Virtual World Global Collaboration: An Educational Quest

Abstract

Purpose:

This research case study shares the partnership between librarians and educators to create a *live* digital literacy experience at *The Quest (Camelot Project)*, a virtual world medieval simulation. The purpose of the partnership was to gain understanding of the learning elements addressed with a group of participants from across the globe, working at various skill levels, and interacting with an immersive virtual world simulation.

Design/methodology/approach:

Using field notes, machinima, and interviews (Participatory Action Research), the study identifies learning elements within three contexts: technological, pedagogical, and content. Learners cycle toward intended learning outcomes in a virtual world treasure hunt game from the perspective of both designers and participants.

Findings:

Findings of the case study illustrate the value of collaboration in a Digital Game-Based Learning (DGBL) environment through scaffolding of knowledge and skills in a virtual world. Findings exemplify the experiential learning cycle within a virtual world for constructing learning, and support a proposed new theoretical framework of technology-mediated learning which may help educators in both design and implementation.

Originality:

As virtual worlds and immersive learning opportunities continue to expand for learners and educators, this study shares the value of experiential learning from the perspective of both the teacher and the learner. Socially constructing knowledge and acquiring skills across distance with a team of librarians and educators is an innovative example of Digital Game-Based Learning in an alternative reality setting.

Keywords: virtual worlds, immersive learning, Constructionism, role-play, serious games, global collaboration, simulations, Participatory Action Research, digital literacies, Game-Based Learning, Digital Game-Based Learning

Paper type: Research paper

Introduction

Background of the Quest

The intent of the Quest was to introduce the use of the virtual world to the training of digital literacies in a course titled “The Musical” at a university in Hong Kong. Funded by a teaching development grant, a simulated medieval village was designed and constructed by the co-author (Brant Knutzen) on a full region in the Second Life (SL) virtual world, which is an island covering about 16 acres, or over 65

thousand square meters. To train and support the sixteen students taking the Musical course in the virtual world, Brant developed a supplementary course called the Virtual Classroom using the Moodle LMS, on a server with a customized Participation Forum plugin installed to automatically award points as the students contributed to an online discussion. In collaboration with the subject teacher, Brant developed and then facilitated five Participation Forum small-group formative assessment activities to support student exploration of the Second Life virtual world, worth a combined total of 20% of the course grade.

The Quest was then developed by Brant as a game-based learning (GBL) training exercise within the virtual world, with a series of 10 challenges designed to promote specific user interface skills. Each challenge consisted of a genie lamp that gives each participating Questor a written clue at the start (see Figs 1 and 2), a path littered with secret doors and surprises (see Fig 3 and 4), and a treasure chest as a goal, which rewarded successful completion with medieval clothing and accessories (see Fig 5). A "magic door" then teleported the Questor to the starting point of the next clue, a place far removed yet still on the same virtual island.

Figure 1. Two Questors near the genie lamp which gives the first clue

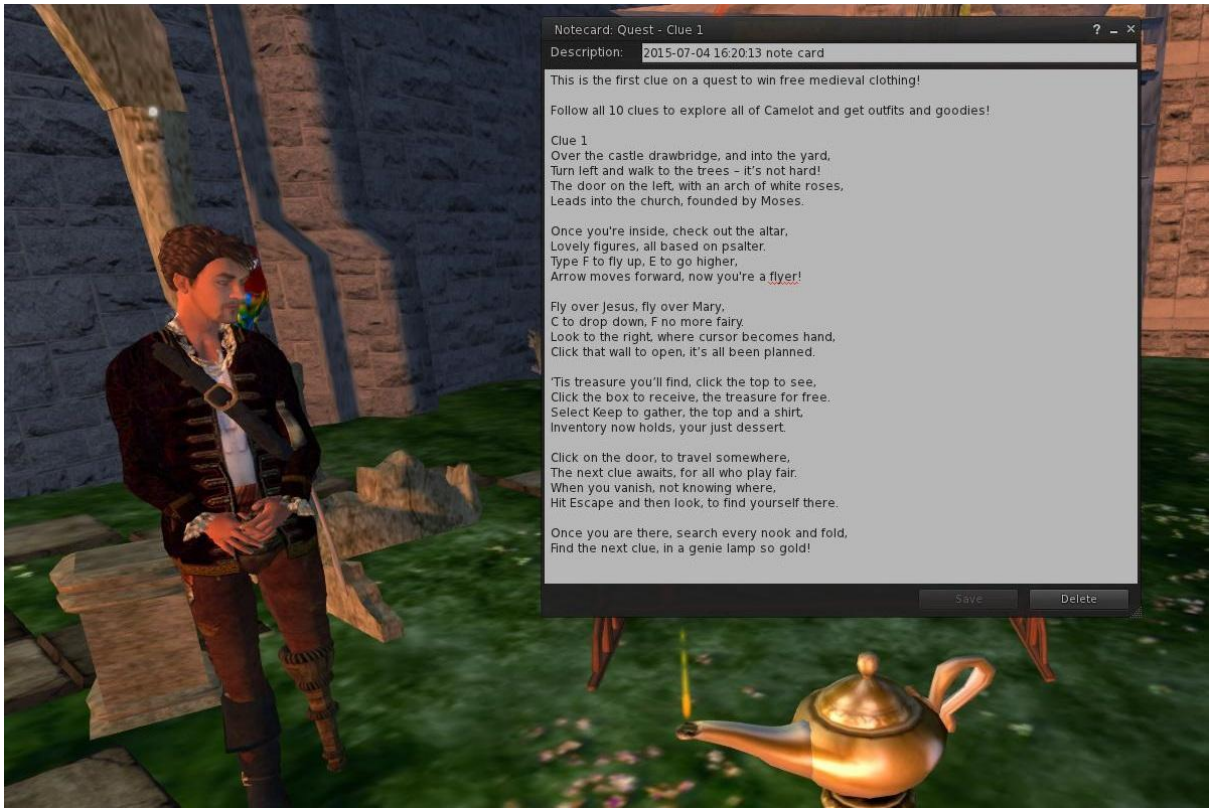


Figure 2. The avatar of Brant with the genie lamp for Clue #1.
Note the tutorial for the basic commands embedded into the poetic clue.

