Author (2012). *Incorporating Virtually Immersive Environments as a Collaborative Medium for Virtual Teaming, Journal of Education and Learning, Vol.6 (3) pp. 185-200.*

Incorporating Virtually Immersive Environments as a Collaborative Medium for Virtual Teaming

Charles J. Lesko, Jr.[*], Christine R. Russell James[**]
East Carolina University

Abstract
Virtually immersive environments incorporate the use of various computer modelling and simulation techniques enabling geographically dispersed virtual project teams to interact within an artificially projected three-dimensional space online. This study focused on adoption of virtually immersive technologies as a collaborative media to support virtual teaming of both graduate and undergraduate-level project management students. The data and information from this study has implications for educators using virtually immersive environments in the classroom. In this study, we specifically evaluated two key components in this paper: 1) students' level of trust and; 2) students' willingness to use the technology, along with their belief about the virtual environment's ability to extend and improve knowledge sharing in their team work environment. We learned that while students did find the environment a positive add on for working collaboratively, there were students who were neither more nor less likely to use the technology for future collaborative ventures. Most of the students who were not very positive about the environment were "fence sitters" likely indicating needs related to additional training to improve communication skills. Finally, based on the full study results we have provided basic recommendations designed to support team trust building in the system along with interpersonal trust building to facilitate knowledge transfer and better strategic us of the technology.

Keywords*: virtual teaming, online collaboration, immersive environments*

*Charles J. Lesko, Jr., College of Technology & Computer Science, East Carolina University, Greenville, North Carolina, United States, Telp.: 252-737-1907, e-mail: leskoc@ecu.edu

**Christine R. Russell, Visiting Professor in the College of Technology & Computer Science, East Carolina University, Greenville, North Carolina, United States, Telp.: 252-737-1470, e-mail: russellc@ecu.edu

Introduction

Today's virtual immersive environments (often referred to as 'virtual worlds') have the ability to simulate a dynamic and persistent three-dimensional interactive space that includes rich graphical life-like spaces, high fidelity audio, with motion, viewpoint, and interactivity that provide the end-user with a 'sense of presence' or 'being-there'. Early efforts to incorporate these environments have begun to witness some key successes within a select group of businesses and educational institutions who are integrating the use of these environments as a collaborative solution for their globally distributed work force (Schultze & Orlikowski, 2010) (Traphagan, Mayrath, & Trivedi, 2009). Researchers are finding it is crucial that virtual project team collaborative solutions support not only formal (explicit) knowledge transfer, but also informal (implicit) knowledge transfer and that these environments support the enabling of trust amongst team members; recent study indicates that virtual project teams should consider the extent to which knowledge that is traditionally shared implicitly might be augmented via online media (Reed & Knight, 2010).

Availability of the virtually immersive environments to support project team collaborations has been significant in the past few years. Recent growth in the virtual world industry has witnessed revenues in 2011 from the virtual goods industry--an industry that was virtually non-existent a few years ago--now reaching $7.3 billion globally with $2.1 billion of that projected to be in the United States alone (Sorom, 2010). According to KZero (2011), there were over 1.1 billion registered users in all virtual worlds in the first quarter of 2011; a number that has more than doubled in the past two years. Currently, the largest segment of virtual world end-users, with over 560 million online users, is between the ages of 10 and 15 (KZero, 2011). Since 2010, the industry has seen comparable growth in virtual world developments as well with several new open source and browser-based virtual worlds such as OpenSim, BlueMars, OurBricks, Kitely, and realXtend coming online; all of which are opening up new virtual world opportunities and are helping to move the industry "toward the productivity plateau" (Wasko, Teigland, Leidner, & Jarvenpaa, 2011)

However, along with the growth of this new immersive medium come a number of challenges-especially for those seeking to use the technology in teamwork settings. It has long been established that trust and commitment between virtual project team members can be the lynch-pin between success and failure with the project. Virtual project teams working within knowledge-intensive contexts can find themselves mired in an ineffective process of interpersonal trust formation (Warkentin & Beranek, 1999)(Rusman, van Bruggen, Sloep, & Koper, 2010). Our collective research over the study's three year period has concentrated on evaluating the use of virtually immersive environments as not only a learning media but also as a collaborative media for virtual team interaction. An underlying focal point to this study has involved gaining a better basic understanding of the capabilities of this virtual media to enable both formal and informal knowledge transfer that is necessarily based on development of sufficient trust among team members and between management and the team members. Review of survey data conducted over the study's three-year time period, along with observational analysis is the foundation for discussion in this article. Much of this data provides us with information about student beliefs related to the development of trust and the quality of their team experience in the tested environment. Based on this current data we are reformulating more specific survey instruments and processes to gather objectively not just student reaction and beliefs regarding trust building and collaboration in the environment but to identify whether actual trust building is exhibited in the student's working environment.

How Virtually Immersive Environments Can Enable

Virtual or geographically dispersed teams are defined as the degree to which members use technology to interact across geographic, organizational, or other boundaries. Geographical dispersion for teaming has changed the landscape of collaborative work in organizations (Powell, Piccoli, & Ives, 2004). Recently that definition was more explicitly augmented to reference "small temporary groups" of "dispersed knowledge workers" (Ale Ebrahim, Ahmed, &Taha, 2009). Any project manager will tell you, that the need to identify and leverage team member knowledge effectively is crucial to the success of the project itself. As virtual teams become more common in the workplace, this process of knowledge sharing in virtual teams is gaining more attention among practitioners and scholars. It's capacity to solve current issues related to effective trust building for effective team collaboration and work has excited both practitioners and educators alike.

Interestingly, over the course of their relatively short lifespans virtual worlds have evolved mostly from within the entertainment and gaming industries. Inevitably, further growth in the industry by the business community saw early successes using virtual worlds as a marketing research and training tool. Recently businesses have begun building a virtual presence to explore this new medium

for its organizational communication capabilities (Nevo, Nevo, & Carmel, 2011) (Blythe, 2011) (Brown, Recker, & West, 2011). At least one study investigated how these virtual working spaces support team collaboration-- asserting that this medium offers potentially more expansive and effective collaboration experiences for workers over the more traditional text-based collaboration technologies used in the past (Schouten, van den Hooff, &Feldberg, 2010). It appears that the synchronous natural ability to communicate in virtual worlds with 3D capability is an important factor in improving collaboration for geographically dispersed groups by allowing more effective bonding and trust building to occur. Improved trust in turn increases knowledge share among the team members.

