study with a different learning experience and comparing the findings between learning experiences.

Finally, whilst MUVEs provide opportunity for users around the world to collaborate, this is often restricted by location within time zones. The impact of time zones for this study meant that whilst some participants in the first case were experiencing the activity at 9am in Australia others within the group were experiencing it at 4pm the previous day. Each case had participants taking part in the learning experience at different geographical times. Although this provides a limitation to the study as geographical time was not consistent within or across cases, it is also one of the potential advantages of this technology.

7.4 Future Research

Future research could be conducted to address the limitations of this study. In addition, the discussion chapter highlights specific areas that require

further research to answer questions.

Transfer of knowledge between groups provides two areas for further study. Firstly, the previous chapter discusses the affect of the number of knowledge artefacts and the need for more time. If time is added as the number of published artefacts increases does a deeper engagement in knowledge construction take place? Does it provide opportunity for learners to extend the knowledge of the overall community? Secondly, is there a need for a certain number of artefacts before subsequent learners move from passively receiving the artefacts of past groups and actively using them to build knowledge? Or is it more simply a matter of quality in the artefacts of previous groups that affects how they are used?

Future research may also explore the learning at an individual level within groups over each iteration. Finally, the previous chapter questions whether the evaluation rubric, part of the WebQuest model restricts knowledge construction. From the literature reviewed there is no evidence of this to date. Therefore further research into this may provide valuable insight into the role of evaluative rubrics in enquiry-based learning experiences.

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9 Appendix A: Second Life tools and their affordances.

Tool	Affordance
Text chat	Public, text based, synchronous communication
Voice chat	Public, aural, synchronous communication
Instant Messaging through text	Private, text based, synchronous and semi-asynchronous communication
One-to-one voice chat	Private, aural, synchronous communication
Chat logging	Recording of text based chat Recording of instant messages
Avatar	Sensation of presence Non-physical contact with objects Movement Serendipitous encounters Giving and receiving of objects, notecards, textures etc.

Inventory	Storing of objects, textures, photographs, notecards, landmarks and animations
Teleport	'Instant' transportation
'Build'	Creation of pre-prescribed objects (prims)
Rotation	Rotation of selected object within environment
Resize	Resizing of selected object within environment
Position	Positioning of selected object within environment
Permissions	Affect ownership rights of selected object
Physical properties	Alter the physical laws acting upon an individual object
Content management	Add or remove content such as scripts and other objects to an object
Scripting	Once added to an object through the content management tool, scripts bestow a number of affordances to an object such as: movement, physical change,the giving of content, sensors, opening, etc.

Heads-Up Displays (HUDs)	The viewing of an object without bringing it 'in-world'.
Notecards	Display of text
	Transfer of text between avatars
Texture	Display of an image
	Transfer of images between avatars
	Application of texture to selected objects.
Objects	Grouping
	Touching
	Taking
	Sitting
Camera	Viewing of environment
	Zooming
	Perspective changing
Uploading	Creation of textures

10 Appendix B: Sample extracts of *in vivo* codes.

***In vivo* code**	**Group 1 interview text extract**
	[14:35] Researcher: Was it any different in Second Life to working as a group in real life?
pushing	[14:35] BF: I did feel like I had to do a bit of rounding up and pushing at times, but maybe that is because I am pushy.
came together	[14:36] WP: I liked the way everyone came together and
question, interacted	asked questions and interacted with each other
slower	[14:36] SE: Slower
	[14:36] Researcher: how so SE?
text slows	[14:36] SE: Text slows things down
text slows	[14:36] BF: Everything in SL is slower in chat. Voice
voice speed	would speed it up.
	[14:36] BF: If we were all voice enabled.
mystery	[14:37] ZD: voice takes the mystery out of things. I
appearance	think appearance is a very curoius part of this project.
	[14:37] SE: agree
prefer	[14:37] BF: I prefer chat, except when I am listening to a lecture.

***In vivo* code**	**Group 4 interview text extract**
group work	[10:15] SJ: i don't feel either the book or the group work
level	would have reach the"required" levels
overwhelmed	[10:15] AE: I was a bit overwhelmed with it all yesterday
books again	[10:15] AE: if I could have looked at the other books again yesterday
	[10:15] AE: I would have appreciated that
never heard of	[10:15] SJ: i had never heard of the nth/sth thing b4
more time	[10:15] MD: i'd have liked more time. the what thing?
	[10:15] AE: North/South
	[10:16] SJ: north-south as a view of the have and have nots
lots of info	[10:16] AE: it was lots of info
pressure	[10:16] AE: but the pressure to cut to the heart of it was good too
restraint, team	[10:17] SJ: i felt a big restraint to work as a team and not do
organise	the gung ho, organise thing

***In vivo* code**	**Group 4 interview text extract**
dynamics of group	[10:23] AE: I appreciated the dynamics of this group
discussion	[10:23] MD: the discussion was whre we found
common ground	commoon ground
considerate, supportive	[10:23] AE: very considerate and supportive
lively	[10:23] MD: i loved the lively political debate
	[10:24] Sleepy Littlething listens
knowledge emerged	[10:24] IF: both the knowledge and the group
group identity	identity emerged in discussion
not afraid	[10:24] MD: and not afraid to say stuff
	[10:24] AE: erm...koffs
	[10:24] MD: yes agreed and that is how i created my slide
	[10:24] Researcher: koffs????
	[10:24] MD: ok AE was afraid to say stuff
	[10:24] MD: hahaha
	[10:24] AE: ==tends to talk too much sometimes
	[10:24] AE: not at all
	[10:24] MD: no you were great!
plod along	[10:25] SJ: me too AE, was good just to plod along
personally responsible	with the group and no feel personally responsible for the outcome

	[10:25] MD: not everyone wants to talk all the time
	(well ok the odd one maybe not AE)
	[10:25] AE: yup
cohesive	[10:25] AE: it had a nice coheasive feel
explored	[10:25] MD: i liked the way we explored so much too
verbatim	[10:25] MD: rathr than just quote verbatim
important, pass on	[10:25] MD: dunno it was important that we passed
group's view, new	on our groups view and that we had something new to say
	[10:26] SJ: still, i didn't put in any refs or
structure	anything to structure and argument
	[10:26] MD: if we'd done that we'd have had a huge book
	[10:26] MD: neither did i
	[10:26] AE: we could write a hige book!
	[10:26] AE: a wiki-book
	[10:26] MD: socialist bananpedia
	[10:26] AE: exactly
tension	[10:27] IF: Yeah, I noticed some tension between the
	desire to create and accomplish the rubric

11 Appendix C: Cross-case *in vivo* codes in theme of 'time'.

***In vivo* code**	**Group**
went quickly	2
anticipation	3
more time	3
quickly	3
liked more	4
went quickly	4
pressure	4
remind	4
short	4
absorb quickly	4
out of time	4
2 hours	4
rubric in time allowed	4
rezing	4

too much to do	5
8 hours	5
promted quick focus	5
extra time	5
in depth 8 hours	5
full day	5
reflection	5
adding time	5
time to learn	5
assemble	5
constraint	5
availability	5
convenient	5
pressure	5
not enough	5
quicker	5
rush	5
missed information	5
own time	5
lack	5