Figure 3. A couple of Questors collaborating on following a clue

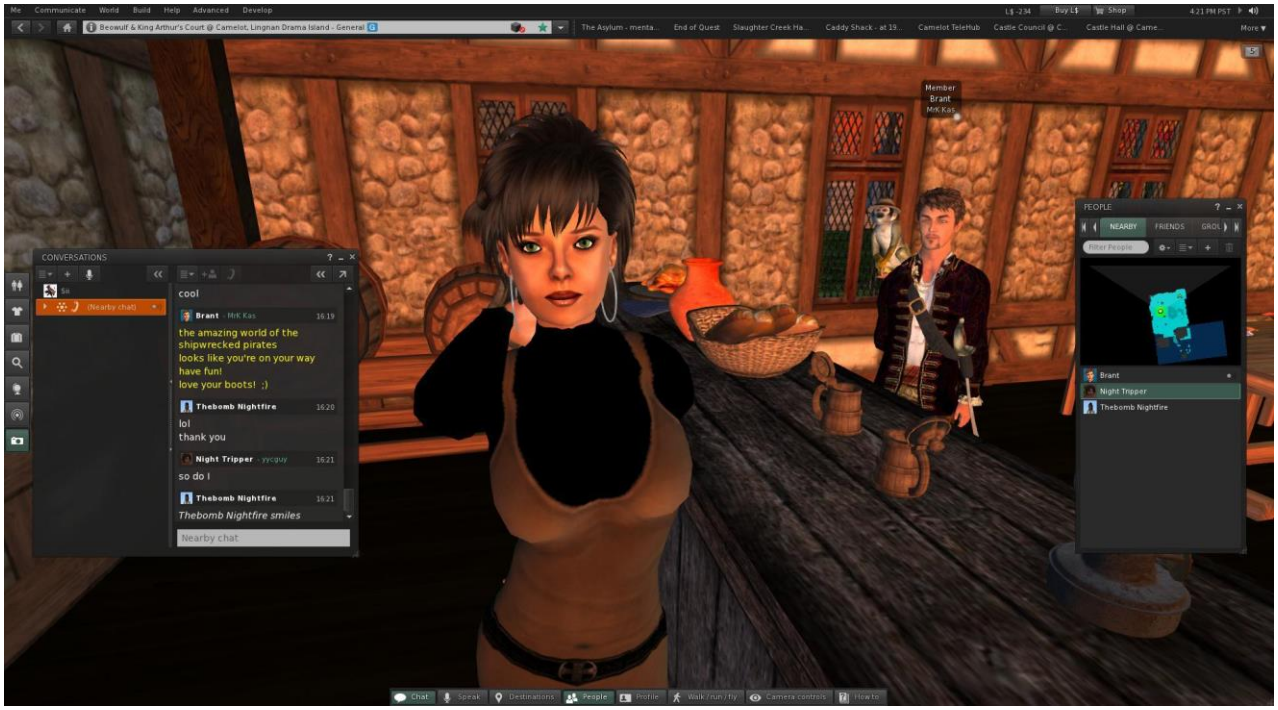


Figure 4. A Questor inside the Seahorse Pub, IM chatting with Brant along the way

Figure 5. The goal of each clue: find a hidden treasure chest and use the magic door to go to the next clue

Much like a blindfold and three spins in the “pin the tail on the donkey” game, the teleportation provided by the magic doors would remove each Questor from the previous location context, thus forcing a focus on the careful comprehension of the next written clue, and comparison with the new virtual location, to stay on the

required path to the next goal. Arrival points might be in a dusty attic, inside a cell in the castle dungeon, or high on the edge of a cliff overlooking the sea.

The intended learning outcomes of the Quest were in all three of Bloom's domains of knowledge. After completing the Quest, each Questor should be able to:

Cognitive

- correctly list the steps and explain to others how to control their avatar
- follow the procedure to open and utilize navigation tools
- relate their position to landmarks within the virtual world

Psychomotor

- demonstrate new hand-eye-mouse skills controlling:
    - their avatars
    - camera control viewpoints
    - menu controls of the viewer software

Affective

- demonstrate confidence and optimism in their attitude towards solving navigation and avatar control challenges in the virtual world (reflecting higher levels of self-efficacy and perceived usability of the technology)

Students were extrinsically motivated to earn points by participating in their group areas on the discussion forums: relating their experiences, seeking assistance on difficulties, communicating their needs, providing support to peers, and reflecting on their learning. See Figure 6 below for a graphic produced by the Participation Map, a learning analytic developed by Brant as a Moodle plugin for displaying individual and group-level activity on the discussion forums. This graphic has been generated using the Anonymous Plot function, to remove all personal identifiers such as student names, user IDs, Moodle profile pictures, course name, etc. The Y axis is time in days, from the forum start at the bottom to the deadline denoted by the red line at the top, which in this instance was 26 days. The X axis displays the forum posts of each student in The Musical course using an assigned unique color, and grouped in the five forum threads. The three-student group project planning discussions are on the left, and on the right, are two formative discussion threads hosted by the researcher to organize the group development of student project plans and purchasing budgets, and to scaffold stage setups. Each colored node denotes an individual student forum post, and the arrows indicate the post to which they are replying. The learning analytic and graphics were developed by Brant to track the patterns of student participation, and quantify the group-level productivity on the Moodle discussion forums, thus creating a feedback mechanism to guide and motivate a consistently high level of student interaction on formative assessment activities.

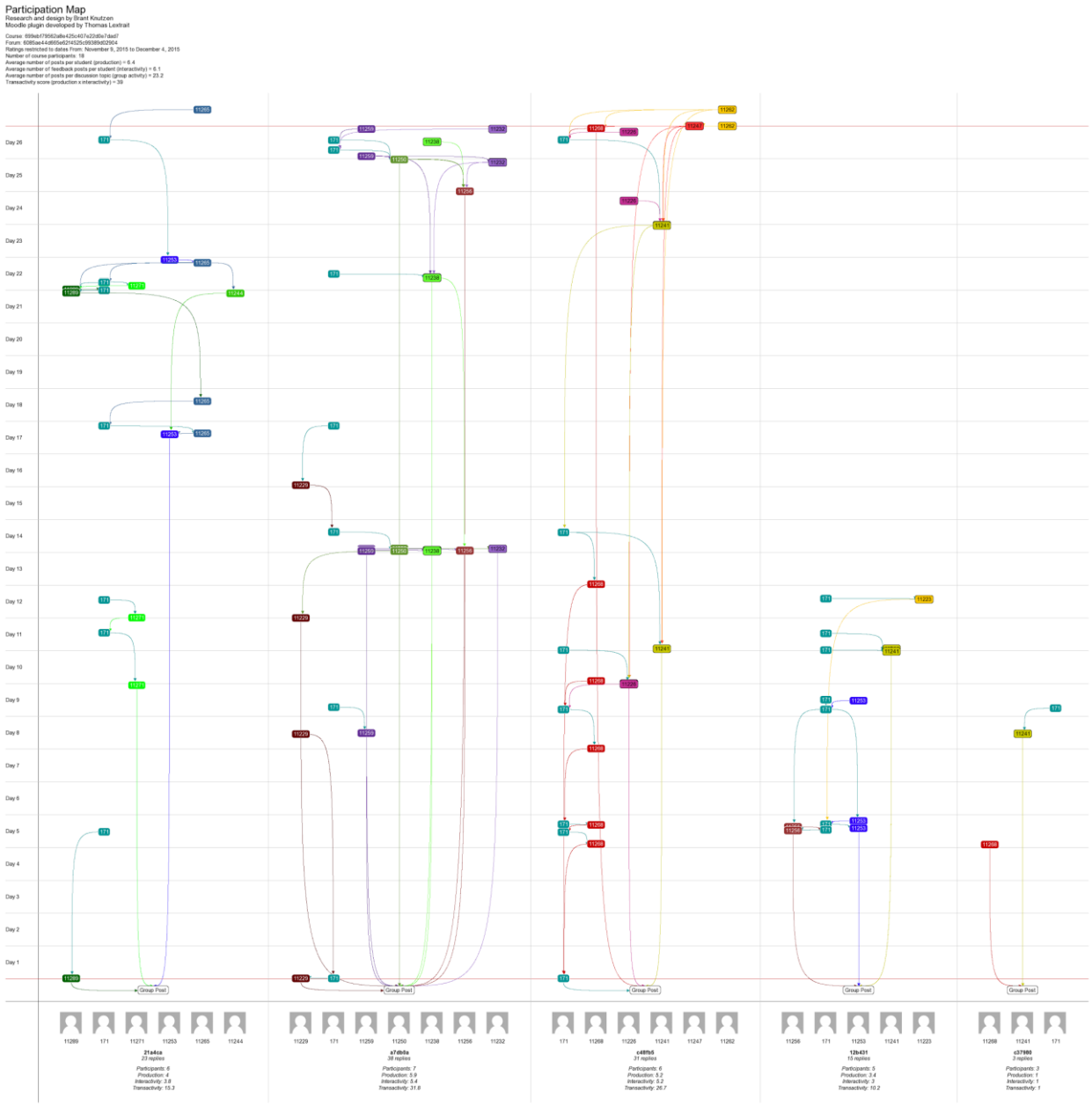


Figure 6. Participation Map displaying individual and group-level student activity on the discussion forum for planning their video production projects.

This foundation of collaborative participation supported the students as they attempted each successive challenge presented by the Quest (Knutzen, 2013). Exploration of the virtual world in small groups created an intrinsic motivation based on several factors: social pressure, engagement with a novel environment, and that elusive joy that is labeled as “fun” when secrets are discovered and puzzles are solved.