Formal and Informal Knowledge-sharing

In order for effective knowledge share to occur, it has long been accepted that one must have established trust between team members as well as between the team and its manager or management system (Hsu, Chang, & Yen, 2011). Trust is built on three different levels in virtual work environments and all three seem to be necessary for knowledge sharing on a firm foundation to occur. The first level is interpersonal team member trust. It is well known the individuals develop trust between one another based on a number of factors. According to Hsu, Chang & Yen (2011) the concept of trust has been increasingly employed within the virtual community literature where several studies have found that interpersonal trust such as trust in members has a positive influence on knowledge sharing (Ridings, Gefen, & Arinze, 2002) (Chiu, Hsu, & Yi, 2006) (Hsu M. H., 2007). Assuming that trust is easy to destroy in some virtual settings (Kanawattanachai & Yoo, 2002), some studies have begun to investigate the antecedent factors of trust in members using various trust-building bases such as calculative base and process base (Ridings, Gefen, & Arinze, 2002) (Lin, Hung, & Chen, 2009) (Fang & Chiu, 2010). However, because virtual communities are the information systems supported by communication technologies, knowledge sharing in virtual communities may be affected by members' trust towards an information system (i.e. system trust) as well (Hsu, Chang, & Yen, 2011).

This is critical, because in a geographically dispersed environment it is difficult to meet face to face and judge individual characteristics as one way to identify a trustworthy colleague. Additionally, colleagues build trust and judge trustworthiness of others based on past performance and the individual's ability to meet deadlines and execute high quality work for their part (Clouder, 2009) (Chang, 2011) (Weber, 2011). This is one advantage of virtual environments for collaborative teaming efforts because the site environment can be maintained over time and teams can work on small pieces of projects live instead of disbanding and working alone on bits and pieces that may or may not be executed as the team or individuals intended. That is team members can have input into the processes as they proceed improving the quality of each person's execution of work in ways that are likely to build team member's trust in one another. The environment allows for informal and formal disclosure and knowledge share among members by improving bonding and trust building opportunities in the form of closer to human interactions.

A second area of trust that is important to consider is related to team members feelings related to management's ability to plan and help them use the system technology. It is critical for team members to have faith in management to clearly articulate needs, outcomes, as well as to control the process of project execution (Hsu, Chang, & Yen, 2011) (Sunindijo, Hadikusumo, & Ogunlana, 2007). In the case of virtual environments management can be less disembodied and more intimately involved and available for the team to depend on so this should help build team members trust in the process. As an additional matter, management should control the way the work environment is designed and chosen so that it supports the development of trust, knowledge sharing and human communication processes. In the case of virtual environments this means considering the process a team uses to execute assigned projects and being sure that the environment supports that process.

We see the third and final area of trust necessary to develop effective knowledge sharing and collaboration in virtual environments as systemic or technology trust. In this case we identify that to be trust in the virtual environment itself, allowing also for the second area conditions of trust in management's knowledge of how that environment can be used and in the ability to convey the parameters and ways the environment is used to effectuate the team collaboration and project completion. This also includes evidence of the user's comfort level with the technology-for example using an avatar to communicate while walking, talking and interacting in a virtual environment can be difficult for some and their comfort level with fundamentals of the software operation "in world" is critical to its success. This means that basic training and help is necessary and identifying barriers to learning or accepting the technology are critical factors for its success.

One of the best things about virtually immersive environments is that they do allow for more visual and synchronous interaction of members and if avatars are reasonably designed and the

environments are well organized by a manager--who is trusted and over time who proves their capability with designing and leading collaboration in virtual spaces--the technologies offer significant advantages for users in project management teams. The environments can be custom made for communities and if a group wishes, avatars can be designed to be extremely life like with the individual person's real facial characteristics for example. Additionally, they can be designed to display emotive expression directly if a company so wishes. Virtual environments can also be entirely free with no cost and while the avatars are not quite as expressive or lifelike with valid in-world company codes of avatar conduct and avatar design rules, they too can be extremely effective as a representative live communicator.

Further, virtually immersive environments exclude barriers related to disability from the communication process. Avatars are free from most physical disabilities and can freely function in ways humans might not be able to manage in their environments thereby increasing productivity and full participation of all of the team members in a broader way. Use of avatars may also decrease the likelihood that race and gender in any way inhibit the collaborative process. So, if these three areas of trust described above can be developed and nurtured in virtual environments then current research indicates that there is a greater likelihood of higher quality knowledge sharing in the collaborative work environment, which should lead to a higher quality work product then we are seeing in more traditional and less immersed forms of old school online team collaboration.

Virtual Team Trust and Commitment

The importance of communication and trust in the context of global virtual teams has been noted and reiterated over the years; yet precisely how communication and trust influence certain outcomes within virtual teams remains unresolved to a large extent. In their recent study, Sarket et.al. (2011) noted that, "the concepts of communication and trust are inherently relational and not properties of individuals" (Sarker, Ahuja, Sarker, & Kerkeby, 2011). As organizational boundaries expand across global borders, virtual teams find they rely primarily on technology for their communication. Particularly, as virtual knowledge sharing involves fewer social cues than face-to-face communication among team members, the role of trust in knowledge sharing among virtual teams is attracting more interest from scholars and practitioners alike (Powell, Piccoli, & Ives, 2004) (Pinsonneault & Caya, 2005) (Staples & Webster, 2008).

Understanding the development and sustainment of trust can be approached from different perspectives. One of the more traditional approaches to evaluating trust is the developmental view of trust, suggesting that trust evolves over time based on direct personal interaction and communication (Lewicki & Bunker, 1996). In this view, trust is seen as a trustor's positive evaluation, which is based on a trustee's repeated behaviour. However, most scholars have acknowledged that trust is not a singular construct. Research has shown that there must also be an emphasis in corporate environments on the more multi-dimensional constructs of trust including: cognition-based trust (referring to a rational-based evaluation of a party); and affect-based trust (focus is on the emotional attachment between parties rather than the process of trust building) (Lewis & Weigart, 1985) (McAllister, 1995). Another, more recent approach to evaluating trust in virtual environments is referred to as swift trust, which refers to high initial trust in virtual teams which forms rapidly and then dissipates when the team is no longer working together (Jarvenpaa & Leidner, 2006). Because virtually immersive environments provide virtual teams with unique capabilities enabling team members to collaborate in more ways than just in the development of shared digital artifacts, trust is more easily established on all levels leading to a stronger, more unified project team which we believe will result in better long term and short term outcomes for businesses.

One additional recent study additionally indicates that task complexity has significant effects on team trust and team process satisfaction (Nah, Schiller, Mennecke, Siau, & Sattayanuwat, 2011). An advantage of collaboration in virtual environments is the system's ability to support work on complex matters, whether they are cognitively complex and/or complex because of digital artifact integration. That is a virtually immersive environment allows for live, animated and more engaged discussion about complex subjects and problems and for more thorough consideration of options because of the level of engagement and type of engagement available. The virtual medium also allows for viewing of complex digital artefacts as well as supports team members sharing and comparing artifacts while actively discussing them instead of sharing asynchronous changes in a more linear fashion as is often done with document sharing technologies absent the virtual components.

Description of Intervention

Since fall 2008, seven course offerings have introduced students to the virtually immersive environment called Second Life, with students taking part in one or more online sessions. Following the completion of the first online session, all students were presented with an online, anonymous survey of (15) closed-ended statements collecting ordinal-level data as responses. The intent of the survey was to collect student perception data following completion of their first course experience with the virtual environment. The goal was to get a sense of students' reaction to the collaborative space and experience of working in a virtually immersive environment. This was a first step to identifying if students formed trust bonds with their groups, if they felt the system made that easy to do, and if the technology itself got in the way of their trust development. Once we have established parameters to identify if and how trust develops in the environment by the subjects, we can then consider identifying what knowledge share is occurring and the quality of that knowledge sharing in later research.

For this project we used Second Life because the product was more mature then other open-source products at the time, and the product is supported on our campus. During the first week of the course, students received basic instructions on Second Life setup with short online videos that took the students through the process of creating an avatar, logging into the environment, learning how to move, interact and communicate in the environment, and how to locate the virtual classroom and collaboration sites.

The survey instrument was designed to focus on four key concept areas. The first area surveyed focused on gaining a foundational understanding of the surveyed population's background with respect to this type of communication media. The second was to assess the initial technology use learning curve experienced by each student and the third focused on the early avatar interactions and mechanics associated with the utilization of the avatar as a personal proxy in a real world communication forum. The final area assessed involved gathering feedback from the students on their experiences with the virtual environment in our classroom environment.

The first area of the survey was designed to help us determine what background students had with immersive and/or learning technologies to determine later if prior experience with these technologies might impact their sense of satisfaction working in the environment with teams. The second area was designed to identify the students' sense of how high or low the learning curve for using this particular technology was for this project. Again the idea was to note of this issue of learning curve might impact student satisfaction with the environment as a collaborative tool. (If this was in fact something that might be a confounding factor later in research we would then be prepared to control for this issue and in a more general, practical setting if this indicated a problem then we also might address better student/user preparation when adopting this technology to improve the speed and deftness with which users adopt to the environment.) The first and second areas of surveying were designed overall to provide us with a sense of what factors might impact the systemic and managerial trust components necessary to support overall trust development by team members.

The third area of survey was designed to provide us with a sense of how students used their avatars as human proxies and how they interacted with one another in the virtual environment. This then impacts the area of interpersonal communication trust development and in many ways is the most significant trust factor in the development of an environment that will support effective knowledge share. The fourth area of the survey was designed to provide an overall sense of how effective the students perceived the virtual collaborative community experience and if they felt it was effective as a collaborative medium.

Survey Research Method and Analysis

Research Overview

The survey collection covers a full three-year period between fall semesters 2008 and fall 2011. The survey was issued to both undergraduate students taking an Introductory Project Management Course and to graduate students enrolled in either 'Technology Project Management' or 'Strategies for Technology Management and Communications'. In each of these courses, the delivery involved not only lecture style learning and knowledge transfer but also involved case study presentations, and virtual teaming and collaboration projects completed by students.

Research Objectives

The overarching objective of this research effort was to gather preliminary data to gain a better understanding of the practical challenges associated with the integration of virtual immersive environments in courses and workplace design requiring virtual project teams and virtual team collaboration.

Based on the theme of this article, only eight of the fourteen total survey statements were analysed for this article. The research activities for this three-year study included:

1) An online, anonymous survey was used to evaluate the early interactions of the students with the virtually immersive environment and the perceived effectiveness of the environment as a virtual collaborative workspace.
2) General observation was incorporated into this study, where appropriate, to evaluate challenges associated with course delivery and management (Babbie, 1990) (Czaja& Blair, 1995).

Hypotheses for select statements were pre-established and chi square analysis was used to evaluate the data.The initial intent of the survey was to collect student opinion data following completion of their first course experience with the virtual workspace. This same survey instrument had been used and pretested in a previous case study involving a smaller group of online graduate students a year prior. Over the course of the new three-year study, the survey population consisted of (201) graduate and undergraduate students that were registered for the 9 different course offerings with (189) students actually completing the survey (see Table 1).

Table 1. Student Survey Response Rate

Survey	Total Population			Undergraduate Students			Graduate Students		
	No. Students	Completed Survey	Return Rate	No. Students	Completed Survey	Return Rate	No. Students	Completed Survey	Return Rate
Total Responses	201	189	94.0%	95	88	92.6%	106	101	95.3%

Since the responses to the survey statements are all categorical variable yield data the chi square (X2) statistic is used here to investigate whether distributions of the various categorical variables differ from one another. The chi square statistic presented here compares the tallies of categorical responses between two independent groups: the on-campus student population and the online student population. The chi-square test is testing the offered null hypothesis asserting that there is no significant difference between the expected and observed result. The p-value is the probability that the deviation of the observed from that expected is due to chance alone with no other forces acting on it. A relative standard commonly used in this type of research is $p > 0.05$ is accepted for this study (Lind & Mason, 2000). For this analysis our predetermined alpha level of significance is (0.05), with a degree of freedom (df =1).

First Area-Population Background with Technology

The results of the first three survey statements (see Table 2) indicate that the majority of the students had past experiences with online courses and various online delivery tools but little virtual world experience. Specifically, the first surveyed statement indicates that the majority (66.7%) of the students had taken online classes for credit. The percentages were practically identical for both graduate and undergraduate populations.

Table 2. Survey results for first concept area: Perceived effectiveness of the medium

Statement	Concept Being Canvassed	Responses	Total Population		Undergrad Students		Graduate Students	
			No.	Percent.	No.	Percent.	No.	Percent.
1. Prior to taking this course, had you ever taken an online distance education course for academic credit?	Population Background	1. YES	126	66.7%	59	67.0%	67	66.3%
		2. NO	63	33.3%	29	33.0%	34	33.7%
2. Prior to taking this course, had you ever utilized online collaboration tools such as or similar to: Centra (online meeting), or Blackboard.	Population Background	1. YES	170	89.9%	81	92.0%	89	88.1%
		2. NO	19	10.1%	7	8.0%	12	11.9%
3. Prior to taking this course, rate your frequency of use with Second Life or other similar virtual worlds.	Population Background	1. Never	136	72.0%	68	77.3%	68	67.3%
		2. Seldom	30	15.9%	12	13.6%	18	17.8%
		3. Sometimes	20	10.6%	7	8.0%	13	12.9%
		4. Often	3	1.6%	1	1.1%	2	2.0%

The second surveyed statement coincides with the first statement indicating a strong familiarization with basic online collaborative tools. The results from the third statement are indicative

of the growing awareness and use of virtual world technologies with nearly a third (32.7%) of the graduate students and (22.7%) of the undergraduate students indicating that they have operated in this virtual environment before.