During the Virtual Worlds Best Practices in Education (VWBPE) Conference (a global online conference presented in several virtual worlds) librarians at the Community Virtual Library served as tour guides and role-players for a live interactive event (VWBPE, 2016). The collaboration between fifteen librarians and educators across the globe is the focus of this study, which illustrates the learning

elements embedded in the immersive learning experience.

Literature review

Background of virtual worlds for education

Learners build deep understanding and expertise by cycling through the four steps of the experiential learning cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb and Kolb, 2009). Jarmon *et al* (2009), applied the experiential learning approach in their interdisciplinary collaborative project using the virtual world of Second Life (see Fig 7), and found that learning was enhanced by the careful combination of instructional design with several of the affordances of the virtual environment, including (p. 175):

- the relevance of the problems to the real world
- communication tools to facilitate social interaction and collaboration
- the capacity to support active testing of solutions
- the opportunity to use multiple abilities and skills
- the stimulation of imagination, exploration and creativity
- an increased sense of personal presence and tangible experiences

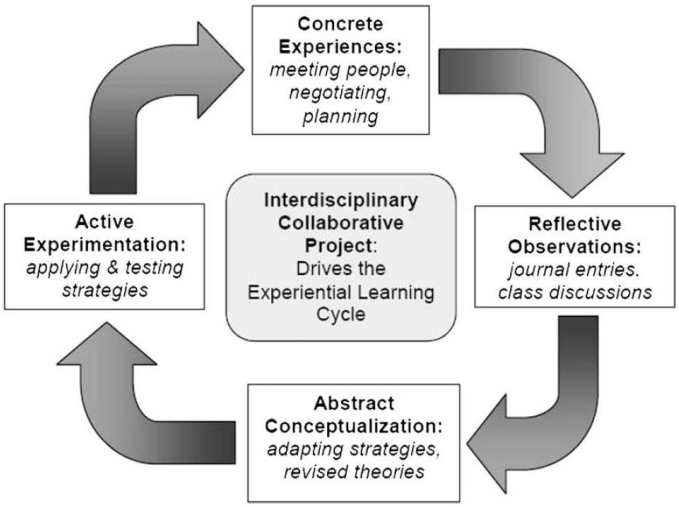


Figure 7. The experiential learning cycle applied to an interdisciplinary project in the virtual world (Jarmon *et al*, 2009)

The learning experience created by the Quest includes both a principled approach and a set of contextualized practices specifically adapted to the teaching situation (Beetham and Sharpe, 2013). This postmodern process of constructing knowledge and skills is provisional and culturally specific rather than discovered (Hassan, 2003). The design of new types of learning experiences is a highly-valued activity in a digital economy, and increasingly important as educational interactions primarily take place within a designed space or interface (Beetham and Sharpe, 2013). New learning technologies afford remote learners the ability to interact with each other, and with

representations of content, in entirely new ways via networks of computers linked together to create virtual learning environments. The most recent developments in learning theory have emerged from the new capacities of learners to be continuously connected with others using a broad spectrum of technologies, from IM chatting to social networking (Siemens, 2005).

In an educational virtual learning environment, the students need to develop digital literacies such as communicating via multiple channels, collaborating with groupmates, and negotiating their roles and identities in the knowledge-building online community. McConnell (2006) notes that the use of digital media for learning interactions can alter roles and relationships in networked collaborative e-learning. The design of e-learning activities should build on these technology-mediated relationships and interactions to create sustainable processes that lead to desired learning outcomes.

Immersive learning in virtual worlds is similar to learning through massive multi-player online games (MMOGs) and includes cognitive, social and affective aspects. The *cognitive* aspect includes the knowledge and skills acquired through the process of the game. Interactions with other individuals and groups provides a *social* aspect and the motivation of engagement (or fun) provides the *affective* aspect. Voulgari (2014) states, "Motivation and positive feelings and attitudes towards the learning environment are shown to increase attention and engagement with the activity and to have a positive impact on the cognitive strategies of the participants and the learning outcomes" (Voulgari *et al*, 2014, p. 247).

Educators began to explore the use of virtual worlds such as Active Worlds and Second Life around 2005, and by 2008 a survey by Kirriemuir found about three-quarters of UK universities to be actively researching Second Life, the most mature of the social virtual world platforms (Warburton, 2009). A review of the studies exploring the educational application of Second Life found that by 2012 research had evolved into rigorous empirical studies involving teacher and language education, mostly in higher education (Wang and Burton, 2012). From 2007 to 2011 the majority of empirical research involving Second Life explored the effects of instructional strategies, and the most recent studies had begun to examine factors that could affect SL-based learning activities, such as student motivational levels. The current study builds on prior research into the educational application of the 3-D virtual world Second Life, and examines the design of problem-based learning to motivate and guide student learning activities, and ultimately impact on learning outcomes. This research seeks to identify instructional strategies which enhance the learning outcomes, such as developing virtual Quests to gamify student skills training, and supplementing the synchronous learning experiences in the virtual world with asynchronous text-based discussions.

Designing virtual world immersive learning experiences is a relatively new pedagogical arena; however, the demand is increasing as students live in a technology enhanced digital culture. A research study based on Papert's (1991) theory of *Constructionism* examined high school students' engagement in a blended instructional format of both face-to-face and virtual world simulation in Second Life.

The findings concluded, “Finally, there is the apparent and urgent need for the introduction of an instructional design framework that will help and guide instructional designers for the efficient use of games and simulations in programming courses for high school students, and more precisely to create game-like learning environments” (Pellas and Peroutseas, 2016, p. 137).

Students at all age levels can find virtual world learning experiences motivating in many subject areas. For example, a research study in Turkey measured students’ attitudes towards Mathematics after encountering a virtual world Mathematics robot in Second Life. A group of 28 third graders were provided an opportunity, with permission from parents, to use the virtual world as an educational simulation. The majority of the students had an increase in interest alongside a decrease in fear of higher level mathematics concepts. Findings showed “ It can be stated within the light of this finding that the increase in the sympathy and the motivation toward mathematics mobilized the academic success in a desired course (Simsek, 2016, p. 167)”.

The Global Classroom project was developed as a collaborative effort between the English language centre of a Hong Kong university and a TESOL course at Texas A&M university in the US. Knutzen (2012a) designed an art-deco restaurant and beachside campfires as immersive social experiences within the virtual world to support a synergistic partnership between student language learners and student language teachers. The study found that although the participants primarily used typed IM chat to interact, when audio voice interaction could be achieved, it was highly preferred and judged to be a superior learning experience: “The immersive virtual environment offers a very good simulation of face-to-face interaction, with its fast-paced small talk and informal language style” (Knutzen, 2012a, p. 99).

A collaborative project across thousands of miles allowed college students in Singapore to interact with students in Hong Kong. Rahim (2012) designed an immersive experience which was found to have positive effects on students’ learning, motivation and attitudes towards learning. “With this knowledge sharing project, Singapore students have been able to virtually meet, discuss and share knowledge online with other students in Hong Kong, thereby providing a more stimulating and independent learning environment which enhances the effectiveness of teaching and student learning" (Rahim, 2012, p. 3).

Game-Based Learning has potential for motivating learnings through engagement and Digital Game-Based Learning (DGBL) may grow in the future as virtual environments become readily accessible through the growth of technology applications. Erhel and Jamet (2013) studied 44 participants comparing traditional quiz style learning with a digital game environment on a health-related topic. The men and woman studied found the DGBL experiment motivating through KCR (*knowledge of correct responses*) feedback. The study concluded “deep learning is indeed compatible with an entertainment instruction, provided that the digital learning game is accompanied by features such as feedback, to help learners mobilize deep cognitive processes” (Erhel and Jamet, 2013, p.164).