Table 3. Chi square results for Statements 1 through 3

Statement	Responses	Category	Expected		Observed			df	Chi-Square	Probability
			1.	2.	1.	2.	Total			
S1	1. YES	Undergrad	58.7	29.3	59	29	88	1	0.011	0.920
	2. NO	Grad	67.3	33.7	67	34	101			
		Total			126	63	189			
S2	1. YES	Undergrad	79.2	8.9	81	7	88	1	0.802	0.371
	2. NO	Grad	90.9	10.2	89	12	101			
		Total			170	19	189			
S3	1. Never	Undergrad	63.3	24.7	68	20	88	1	2.305	0.129
	2. Seldom,Sometimes,Often	Grad	72.7	28.3	68	33	101			
		Total			136	53	189			

Survey Statement 1: "Prior to taking this course, had you ever taken an online distance education course for academic credit?" Responses for this statement were: 1.Yes, 2.No. The hypotheses established for this statement were as follows:

Ho: The experience of taking previous online courses is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The experience of taking previous online courses is associated with type of student (graduate or undergraduate) taking the survey.

For Survey Statement 1, resulting analysis on the chi square statistic (x2 = 0.011) and a corresponding probability (P=0.920) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 3). Based on these results, the null hypothesis that the experience of taking previous online courses is independent of type of student (graduate or undergraduate) taking the survey is accepted.

Survey Statement 2: "Prior to taking this course, had you ever utilized online collaboration tools such as or similar to: Centra (online meeting), or Blackboard?" Responses for this statement were: 1.Yes, 2.No. The hypotheses established for this statement were as follows:

Ho: The experience of utilizing online collaboration tools such as or similar to: Centra (online meeting), or Blackboard is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The experience of utilizing online collaboration tools such as or similar to: Centra (online meeting), or Blackboard is associated with type of student (graduate or undergraduate) taking the survey.

For Survey Statement 2, resulting analysis on the chi square statistic (x2 = 0.802) and a corresponding probability (P=0.371) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 3). Based on these results, the null hypothesis that the experience of utilizing online collaboration tools such as or similar to: Centra (online meeting), or Blackboard is independent of type of student (graduate or undergraduate) taking the survey is accepted. Statement 2 coincides with Statement 1 indicating a strong familiarization with basic online collaborative tools.

Survey Statement 3: "Prior to taking this course, rate your frequency of use with Second Life or other similar virtual worlds?" Responses for this statement were: 1.Never, 2.Seldom, Sometimes, Often (collapsed results to indicate either the student had 'Never' or had ['Seldom',' Sometimes', 'Often'] utilized the tools. The hypotheses established for this statement were as follows:

Ho: The experience of utilizing virtual worlds prior to this course is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The experience of utilizing virtual worlds prior to this course is associated with type of student (graduate or undergraduate) taking the survey.

For Statement 3, resulting analysis on the chi square statistic (x2 = 2.305) and a corresponding probability (P=0.129) below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 3). Based on these results, the null hypothesis that the experience of utilizing online collaboration tools such as or similar to: Centra (online meeting), or Blackboard is independent of type of student (graduate or undergraduate) taking the survey is accepted.

Second Area-Initial Learning Curve

The second group of statements (see Table 4) presented in the survey focused on gaining an understanding of the initial learning curve that the students were tasked to complete. The study's concern here is that the introduction of any new delivery medium to the course should not limit the learning process. Overall, the results of the next two statements indicate that the vast majority of the students had little to no difficulty in communicating within the virtual environment and that there was minimal practice time needed on the frontend to prepare for the students first session with less than (4%) overall taking more than 2 hours to practice prior to their first virtual session (see Table 4).

Table 4. Survey results for second concept area: Initial Learning Curve

Statement	Concept Being Canvassed	Responses	Total Population		Undergrad Students		Graduate Students	
			No.	Percent.	No.	Percent.	No.	Percent.
7. Communicating in Second Life (to include Local Text Chat and Voice Chat) was a difficult skill to learn?	Initial Learning Curve	1. Strongly Agree	2	1.1%	1	1.1%	1	1.0%
		2. Agree	21	11.1%	9	10.2%	12	11.9%
		3. Undecided	31	16.4%	20	22.7%	11	10.9%
		4. Disagree	103	54.5%	40	45.5%	63	62.4%
		5. Strongly Disagree	32	16.9%	18	20.5%	14	13.9%
8. How much time did you take to practice in Second Life prior to your first class session?	Initial Learning Curve	1. Less than 10 minutes	36	19.0%	27	30.7%	9	8.9%
		2. 10 to 29 minutes	70	37.0%	23	26.1%	47	46.5%
		3. 30 to 59 minutes	66	34.9%	32	36.4%	34	33.7%
		4. 1 to 2 hours	11	5.8%	4	4.5%	7	6.9%
		5. More than 2 hours	6	3.2%	2	2.3%	4	4.0%

Survey Statement 7: "Communicating in the virtual environment (to include local text chat and voice chat) was a difficult skill to learn?" Responses for this statement were: 1.Strongly Agree, Agree; 2.Undecided, Disagree, Strongly Disagree. The hypotheses established for this statement were as follows:

Ho: The skill of communicating within the virtual environment is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The skill of communicating within the virtual environment is associated with type of student (graduate or undergraduate) taking the survey.

For Survey Statement 7, resulting analysis on the chi square statistic (x2 = 0.224) and a corresponding probability (P=0.220) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 5). Based on these results, the null hypothesis that the experience of utilizing online collaboration tools such as or similar to: Centra (online meeting), or Blackboard is independent of type of student (graduate or undergraduate) taking the survey is accepted.

Table 5. Chi square results for Statements 7 through 8

Statement	Responses	Category	Expected		Observed			df	Chi-Square	Probability
			1.	2.	1.	2.	Total			
S7	1. Strongly Agree,Agree	Undergrad	11.1	76.9	10	78	88	1	0.224	0.220
	2. Undecided,Disagree,Strongly Disagree	Grad	11.9	83.1	13	82	95			
		Total			23	160	183			
S8	1. Less than 10 minutes, 10 to 29 minutes, 30 to 59 min	Undergrad	80.1	7.9	82	6	88	1	0.953	0.329
	2. 1 to 2 hours, More than 2 hours	Grad	91.9	9.1	90	11	101			
		Total			172	17	189			

Survey Statement 8: "How much time did you take to practice in the virtual environment prior to your first class session?" Responses for this statement were: 1. Less than 10 minutes, 10 to 29 minutes, 30 to 59 minutes, 1 to 2 hours; 2. More than 2 hours. The hypotheses established for this statement were as follows:

Ho: How much time the student took to practice in the virtual environment prior to their first class session is independent of type of student (graduate or undergraduate) taking the survey.

Ha: How much time the student took to practice in the virtual environment prior to their first class session is independent of type of student (graduate or undergraduate) taking the survey.

For Survey Statement 8, resulting analysis on the chi square statistic (x2 = 0.953) and a corresponding probability (P=0.329) below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 5). Based on these results, that the time each student took to practice in the virtual environment prior to their first class session is independent of type of student (graduate or undergraduate) is accepted.

Third Area-Avatar Operation and Interaction

The third group of statements presented in the survey focused on avatar/student interactions. Unlike real world interactions, the interaction of students as they progress through a virtually immersive session can present some real world situations for the student with a unique twist to them in a virtual setting. Overall, the results of this concept area are outlined in Table 6. Three survey statements are analysed to gain a better understanding of team member perceptions of the avatar as the student's virtual 'proxy'. In this case the majority of students taking the survey indicated that maintaining a Code of Conduct in the environment was "important" or "very important". Additionally, avatar appearance was not found to be distracting although approximately half of the students did not feel that avatars needed to resemble the particular human they represent.

Table 6. Chi square results for Statements 9, 10 and 11

Statement	Concept Being Canvassed	Responses	Total Population		Undergrad Students		Graduate Students	
			No.	Percent.	No.	Percent.	No.	Percent.
9. How would you rate the importance of maintaining a Code of Conduct for holding academic sessions in Second Life environments?	Avatar Interaction	1. Unimportant	1	0.5%	0	0.0%	1	1.0%
		2. Of Little Importance	15	7.9%	7	8.0%	8	7.9%
		3. Moderately Important	30	15.9%	16	18.2%	14	13.9%
		4. Important	76	40.2%	35	39.8%	41	40.6%
		5. Very Important	67	35.4%	30	34.1%	37	36.6%
10. The general appearance of most avatars was distracting?	Avatar Interaction	1. Strongly Agree	4	2.1%	2	2.3%	2	2.0%
		2. Agree	21	11.1%	9	10.2%	12	11.9%
		3. Undecided	23	12.2%	14	15.9%	9	8.9%
		4. Disagree	121	64.0%	56	63.6%	65	64.4%
		5. Strongly Disagree	20	10.6%	7	8.0%	13	12.9%
11. It is important for avatars to closely resemble the human they represent?	Avatar Interaction	1. Strongly Agree	3	1.6%	1	1.1%	2	2.0%
		2. Agree	36	19.0%	19	21.6%	17	16.8%
		3. Undecided	51	27.0%	21	23.9%	30	29.7%
		4. Disagree	80	42.3%	40	45.5%	40	39.6%
		5. Strongly Disagree	19	10.1%	7	8.0%	12	11.9%

Survey Statement 9: "How would you rate the importance of maintaining a Code of Conduct for holding sessions in virtual environments?" Responses for this statement were: 1. Unimportant, Of Little Importance; 2. Moderately Important, Important, Very Important. The hypotheses established for this statement were as follows:

Ho: How would you rate the importance of maintaining a Code of Conduct for holding sessions in virtual environments is independent of type of student (graduate or undergraduate) taking the survey.

Ha: How would you rate the importance of maintaining a Code of Conduct for holding sessions in virtual environments is independent of type of student (graduate or undergraduate) taking the survey?

Table 7. Chi square results for Statements 9, 10 and 11

Statement	Responses	Category	Expected		Observed			df	Chi-Square	Probability
			1.	2.	1.	2.	Total			
S9	1. Unimportant,Of Little Importance	Undergrad	4.7	95.7	7	81	88	1	0.056	0.806
	2. Moderately Important, Important, Very Important	Grad	5.3	83.3	9	92	101			
		Total			16	173	189			
S10	1. Strongly Agree,Agree	Undergrad	11.6	76.4	11	77	88	1	0.076	0.080
	2. Undecided,Disagree,Strongly Disagree	Grad	13.4	87.6	14	87	101			
		Total			25	164	189			
S11	1. Strongly Agree,Agree	Undergrad	18.2	69.8	20	68	88	1	0.440	0.440
	2. Undecided,Disagree,Strongly Disagree	Grad	20.8	80.2	19	82	101			
		Total			39	150	189			

For Survey Statement 9, resulting analysis on the chi square statistic (x2 = 0.056) and a corresponding probability (P=0.806) below the conventionally accepted significance level of 0.05, so

the null hypothesis that the two distributions are the same is verified (see Table 7). Based on these results, that the importance of maintaining a Code of Conduct for holding sessions in virtual environments is independent of type of student (graduate or undergraduate) is accepted.

Survey Statement 10: "The general appearance of most avatars was distracting?" Responses for this statement were: 1.Strongly Agree, Agree; 2.Undecided, Disagree, Strongly Disagree. The hypotheses established for this statement were as follows:

Ho: The student perception that the general appearance of most avatars was distracting is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The student perception that the general appearance of most avatars was distracting is associated with type of student (graduate or undergraduate) taking the survey.

For Statement 10, resulting analysis on the chi square statistic (x2 = 0.076) and a corresponding probability (P=0.080) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 7). Based on these results, the null hypothesis that the student perception that the general appearance of most avatars was distracting is associated with type of student (graduate or undergraduate) taking the survey is accepted.

Survey Statement 11: "It is important for avatars to closely resemble the human they represent?" Responses for this statement were: 1.Strongly Agree, Agree; 2.Undecided, Disagree, Strongly Disagree. The hypotheses established for this statement were as follows:

Ho: The student perception that it is important for avatars to closely resemble the human they represent is independent of type of student (grad or undergrad) taking the survey.

Ha: The student perception that it is important for avatars to closely resemble the human they represent is associated with type of student (grad or undergrad) taking the survey.

For Statement 11, resulting analysis on the chi square statistic (x2 = 0.440) and a corresponding probability (P=0.440) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 7). Based on these results, the null hypothesis that the student perception that it is important for avatars to closely resemble the human they represent is associated with type of student (graduate or undergraduate) taking the survey is accepted.

Fourth Area-Perceived Effectiveness of the Medium

The last group of statements presented in the survey focused on the perceived effectiveness of the virtual environment that was presented to the students for use in the class. The final survey statement to be evaluated seeks to assess the student's perceived motivation toward the virtual medium. Overall results of the final statement (see Table 8) indicate that over (42%) indicated that, following their initial exposer, the virtual environment made them more motivated to conduct online collaboration.