A research study on virtual environments used for cultural learning reviewed six virtual learning environments based on cultures around the world (Spanish, Chinese, Iraqi, Dari, Pashto, and French). Findings concluded, “The immersive, affective power of games might go a long way towards enabling us to change students’ attitudes towards other cultures (Lane and Ogan, 2009, p. 9). Just as with all media forms, accurate depiction of cultural elements is imperative and librarians may serve a role in the evaluation of these learning environments to examine authenticity, bias, or historical accuracy.

Bulu (2012) presented three types of presence found in virtual worlds: place presence, social presence and co-presence. This “sense of presence” is experienced by learners when embodied as an avatar and immersed in a virtual space. The Medieval village built for the Quest illustrates all three types of presence, particularly when experienced at a live event such as the Virtual Worlds Best Practices in Education Conference where role-players served as guides to participants.

Librarians have been utilizing virtual worlds for over a decade as illustrated by Gantt and Woodland (2013). After examining over 75 virtual libraries, in the virtual world of Second Life (SL), researchers opined “Building on the experiments and successes we have documented in SL, we are confident that libraries and information space will be created in new virtual environments” (Gantt and Woodland, 2013, p. 138).

In a study of Second Life libraries, a library director believe there were four reasons for exploring virtual worlds for librarianship: (1) to examine new technologies and services for patrons, (2) to prepare for an increasing demand for virtual services as patrons become digital natives, born with the Internet, rather than digital immigrants, (3) to provide a platform for librarians to be leaders in new technologies rather than merely followers, and (4) to utilize immersive virtual worlds as a cost effective way to network and offer services with the largest expense being allocated staff time (Chow et al, 2012, p. 493).

Sharing new formats for multiple literacies aligns with the core values of librarianship. Literature-based game platforms provide opportunities for learners to “enter” stories as active participants. Researchers in game design show evidence of the importance of narratives and storytelling within immersive games. A study of alternate reality games (ARGs), states, “Further, the storyline should remain in the foreground as the interface, so that the technologies used to convey the story are as transparent as possible to players” Bonsignore, 2016, p. 64).

Research shows evidence of numerous benefits for librarians using virtual worlds. Hill states, “Among those advantages, resource delivery, professional development, educational content, virtual field trips, collegiality, and a shared sense of presence were indicated most often” (Hill, 2012, p. 108). In fact, the library may be a perfect place for students to encounter virtual worlds for learning. After working with 5th graders, designing a digital citizenship game in Minecraft, a school librarian wrote, “The library, in this case, worked well for providing the time and space to explore embedding information literacy elements through innovative technology”

(Hill, 2015, p. 381).

In a study of educational use in the virtual world of Second Life, 14 tools for learning and sharing information were illustrated by Hill and Lee (2009), including publishing, performing arts, reference help, classroom experiences, and live presentations. These tools exemplify potential for Participatory Action Research as immersive spaces, such as Minecraft and Second Life, require participatory experience. Educators and students may share experiences created for Digital Game-Based Learning and also have opportunities and tools available to create those experiences themselves.

Future pedagogical models for education will no doubt include digital spaces: virtual worlds, augmented reality (AR) and virtual reality (VR). These digital spaces will provide new opportunities for digital literacies, allowing learners to "enter the book" and experience history, art, and all subject areas through constructing learning collaboratively. Librarians are in a perfect position to embrace and advocate for new learning modes for digital literacies. Hill writes, "Librarians have been in the forefront of technological change for decades and are well suited to advocate and teach information literacy in a global digital participatory culture" (Hill, 2016, p. 233).

Methodology

Participatory Action Research

Using a Participatory Action Research (PAR) method, the study identifies learning elements within three contexts: technological, pedagogical, and content elements (see Fig. 8). Data was gathered using field notes, machinima, and interviews, a tri-fold observation or triangulation analysis. The advantages and benefits of immersive learning environments are explored alongside disadvantages and obstacles.

Because the Quest is an immersive Digital Game-Based Learning experience, the study aligns well with PAR requiring consideration of the participatory nature of experiential learning. Glassman and Erdem (2014) explain three elements comprising PAR: participation (vivencia), action (praxis) and research (reflection or understanding). The personal experience is described with a Spanish term "vivencia", stating the following:

> "Vivencia can be defined as a full experience of an event with its all possibilities, lived through direct participation. In other words, vivencia cannot be observed; it can only be lived, felt, and experienced. Although there is no equivalent word in English for vivencia, we believe the concept is closely linked to the idea of participation in PAR (Glassman and Erdem, 2014, p. 212)."

Praxis, or the action element of PAR, suggests dynamic engagement rather than passive intake of information. The learner engaged in a DGBL experience, such as the Quest, is fully and actively engaged with the environment, the content and the community. Thus, praxis compromises the personal involvement of participation,as

researchers state, “It is an exploration of participants in praxis as to why they engage in their own actions and why they conduct them in the ways they do” Glassman and Erdem, 2014, p. 214).

And, finally, the *research* element of PAR includes reflection or understanding of the purpose and meaning of the learning experience. Digital computerized games may be enjoyable and entertaining, but critical thinking and inquiry is required in order to make them educational. The personal involvement in participation, action, and reflection makes the learning experience *hermeneutical* or open to personal interpretation of a “lived” experience. Combining this understanding with participation and action is illustrated in this study of the Quest, a digital literacy learning experience.