Table 8. Survey Results for Fourth Concept Area: Perceived Effectiveness of Medium

Statement	Concept Being Canvassed	Responses	Total Population		Undergrad Students		Graduate Students	
			No.	Percent.	No.	Percent.	No.	Percent.
14. Does a virtual environment such as Second Life make you more or less motivated to conduct online collaboration?	Perceived Effectiveness of the Medium	1. More Motivated	80	42.3%	35	39.8%	45	44.6%
		2. No Difference	69	36.5%	31	35.2%	38	37.6%
		3. Less Motivated	40	21.2%	22	25.0%	18	17.8%

Survey Statement 14: "Does a virtual environment such as Second Life make you more or less motivated to conduct online collaboration?" For Statement 14 from the three responses ('More Motivated', 'No Difference', and 'Less Motivated') an evaluation based on motivation was sought so the data was evaluated comparing all responses indicating more motivation ('More Motivated') to those responses indicating otherwise ('No Difference', and 'Less Motivated'). Responses for this statement were: 1. More Motivated; 2. No Difference or Less Motivated. The hypotheses established for this statement were as follows:

Table 9. Chi square results for Statement 14

Statement	Responses	Category	Expected		Observed			df	Chi-Square	Probability
			1.	2.	1.	2.	Total			
S14	1. More Motivated	Undergrad	37.3	50.8	35	53	88	1	0.440	0.507
	2. No Difference, Less Motivated	Grad	42.8	58.3	45	56	101			
		Total			80	109	189			

Ho: The student perception that virtual environments such as Second Life make you more or less motivated to conduct online collaboration is independent of type of student (graduate or undergraduate) taking the survey.

Ha: The student perception that virtual environments such as Second Life make you more or less motivated to conduct online collaboration is associated with type of student (graduate or undergraduate) taking the survey.

For Statement 14, resulting analysis on the chi square statistic ($x2 = 0.440$) and a corresponding probability ($P=0.507$) were below the conventionally accepted significance level of 0.05, so the null hypothesis that the two distributions are the same is verified (see Table 9). Based on these results, the null hypothesis that the student perception that virtual environments such as Second Life make you more or less motivated to conduct online collaboration is independent of type of student (graduate or undergraduate) taking the survey is accepted.

Discussion of Results

So we can see from the students' responses and data analysis in area 1: Population Background, that students have an average level of experience using technology in their workplace. Many students have taken online course and have used some forms of technology particularly focused on software and technologies that are video based and either synchronous or asynchronous in use. However, video based technology even used in a synchronous environment is still 2D and limited in the ways it can create a sense of community and build trust via interpersonal communication experiences and in the ways one can share with a community of physical artefacts. Interestingly a growing number of students had some experience in virtual environments. Almost 33% of graduate students and almost 23% of undergraduate students stated they had operated in virtual worlds in the past. This experience in virtual worlds by close to one third of graduate students and one quarter of the undergraduate students may have influenced other students in the class by providing support and advice informally to those new to the virtual environment. As a consequence this may have improved interpersonal communication trust among classmates and team members and should be more closely studied in the future.

In Area 2: Learning Curve, students at both the graduate and undergraduate levels indicated that there was minimal time necessary to adapt and learn to use the basic functions in Second Life. Only 4% of survey participants reported that they took over 2 hours to practice and prepare to function in the virtual environment prior to the first class meeting and work. This is strong anecdotal indication that workers do not find basic avatar and virtual environment navigation to be overwhelming to learn or overly burdensome. The lesson here is that providing a simple automated method for logging in and creating and operating an avatar, along with providing appropriate and clear training about the steps to do so can result in systemic trust of the technology because there is not an overwhelming time commitment to learning how to operate in this new environment. The outcome of this question likely impacted also the later survey responses related to satisfaction with the medium as a whole.

In Area 3: Avatar Interaction was particularly important because the responses from students impact two areas of trust evaluation. One is related to their sense of control and ease with which they operate the avatar-that is we needed to know if the technology interfered with their sense of ability to communicate effectively in the environment. Additionally, we needed to probe if as an overall matter they felt the use of a proxy-that is an avatar in this case-in a live synchronous communication was an effective way to work collaboratively and communicate with others in their group. These outcomes are related to building interpersonal trust among group members as well as impact the development of a group identity. Additionally, the outcomes provide us with indicators related to group inclusiveness. Did people feel left out of the group if they had difficulty engaging with other students using an avatar-either because they found the avatar difficult to use or because they were not comfortable emotionally with the use of an avatar proxy?

First, a little over 75% of students from the graduate classes and roughly 74% of the undergraduate students stated they found the use of a Code of Conduct in the development of avatar appearance and behaviour "important" or "very important" indicating a clear preference for parameters designed by management to give guidance to the activity and interaction between people in the environment. Additionally, approximately 64% of graduate and 72% of undergraduate students indicated they did not feel that the avatar's appearance was distracting in the work environment in any way. So, one advantage of having a basic Code of Conduct including avatar appearance seems to be that it avoids distraction based on avatar appearance which should support trust building in the environment itself.

One very interesting response, however, was that a little over 50% of students in both groups indicated that the avatars did not have to closely resemble their human counterparts. This response needs further defining and consideration as it is not clear if students mean that avatars should still look human but do not need to look like the human for which they stand as a proxy or whether they in fact mean it is less important that an avatar even resemble a human being at all. What is significant here however is that the majority of students do seem to be comfortable using the avatar as a proxy for themselves in the environment and that most of the proxies in this situation were not distracting.

The final area of survey for this paper was Area 4: Perceived Effectiveness of the Medium. In this area we saw that a little over 40% of graduate students and close to 40% of undergraduate students reported that use of the virtual environment makes them more motivated to conduct online collaboration. A little over 36% of graduate students and roughly 37% of undergraduate students indicated use of Second Life made no difference in their motivation to collaborate in and only a little over 21% of graduate students and almost 18% of undergraduate students indicated their experience made it less likely they would collaborate in virtual environments in the future. This data provides us with a ground level idea of what questions should be asked next to determine the reasons for the responses here. While it is a positive indication that almost one half of the graduate students and over one third of the undergraduate students felt they were more likely to use virtual reality in collaborative ventures again there is still a relatively large group that either is neutral on its use or negative about the use. Because the much larger group is neutral on the use of the medium for collaboration in the future we feel taken with the largest populations being more motivated to use the medium again for collaboration, that the medium should be more closely studied to develop clear practices for use in project management and other collaborative work environments in order to assure a positive outcome.

Conclusions

Virtually immersive environments provide an opportunity for geographically dispersed project teams or students to engage in a more dynamic and satisfying online work experience assuming appropriate levels of trust can be developed which lead to effective knowledge share and positive project completion. From the data we have gathered and reported here we believe the following recommendations will help support those outcomes:

First, when deploying virtual technologies for teaming in the workplace among geographically dispersed audiences remember that it is important to provide a structured set of guidelines to help your users get started either building their avatars or learning to navigate the environment your create for their work. Create an environment from work that is not overly complex or difficult to navigate and design a Code of Conduct that provides at least some basic guidelines of behaviour as well as visual avatar representations. If you are working with a group of particularly creative team members you may find that the look of the avatar is less important and that you can allow for more creativity in that area but it is important that team members know parameters for behaviour and visual representation just as they would be aware of those in the real world workspace.