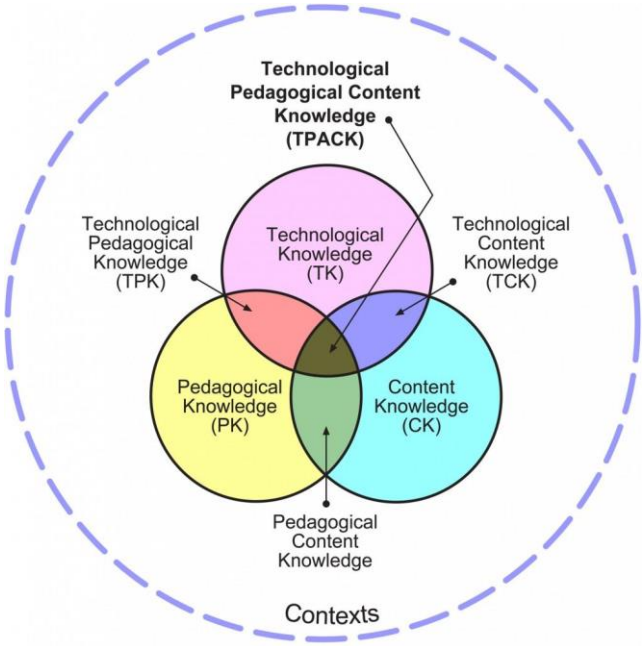


Figure 8. TPACK Venn Diagram

Project Overview

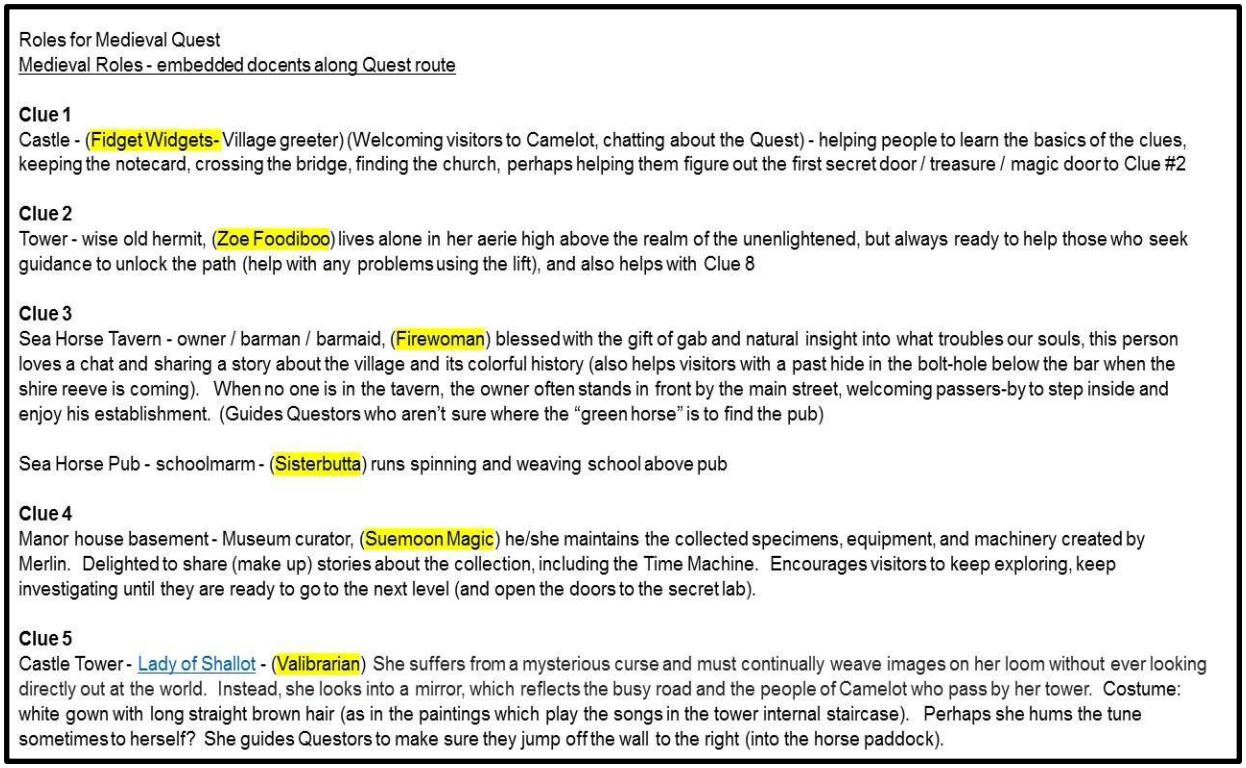
The designer of the Quest, co-author Brant Knutzen, developed a historical simulation within the virtual world of Second Life for training digital literacy skills, either alone or in a group setting. As a special event for the Virtual Worlds Best Practices in Education Conference 2016, Brant invited the Community Virtual Library to collaborate. The recruitment and training of role-model guides would be a joint venture between Brant and co-author Valerie Hill, the leader of the Community Virtual Library. A call for librarians and educators to serve as role-players and tour guides was sent through educational groups.

Planning and training sessions for the role-player guides were held in Second Life. The live VWBPE 2016 event was attended by educators around the globe- in the United States, Mexico, and Japan, for example. Through embedding curriculum into a 3D immersive learning simulation, technological, pedagogical, and content learning elements were documented.

Field Notes

Planning and preparation for the live VWBPE event at the Quest included use of inworld communication tools as well as email and sharing of resources through Google Drive. The collaborative online tools helped embed the technological content, the pedagogical (teaching design) elements, and the curriculum content of the project into the virtual world experience. Participants were sent a list of possible role descriptions for characters supporting the Quest, along with suggestions for historical attire, medieval speech patterns, and links to literature.

Practice sessions were held in Second Life, with the leader playing the role of a newcomer with very little virtual world experience. Through email communication and inworld group notecards (delivered in Second Life), the librarians and educators collaborating on the project used asynchronous communications to arrange synchronous in-world meetings. Schedules and documents about the project were shared through Google Drive. For example, a press release was shared through a Google Documents link and participants signed up for various roles (see Fig 9).



Roles for Medieval Quest
Medieval Roles - embedded docents along Quest route

Clue 1
Castle - (Fidget Widgets- Village greeter) (Welcoming visitors to Camelot, chatting about the Quest) - helping people to learn the basics of the clues, keeping the notecard, crossing the bridge, finding the church, perhaps helping them figure out the first secret door / treasure / magic door to Clue #2

Clue 2
Tower - wise old hermit, (Zoe Foodiboo) lives alone in her aerie high above the realm of the unenlightened, but always ready to help those who seek guidance to unlock the path (help with any problems using the lift), and also helps with Clue 8

Clue 3
Sea Horse Tavern - owner / barman / barmaid, (Firewoman) blessed with the gift of gab and natural insight into what troubles our souls, this person loves a chat and sharing a story about the village and its colorful history (also helps visitors with a past hide in the bolt-hole below the bar when the shire reeve is coming). When no one is in the tavern, the owner often stands in front by the main street, welcoming passers-by to step inside and enjoy his establishment. (Guides Questors who aren't sure where the "green horse" is to find the pub)

Sea Horse Pub - schoolmarm - (Sisterbutta) runs spinning and weaving school above pub

Clue 4
Manor house basement - Museum curator, (Suemoon Magic) he/she maintains the collected specimens, equipment, and machinery created by Merlin. Delighted to share (make up) stories about the collection, including the Time Machine. Encourages visitors to keep exploring, keep investigating until they are ready to go to the next level (and open the doors to the secret lab).

Clue 5
Castle Tower - Lady of Shallot - (Valibrarian) She suffers from a mysterious curse and must continually weave images on her loom without ever looking directly out at the world. Instead, she looks into a mirror, which reflects the busy road and the people of Camelot who pass by her tower. Costume: white gown with long straight brown hair (as in the paintings which play the songs in the tower internal staircase). Perhaps she hums the tune sometimes to herself? She guides Questors to make sure they jump off the wall to the right (into the horse paddock).

Figure 9. Role-play sign-up list on Google Docs

Role-players were given examples of methods for troubleshooting clues. For example, Brant led the group through the Quest pretending to be a first-time visitor with very little skill in navigating within the virtual world. He asked questions, appeared to be lost, and illustrated a range of common ways that participants lose their way and cannot recover. The role-player guides learned how to "zoom in" to locate a lost individual, help them navigate through the clues, and resume progress

towards the goal.

While helping individuals to experience learning through Medieval Quest, Brant (as trainer) emphasized the importance of not giving too much information at once. The learner is motivated to explore and find the answers themselves and it is tempting to give them help. Constructive learning provides time for discovery, which enhances the experience and motivates the learner.

Global participation

Over a 15-month data collection period, over 2500 participants from all over the connected globe attempted the Quest. Brant directly observed hundreds of these people in real-time, and often interacted, collected situational feedback, and aided where necessary. About half the participants were from the US, another third were English-speakers from the UK and Scandinavia, and the remainder were from many countries, including Russia, Brazil, and France. These latter participants generally had little to no fluency in English, and thus faced the additional challenge of translating the clues into their native languages, and trying to follow the clues despite the resulting ambiguities. One Brazilian couple, both teachers in their real lives, spent 15 or 20 hours over several days pondering the clues, exploring the sim region, and IM chatting with Brant (assisted by Google Translate). They both left heartfelt and insightful responses (in Portuguese) to the open-ended questions of the survey.

Observed gender differences on accepting assistance

There were several scenarios where gender differences were observed. Male participants often detected they were being observed, and were quick to challenge the unknown male observer (Brant's avatar name is "MrK Kas"), especially if they were escorting a female participant. Casual offers of assistance (i.e. "Let me know if you need help") to males often met with curt responses, or were even ignored completely. Female participants were much more receptive to offers of help, and often chatted quite extensively as they worked their way through the Quest. In the virtual world, the representational avatar identity is often an idealized self, and this tends to result in exaggerated male and female characteristics as part of self-presentational promotion strategies (see Fig 1.). Researchers found "a collaborative virtual environment could be used to help lonely youths develop a more effective self-portrayal through the exploration of possible future selves" (Knutzen and Kennedy, 2012b, p. 26). Future research studies may focus on gender differences in identity experiments within virtual environments to help educators understand best teaching practices.

Machinima

The use of machinima is helpful for documenting and archiving immersive learning experiences. Machinima (machine plus cinema) captures video from the computer screen which can be edited and shared with others who may not have attended the event. During the VWBPE 2016 event at the Quest, educators from around the

world had the opportunity to interact in a live learning experience. One educator from Mexico did not speak fluent English but was able to interact and complete the Quest with the help of the role-player librarians. He is seen at the end of the machinima asking if he can bring his students in to "observe what you can do in this virtual world" (Hill, 2016, 4:40).

The "shared sense of presence" one finds in a virtual world is evident in the machinima as a group of avatars meet at specific locations of clues. Research shows, "Representation of the environment with three dimensions, texture, light, sound, motion and other details can bring realism to the virtual world environment" (Bulu, 2012, p. 156). This shared sense of place and presence provides satisfaction to the learners which is illustrated in the machinima as avatars interact and explore.

The machinima illustrates some of the technological elements encountered in the interface of Second Life as avatars interact with each other in the simulated space. The teaching design (pedagogical learning elements) is exemplified in the structured clues which assess the learner's progress. Historical content is documented throughout the Quest with references to King Arthur's Court, the sword in the stone, and a range of representative medieval structures and furnishings: Tudor cottages, a large castle, and a manor house.

Interviews

The librarians and educators serving as role-player guides participated in a brief interview about their personal experience. All of those interviewed found the Quest to be an effective and engaging learning experience. One interviewee said, "Certain cues became more predictable alleviating frustration. These cues represented a game-based learning scaffold that preserved challenge, driving the inquiry for discovery and reward".

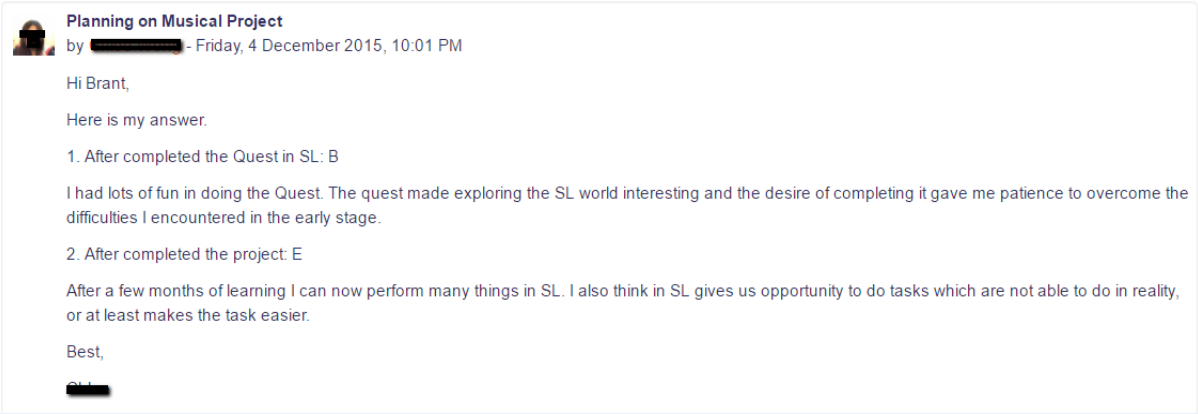
Designing the learning experience to build upon skills acquired was validated by one interviewee stating, "Repetition was effective. Because there was a pattern of repetition about finding the lamps, and reading clues, going thru an action/movement search, ending with a treasure chest leading to another lamp; I was able to learn from the later iterations (rounds/clues) better than I did the first 3 or so". Another librarian who was interviewed compared this building upon skills learned to Vygotsky's Zone of Proximal Development (Vygotsky, 1978).

One of the library volunteers was a newcomer to virtual worlds and found the Quest after only being in Second Life for two months. She was struggling to navigate the clues and learn the virtual world interface and stumbled into one of the librarians a few months later when she returned to the Quest. She explained, "[the librarian was] understanding what I was doing I was amazed. Not only had I stumbled back into the quest … I was now responsible for assisting others to move through it. As I look back on it now, over a year later … I see the benefit of Virtual Worlds". This volunteer has continued to partner with educational groups to help learners, illustrating the benefits of collaborative learning.

Findings

Using field notes, machinima, and interviews, the Quest global collaborative learning experience was found to address three learning contexts (technological, pedagogical, and content). Learners demonstrated proficiency in all three contexts through completion of the Quest, and expressed satisfaction about their engagement, enhanced by a shared sense of presence. Knowledge was successfully constructed through social collaboration within a simulated environment.

Evidence of a change in the affective domain of perceived self-efficacy was collected via a forum-based survey of the sixteen students in The Musical course. The stages of technology adoption described by the Gartner Hype Cycle was explained to the group, and they were asked to individually estimate their progress along this curve. See Figure 10 below for an example of one of the student posts indicating their response to this question.



Planning on Musical Project

by [redacted] - Friday, 4 December 2015, 10:01 PM

Hi Brant,

Here is my answer.

1. After completed the Quest in SL: B

I had lots of fun in doing the Quest. The quest made exploring the SL world interesting and the desire of completing it gave me patience to overcome the difficulties I encountered in the early stage.

2. After completed the project: E

After a few months of learning I can now perform many things in SL. I also think in SL gives us opportunity to do tasks which are not able to do in reality, or at least makes the task easier.

Best,

[redacted]

Figure 10. Example student response to the forum survey rating their self-perceived progress along the Gartner Hype Cycle of technology adoption.

See Figure 11 below for the self-rating data collected from the 10 students who responded. The blue dots indicate their evaluation of their progress after they had completed the Quest (first week of the project), and the green dots indicate their attitude after they had completed their video production projects (about 3 months). These results indicate that the students found the Quest self-learning activity useful in motivating them from Point A (Technology Trigger) up to Point B (Peak of Inflated Expectations), and the respondents often commented that the Quest provided them a useful foundation of basic skills training to prepare them for the subsequent video-production project. This finding shows that a self-learning activity in the virtual world can be useful for training basic user interface psycho-motor functions, a key digital literacy skill required for creating machinima videos.

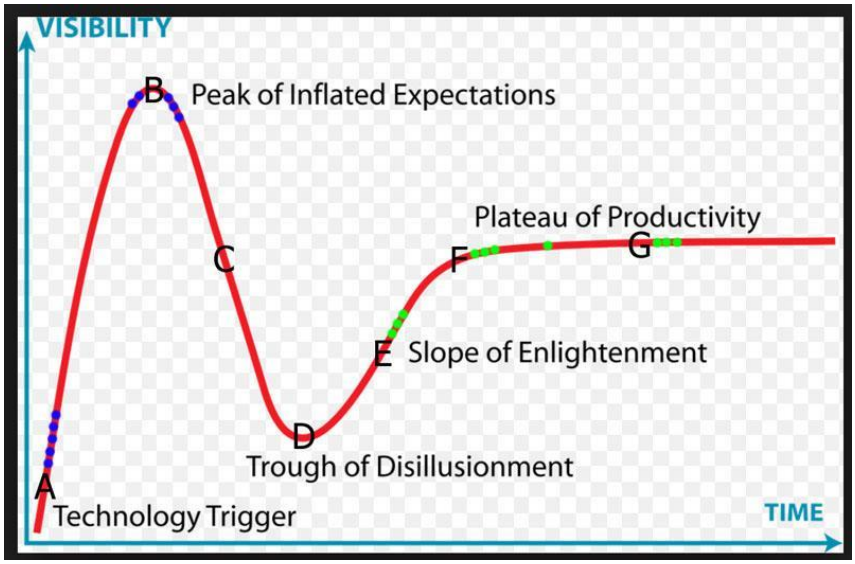


Figure 11. Self-ratings of the virtual world environment for supporting learning. Blue dots: after completing the Quest Green dots: after completing their project

Preliminary analysis of the survey data collected (310 records after validation) provided strong evidence to support a hypothesized moderating relationship between virtual identity and presence, and between social constructionism and reflective thinking. See Fig 12 below for the proposed Knutzen conceptual model of learning within a virtual world. This technology mediated learning model builds on prior theoretical frameworks including Salzman (1999), Wan (2007), Dalgarno & Lee (2010), and Lee *et al* (2010). Structural equation modeling (SEM) analysis using IBM AMOS indicated an excellent goodness-of-fit of the conceptual model with the observed survey data. Qualitative analysis of the open-ended item responses is in process, and a rigorous mixed-method rationale of the theoretical framework with seven psychological constructs will be presented in a later paper.