It is helpful to query team members about their experiences in virtual environments-many users have experience in one form or another in these environments as gamers-and our data at least anecdotally indicates with a small base population of users familiar with the environments there is more support for trust building among peers. We don't yet know if peers were aiding one another in use of the technology but if so this is likely to result in even stronger trust building at the interpersonal level.

Additionally, we suspect team members with a negative response to using the medium again for collaboration were likely influenced either by the platform itself-that is they felt that the virtual medium was not as smooth as other immersed environments-which is something we've seen before-or that they did not have confidence in the system or technology because of its newness or some difficulty in use. We do note that a little over 16% of graduate students reported that communicating using an avatar was neither difficult nor easy to learn and 11% agreed it was in fact difficult to learn with roughly 1% considering it extremely difficult to learn. While these numbers are lower they do resemble the numbers at the graduate level the responses to the question related to the students' likelihood of future use of the virtual environment as a collaborative tool. The undergraduate students reported like responses and so while students overall indicated there was not a steep learning curve involved in their use of the virtual environment this may be an indicator that they did not practice using and communicating with their avatars enough prior to use and that this failure impacted their ability to fully develop interpersonal trust and bonds with other team members during this project time. It makes sense based in this introductory data to be sure to focus some training on the processes involved in communicating using avatars-this is particularly true because avatars can use live audio as well as

something called back chatting which is text communications that may or may not be seen by the entire group.

To sum up, based on our current preliminary data and based on the assumption that in order to most effectively use virtual world environments for team collaboration managers/educators should engage several supportive preparations first:

1. Determine what if any experience in virtually immersive environments team members have prior to this use.
2. Design a virtual working environment that is task-oriented and easy to manipulate assuming that to begin with well over three quarters of your users will not have any experience working or playing in these environments.
3. Design and launch effective training for work in these virtual environments-this can be short and quite simple as well as reusable so while there is some up-front investments in this process it is redundant and reusable.
4. Encourage practice communicating among peers in the team environment to be certain users are comfortable with the process of communicating using this technology.
5. Consider developing a code of conduct that can be flexible but provides teams with basic rules of behaviour and avatar appearance so those things do not interfere with the teamwork.

If these preparations are executed effectively it is our belief that virtually immersive environments can be extremely effective working spaces for collaboration on project teams.. The above recommendations are designed to support project team trust not only in the system (including trust in the technology) but also in interpersonal trust building and team bonding which taken all together should facilitate knowledge-sharing and improve project team success.

References

Ale Ebrahim, N., Ahmed, S., & Taha, Z. (2009). Virtual R & D teams in small and medium enterprises: A literature review. Scientific Research Essay, Volume 4, Issue 13, 1575-1590.

Babbie, E. (1990). Survey Research Methods. Belmont, CA: Wadsworth Publishing Company.

Blythe, A. (2011, May 30). Business Benefits in the Virtual World. Retrieved from Strategic Social Media: http://prosintraining.com/ssm/2011/05/business-benefits-in-the-virtual-world/

Brown, R. A., Recker, J. C., & West, S. (2011). Using virtual worlds for collaborative business process modeling.Journal of Business Process Management, Volume 17, Issue 3, (In Press).

Cahalane, M., Feller, J., & Finnegan, P. (2010). Investigating Collaborative Development Activities in a Virtual World: An Activity Theory Perspective. ICIS 2010 Proceedings (p. 84). St. Louis, MO: AIS Electronic Library.

Casarez, V., Cripe, B., Sini, J., & Weckerle, P. (2009). Reshaping Your Business with Web 2.0: Using the New Collabortive Technologies to Lead Business Transformation. New York, NY: McGraw-Hill.

Chang, K.-c. (2011). The Companies We Keep: Effects of Relational Embeddedness on Organizational Performance. Sociological Forum, Volume 26, Issue 3, 527-555.

Chiu, C. M., Hsu, M. H., & Yi, H. (2006). Understanding knowledge sharing in virtual communities: an integration of social capital and social cognitive theories. Decision Support Systems, Volume 42, 1872–1888.

Clouder, L. (2009). 'Being responsible': Students' perspectives on trust, risk and work-based learning.Teaching in Higher Education. Volume 14, Issue 3, 289-301.

Czaja, R., & Blair, J. (1995). Designing Surveys: A Guide to Decisions and Procedures. Thousand Oaks, CA: Pine Forge Press.

deFreitas, S., & Neumann, T. (February 2009). The use of ‘exploratory learning’ for supporting immersive learning in virtual environments.52(2).

Dede, C. (2009). Immersive Interfaces for Engagement and Learning. Science, Volume 323, No. 5910, 2(5910), 66-69.

Fang, Y. H., & Chiu, C. M. (2010). In justice we trust: Exploring knowledge-sharing continuance intentions in virtual communities of practice. Computers in Human Behavior, Volume 26, 235–246.

Garrison, D. R., & Vaughan, N. D. (2008). Blended Learning in Higher Education: Framework, Principles, and Guidelines . San Francisco, CA: John Wiley & Sons, Inc.

Heiphetz, A., & Woodill, G. (2010). Training and Collaboration with Virtual Worlds: How to Create Cost-Saving, Efficient, and Engaging Programs. New York, NY: McGraw-Hill.

Hsu, M. H. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. . International Journal Human-Computer Studies, Volume 65 , 153–169.

Hsu, M.-H.C., Chang, C.-M., & Yen, C.-H. (2011). Exploring the antecedents of trust in virtual communities. Behavior and Information Technology, Volume 30, Issue 5 , 587-605.

Jarvenpaa, S. L., & Leidner, D. E. (2006). Communication and Trust in Global Virtual Teams. Journal of Computer-Mediated Communication, Volume 3, Issue 4, 0.

Kanawattanachai, P., & Yoo, Y. (2002).Dynamic nature of trust in virtual teams. Journal of Strategic Information Systems, Volume 11, Issue 3–4, 187–213.

Korsgaard, M. A., Picot, A., Wigand, R. T., Welpe, I. M., & Assmann, J. J. (2010). Cooperation, Coordination, and Trust in Virtual Teams: Insights from Virtual Games. In W. S. Bainbridge, Online Worlds: Convergence of the Real and the Virtual (pp. 253-264). London, England: Springer-Verlag.

Krejci, G. P. (2009). Project management with virtual teams? GruppendynOrganisationsberat, 40(3), 303-314.

KZero. (2011, October 21). Slideshare Universe presentation, Q1 2011. Retrieved from KZeroWorldswide: http://www.kzero.co.uk/blog/slideshare-universe-presentation-q1-2011/

Larson, E. W., & Gray, C. F. (2011). Project Management: The Managerial Process. New York, NY: McGraw-Hill.