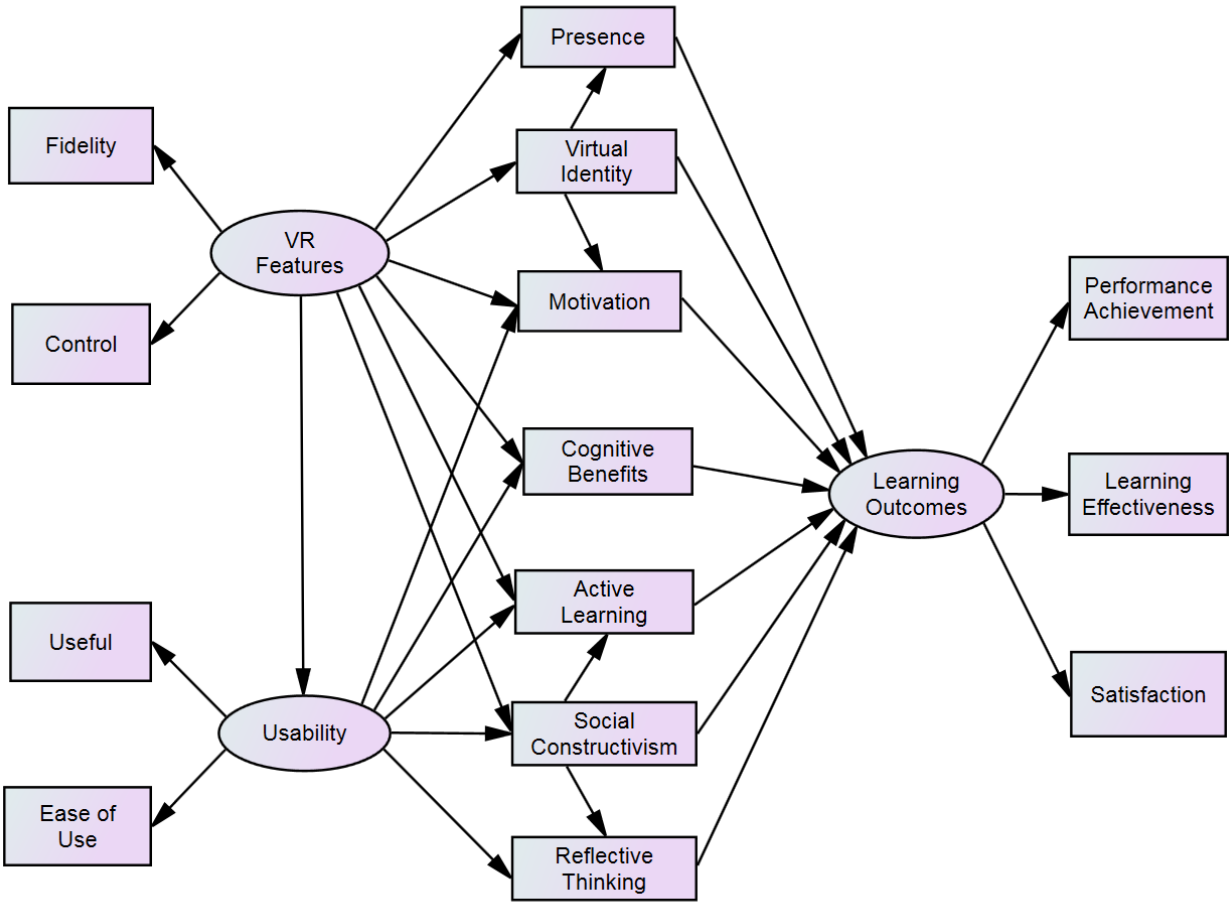


Figure 12. The proposed Knutzen conceptual model for technology-mediated learning within a virtual world, which includes 7 internal psychological constructs.

Participants expressed motivation to understand the literary characters and historical era, contributing to content knowledge acquired through the participation of this digital literacy immersive experience. This suggests a need for funding technologically mediated learning experiences with embedded academic content beyond the violence found in many commercial games.

Evidence of helping learners develop digital literacies was shown in the field notes, machinima, and interviews. One participant stated, “I found there is a place I can visit time and again to find literature links to read and expand my knowledge of this time in history and story”. This example of personal reflection illustrates the need for creating educational Digital Game-Based Learning simulations and training educators in how to use them.

Not only does the study show implications for putting DGBL opportunities in classroom, it also translates into impacting society through simulation of important issues ranging from global warming, natural disasters to basic mathematical concepts. Certainly simulated environments put the learner in situations that might be too dangerous, too expensive or simply impossible to create in the physical world. The example of simulating a medieval village to promote digital literacy sparks the

imagination for numerous other potential scenarios which could impact public attitudes and quality of life.

Limitations

The small number of participants (15 librarians/educators) may be viewed as a limitation but the global aspect of this exploratory project shows potential for learning across distance at all levels from beginner to expert. Although this live immersive experience organized on a single day as part of an educational conference involved only 15 participants, it should be noted that over a 15-month period 405 survey records were collected. The research potential of examining self-learning experiences in a virtual world open to participants from all over the connected globe has only begun to be tapped.

Another limitation to be considered is the lack of understanding of both how and what learners can achieve best through experiences in virtual worlds. Documenting experiences of role-play in simulated environments across long distance is just beginning.

Future Research Directions

More research is needed to help instructional designers effectively embed constructivist pedagogy into simulated environments. A study of eleven various learning theories found that virtual worlds provide rich learning experiences for types of situations. The research concluded, “If educators knew which learning mechanisms apply to virtual worlds and which do not, they would be able to more precisely determine what their students can learn from virtual worlds and what they cannot” (Loke, 2015, p. 113).

In addition to researching best practices for immersive learning environments and the learning theories that coincide with them, research is needed on assessment tools. Understanding how to evaluate the needs of learners and assess the learning outcomes at all age groups will help educators continue to design and implement immersive learning environments that are cost effective, engaging, accurate, and valuable for promoting academic success.

Future research might include specific obstacles encountered by both participants and role-play guides in planning and executing live simulation events. Another direction might explore the development of challenges which require group coordination to overcome, thus necessitating the social construction of knowledge. Psychological aspects of avatars could be examined, including gender differences and developmental needs of learners of various ages. Through documenting simulation experiences, best practices for learning can be identified.

The popularity of Minecraft for use in education shows promise for Digital Game-Based Learning in all curriculum areas and suggests that the next generation of learners may be ready for utilizing immersive learning environments for academic success. As virtual worlds, virtual reality, and augmented reality evolve (and perhaps merge), research on game design and assessment of learning outcomes will be

necessary.

Conclusion

As virtual worlds and virtual reality continue to offer new pedagogical opportunities, it is imperative that librarians and educators collaborate on designing and evaluating simulations for learning. Embedding information literacy and accurate curriculum content is essential for the future success of students who are proficient in videogames and global networking. Librarians may play a role in both evaluation of content in virtual spaces and embedding resources to help educators in all academic areas, both fiction and nonfiction, to help develop critical inquiry and digital literacies within technologically mediated learning spaces.

This study shares some of the initial work of collaborating on a global scale and the potential for immersive learning through constructivism, particularly to promote the development of digital literacies. Through Participatory Action Research, the intended learning outcomes designed and embedded in the Quest were documented, and the study concluded that learning took place at all levels from the skilled educators and librarians to include newcomers and first time visitors. Early adopters of virtual worlds in education may pave the way for best practices in the future.

References

Beetham, H., and Sharpe, R. (Eds.). (2013). *Rethinking pedagogy for a digital age: Designing for 21st century learning*. Routledge.

Bonsignore, E. M. (2016). *Playing for Real: Designing Alternate Reality Games in Learning Contexts* (Doctoral dissertation). Available at: http://drum.lib.umd.edu/handle/1903/18334 (accessed 12 January, 2017).

Bulu, S. T. (2012). Place presence, Social Presence, and Satisfaction in Virtual Worlds. *Computers and Education*, 58(1), 154-161.

Chow, A.S., Baily, C.C., Zamarripa, M., Chappell, P., Rachlin, D., and Vinson, C. (2012). The Information Needs of Virtual Users: A Study of Second Life Libraries. *Library Quarterly*, 82(4), 477-510.

Dalgarno, B. & Lee, M. (2010). What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology*, 41(1), 10-32.

Erhel, S., and Jamet, E. (2013). Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness. *Computers & Education*, *67*, 156-167.

Gantt, J.T., and Woodland, J.R. (2013). Libraries in Second Life: Linking Collections, Clients, and Communities in a Virtual World. *Journal of Web Librarianship*, 7(2), 123-141.

Glassman, M., & Erdem, G. (2014). Participatory action research and its meanings: Vivencia, praxis, conscientization. *Adult Education Quarterly*, *64*(3), 206-221.

Hassan, I. (2003). Beyond Postmodernism. *Angelaki: Journal of Theoretical Humanities*, *8*(1), 3-11.

Hill, V. (2012), The Adoption of Virtual Media and Virtual Worlds by Librarians, in Delmus E. Williams, Janine Golden (ed.) Advances in Library Administration and Organization (Advances in Library Administration and Organization, Volume 31), Emerald Group Publishing Limited, pp.89-119.

Hill, V. (2015), Digital Citizenship Through Game Design in Minecraft. *New Library World.* 116 (7/8): 369-382.

Hill, V. J. (2016). The Future of Libraries in the Digital Age. In P. Franks, L. Bell, and R. Trueman (Eds.) Teaching and Learning in Virtual Environments: Archives, Museums

and Libraries. (pp.225-235). Hershey, PA: Information Science Reference. Santa Barbara, CA: Libraries Unlimited.

Hill, V. and Lee, H. J. (2009), Libraries and immersive learning environments unite in second life. Library Hi Tech 27, (3): 338-56.

Hill, V. (2016). The Quest: Camelot Project VWBPE. Available at: https://youtu.be/d-75q8nFiGw (accessed 18 January, 2017).

Jarmon, L., Traphagan, T., Mayrath, M., and Trivedi, A. (2009). Virtual world teaching, experiential learning, and assessment: An interdisciplinary communication course in Second Life. *Computers and Education*, *53*(1), 169-182.

Knutzen, B., and Kennedy, D. M. (2012a). The Global Classroom Project: Learning a Second Language in a Virtual Environment. *Electronic Journal of e-Learning*, *10*(1).

Knutzen, K.B. and Kennedy, D.M. (2012b). Designing the self: the transformation of the relational self-concept through social encounters in a virtual immersive environment. *Interactive Learning Environments, 20*(3), 271-292.

Knutzen, K.B. (2013). Building on a Foundation of Participation- Introducing the Participation Forum. *Proceedings of eFiesta on Open Learning*, Singapore. Available at https://youtu.be/6tL91T6C478 (accessed 22 February, 2017).

Kolb, A. Y., and Kolb, D. A. (2009). The Learning Way: Meta-cognitive Aspects of Experiential Learning. *Simulation and Gaming*, *40*(3), 297-327.

Lane, H. Chad, and Amy E. Ogan. "Virtual environments for cultural learning." *Second Workshop on Culturally-Aware Tutoring Systems in AIED 2009 Workshops Proceedings*. 2009.

Lee, E. A., Wong, K. W., & Fung, C. C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach. *Computers & Education, 55*, 1424–1442.

Loke, S. K. (2015). How do virtual world experiences bring about learning? A critical review of theories. *Australasian Journal of Educational Technology*, *31*(1), 112-122.

McConnell, D. (2006). *E-learning groups and communities*. McGraw-Hill Education (UK).

Moodle. (2017). Moodle Participation Map. Available at: http://www.participationmap.org/ (accessed 10 April, 2017, 2017).

Rahim, N.A. (2013). Collaboration and Knowledge Sharing Using 3D Virtual Worlds on

Second Life. Education for Information, 30(1), 1-40.

Papert, S., and Harel, I. (1991). Situating Constructionism. In Constructionism. New York,
NY: Ablex Publishing Corporation.

Pellas, N., and Peroutseas, E. (2016). Gaming in Second Life via Scratch4SL: Engaging HIgh School Students in Programming Courses. *Journal of Educational Computing Research*, 54(1), 108-143.

Salzman, M., Dede, C., Loftin, R., & Chen, J. (1999). A model for understanding how virtual reality aids complex conceptual learning. *Presence: Teleoperators and Virtual Environments, 8*, 3, 293-316.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International journal of instructional technology and distance learning*, *2*(1), 3-10.

Simsek, I. (2016). The Effect of 3D Virtual Learning Environment on Secondary School Third Grade Students' Attitudes toward Mathematics. *Turkish Online Journal of Educational Technology -TOJET*, 15(3), 162-186.

TPACK. (2017). What is TPACK? Available at: http://tpack.org/ (accessed 12 January, 2017).

VWBPE. (2016). Virtual Worlds Best Practices in Education Conference. Available at: https://vwbpe.org/vwbpe-news/jovs-vwbpe16-proceedings-and-a-call-for-papers (accessed 24 November, 2016).

Voulgari, I., Komis, V., and Sampson, D. (2014). Learning outcomes and processes in massively multiplayer online games: exploring the perceptions of players. Educational Technology Research and Development, 62(2), 245-270.

Vygotsky, L. S. (1978). Mind in society. Cambridge, MA: Harvard University Press.

Wan, Z., Fang, Y., & Neufeld, D. J. (2007). The role of information technology in technology-mediated learning: A review of the past for the future. *Journal of Information Systems Education, 18*(2), 183 - 192.

Wang, F., and Burton, J. K. (2013). Second Life in education: A review of publications from its launch to 2011. *British Journal of Educational Technology*,*44*(3), 357-371.

Warburton, S. (2009). Second Life in higher education: Assessing the potential for and the barriers to deploying virtual worlds in learning and teaching. *British Journal of Educational Technology, 40*, 414–426.

Appendix

Useful links for further investigation

Brant's video record of the Quest presentation for the VWBPE 2016 conference (2h 21min): https://www.youtube.com/watch?v=ZjtAjQc4EGI

Link to the start of the Quest in the virtual world of Second Life: http://maps.secondlife.com/secondlife/Lingnan%20Drama%20Island/151/171/24

Example text of clue #1 (given as a notecard when a user touches the genie lamp):

This is the first clue on a quest to win free medieval clothing!

Follow all 10 clues to explore all of Camelot and get outfits and goodies!

Clue 1
Over the castle drawbridge, and into the yard,
Turn left and walk to the trees – it's not hard!
The door on the left, with an arch of white roses,
Leads into the church, founded by Moses.

Once you're inside, check out the altar,
Lovely figures, all based on psalter.
Type F to fly up, E to go higher,
Arrow moves forward, now you're a flyer!

Fly over Jesus, fly over Mary,
C to drop down, F no more fairy.
Look to the right, where cursor becomes hand,
Click that wall to open, it's all been planned.

'Tis treasure you'll find, click the top to see,
Click the box to receive, the treasure for free.
Select Keep to gather, the top and a shirt,
Inventory now holds, your just dessert.

Click on the door, to travel somewhere,
The next clue awaits, for all who play fair.
When you vanish, not knowing where,
Hit Escape and then look, to find yourself there.

Once you are there, search every nook and fold,
Find the next clue, in a genie lamp so gold!