Lebedieva, O., Matvijkiv, O., & Lobur, M. (2011). Virtual project management. CAD Systems in Microelectronics (CADSM), 2011 11th International Conference The Experience of Designing and Application of (pp. 364-365). Polyana-Svalyava , Ukraine: CADSM'2011.

Lewicki, R. J., & Bunker, B. B. (1996). Developing and maintaining trust in working relationships. In R. M. Kramer, & T. R. Tyler, Trust in organizations: Frontiers of theory and research (pp. 114-139). Thousand Oaks, CA: Sage.

Lewis, J. D., & Weigart, A. (1985). Trust as a social reality. Social Forces, Volume 63, Issue 1, 967-985.

Lin, M. J., Hung, S. W., & Chen, C. J. (2009).Fostering the determinants of knowledge sharing in professional virtual communities. Computers in Human Behavior, Volume 25, 929–939.

Lind, D., & Mason, R. (2000).Basic Statistics for Business and Economics. New York City, NY: McGraw-Hill.

Lipnack, J., & Stamps, J. (1997). Virtual teams: Reaching across space, time, and organizations with technology. New York, NY: John Wiley & Sons, Inc.

Livingstone, D. (2011). Second Life Is Dead, Long Live Second. EDUCAUSE Review, Volume 46, Issue 2.

McAllister, D. J. (1995). Affect- and cognition based trust as foundations for interpersonal cooperation in organizations. Academy of Management Journal, Volume 38, 24-59.

Nah, F. F.-H., Schiller, S., Mennecke, B. E., Siau, K., & Sattayanuwat, P. (2011). Team Collaboration in Virtual Worlds: The Role of Task Complexity. AMCIS 2011 Proceedings (p. 383). Detroit, MI: AIS Electronic Library.

Nevo, S., Nevo, D., & Carmel, E. (2011, March 23). Unlocking the Business Potential of Virtual Worlds. Retrieved from MITSloan Management Review: http://sloanreview.mit.edu/the-magazine/2011-spring/52311/unlocking-the-business-potential-of-virtual-worlds/

Pinsonneault, A., & Caya, O. (2005). Virtual Teams: What We Know and What We Don't Know. International Journal of Electronic Collaboration, Volume 1, Issue 3, 1-16.

Powell, A., Piccoli, G., & Ives, B. (2004). Virtual teams: a review of current literature and directions for future research. The DATA BASE for Advances in Information Systems, Volume 35, Issue 1.

Rad, P. F., & Levin, G. (2003).Achieving Project Management Success Using Virtual Teams. Boca Raton, FL: J. Ross Publishing.

Reed, A. H., & Knight, L. V. (2010).Effect of a virtual project team environment on communication-related project risk. International Journal of Project Management, Volume 28, Issue 5, 422-427.

Ridings, C. M., Gefen, D., & Arinze, B. (2002). Psychological barriers: Lurker and poster motivation and behavior in online communities. Communications of the Association for Information Systems, Volume 18 , 329–354.

Rossett, A., Douglis, F., & Frazee, R. V. (2003, July).Strategies for Building Blended Learning. Retrieved August 21, 2011, from learningcircuits.org: https://files.pbworks.com/download/nStd6zxaHf/ablendedmaricopa/1240589/Strategies%20Building%20Blended%20Learning.pdf

Rusman, E., van Bruggen, J., Sloep, P., & Koper, R. (2010). Fostering trust in virtual project teams: Towards a design framework grounded in a Trust Worthiness A Ntecedents (TWAN) schema. International Journal of Human-Computer Studies, 834-850.

Rusman, E., van Bruggen, J., Valcke, M., & Koper, R. (2010). Can I Trust You?. Profile Elements that Inform First Impressions of Trustworthiness in Virtual Project Teams. International Journal of Information Technology Project Management, 1-19.

Sarker, S., Ahuja, M., Sarker, S., & Kerkeby, S. (2011). The Role of Communication and Trust in Global Virtual Teams: A Social Network Perspective. Journal of Management Information Systems, Volume 28, Number 1, 273-310.

Schouten, A. P., van den Hooff, B., & Feldberg, F. (2010). Real decisions in virtual worlds: Team collaboration and decision making in 3D virtual worlds. ICIS 2010 Proceedings (p. Paper 18). St. Louis, MO: AIS Electronic Library (AISeL).

Schultze, U., & Orlikowski, W. (2010). Research Commentary-Virtual Worlds: A Performative Perspective on Globally Distributed, Immersive Work. Journal of Information Systems Research, Volume 21, Issue 4, pp. 810-821.

Schultze, U., & Rennecker, J. (2007). Reframing Online Games: Synthetic Worlds as Media for Organizational Communication. In K. Crowston, S. Sieber, & E. Wynne, IFIP International

Federation for Information Processing, Vol 236, Virtuality and Virtualization (pp. 335-351). Boston, MA: Springer.

Sorom, T. (2010, December 31). The Year in Virtual Goods by the Numbers. Retrieved from techcrunch.com: http://techcrunch.com/2010/12/31/the-year-in-virtual-goods-by-the-numbers/

Staples, D., & Webster, J. (2008).Exploring the Effects of Trust, Task Interdependence and Virtualness on Knowledge Sharing in Teams. Information Systems Journal, Volume 18, 617-640.

Sunindijo, R. Y., Hadikusumo, B. H., & Ogunlana, S. (2007). Emotional Intelligence and Leadership Styles in Construction Project Management. Journal of Management Engineering, Volume 23, Issue 4, 166-171.

The Pensylvania State University. (2009). What is Blended Learning? Retrieved December 16, 2010, from http://weblearning.psu.edu/: http://weblearning.psu.edu/blended-learning-initiative/what_is_blended_learning

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

Warkentin, M., & Beranek, P. M. (1999).Training to improve virtual team communication. Information Systems Journal, Volume 9, Issue 4, 271-289.

Warren, J. (2007, April 23). Leveraging Virtual Worlds for Real Organizational Communication. Retrieved from cox.smu.edu: http://www.cox.smu.edu/web/guest/faculty-research/-/blogs/leveraging-virtual-worlds-for-real-organizational-communication;jsessionid=3BF67A798DDCDBB54EE2DA7985CCD548?_33_redirect=%2Fweb%2Fguest%2Ffaculty-research

Wasko, M., Teigland, R., Leidner, D., & Jarvenpaa, S. (2011). Stepping into the Internet: New ventures in virtual worlds. MIS Quarterly Vol. 35 No. 3, 645-652.

Weber, L. (2011). Self at the Heart of Trust: The Global Relevance of an Interactionist Understanding of Trust as a Form of Association. Comparative Sociology, Volume 10 , 413-440.