Engaging E-Learning in Virtual Worlds: Supporting Group Collaboration

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Abstract

Current e-learning environments do not provide sufficient support for group collaboration. The absence of the visual identification of the users makes effective collaboration in e-learning very difficult. This paper argues that virtual worlds (VW) possess the necessary tools to foster effective group collaboration for e-learning initiatives. The use of avatars, the support of verbal and non-verbal communications and creative capabilities offered in VWs are suggested as the key elements that promote effective group learning.

1. How e-learning doesn't work for groups

For many years, new learning environments, methodologies and technologies have been developed and implemented looking for the right combination of learning conditions in order to optimize the outcome. During the last couple of decades computers has become a fundamental tool to enhance learning processes, generally called electronic learning or e-learning. E-learning is particularly suitable for flexible and distance learning. The flexibility of self paced learning and distance learning support provided by these endeavors is mainly responsible for their popularity in today's education setting. On the other hand the lack of face-to-face interaction with teachers and peers, and the feeling of isolation experienced by the distance learners hinder the e-learning experience. These disadvantages of e-learning environments are the source of an additional disadvantage: poor support for effective group collaboration

Group learning has been found to significantly enhance learning and student engagement [5], thus it has become one of the most used pedagogical methodologies. At the same time research shows that e-learning students favor the use of collaborative learning techniques [1]. Even though group collaboration is desired and many times required in online learning initiatives, available e-learning environments do not provide proper support for it.

The lack of face-to-face interactions among participants limits the user's ability to distinguish other users. It also affects the effective management of group roles and responsibilities, and the trust building process, which are necessary for effective group performance [2].

The growth of the Internet coupled with the technological advancements of the last few years triggered the explosive development of virtual worlds. Although VWs have been around for a long time they were primarily used as communities and chat rooms it was not until recently that their power for enhancing learning started to attract attention. The goal of this paper is to discuss the potential of VWs for the support of effective collaborative e-learning efforts.

2. VWs – potential for e-learning

VWs take advantage of a wide array of technologies to support and enhance their user's experience. These technologies, which vary from text-based communication tools to sophisticated visual technologies, make VWs an excellent platform to provide support for collaboration in e-learning efforts.

2.1. Background

2.1.1. What is a VW?. Bartle [4] define VWs as "places where the imaginary meets the real". With this definition he refers to the balance of fantasy and realism that VW designers achieve and that captures the interest of many.

A VW is a set of computer rendered images that comprise a simulated environment in which users interact through the use of avatars. Some of the most common and distinguishing characteristics of these worlds are: the support of multiple players, their persistent nature, social networking capabilities and the similarity to the real world. These worlds are also known as MMOGs or Massively Multiplayer Online Games; this acronym makes reference to the VW's feature of allowing multiple users to interact simultaneously through the simulated

environment. VWs are persistent since they continue to exist even without user interaction and those interactions affect its development.

VWs have been around for some time. The first VWs, called Multiple User Dungeon (MUD) and Multi-User Shared Habitat (MUSH), were text-based multiple user computer games that combined social communications with role-playing. Today's VWs keep these goals but achieve them through the use of more sophisticated and engaging designs and technologies.

2.1.2. Game oriented VWs. It is no coincidence that most VWs are developed around a fantasy theme. This actually responds to the fact that video games are the precursors of VWs.

Still a large amount of the VWs available and in development is geared around a gaming or role-playing theme. These game-oriented VWs are characterized by having a story line behind the emergence of the VW which delineates the activities and goals of the users while interacting with it. To sustain the VW's storyline and theme the designers make sure the environment is designed accordingly, including all images, sounds, and activities. While it provides for choices that allow the user to feel like having a unique experience, the choices provided are limited in order for the storyline to be present and consistent at all times. This characteristic is what has earned them the classification of strong culture VWs.

Many consider game oriented VWs as the next generation of video games [4, 24], since they are created following the basic guidelines of designing console video games and the storylines generally involve some type of fight for survival that ends up giving a strong shooting and fighting experience to the users, just like most video games do. Two of the most popular game oriented VWs are Sony Online Entertainment's EverQuest and Blizzard Entertainment's World of Warcraft, which together account for 56% of the VW's user base [21]. Even though the design and functionalities of these VWs have changed the ultimate goal of the users experiencing them continues to be the successful completion of the challenges and quests embedded in the world by the designers, in other words to "finish" the game.

This type of VWs provide a certain level of customization of the experience to the users with the goal of developing a sense of control which allow them to feel more engaged in the virtual experience. The content of a game oriented VW is the result of the designers' imagination, users have very limited (if any) power to modify or create content. One of the main sources of engagement of these categories of VWs is having a consistent theme throughout the world (i.e. the aesthetics of the world should support the storyline) and to preserve it the creative power of the users must be limited.

2.1.3. Open culture VWs. Open culture VWs are a growing segment of VWs. These are generally geared towards the simulation of real-life activities. This category of VWs is characterized by allowing users to personalize their experience through a wide variety of controls. Here users are provided with tools that allow them to give their personal touch to their VW experience, from personalizing their avatars to developing a truly unique experience in the environment for them and other users.

A distinctive characteristic of open culture VWs is the creative power that is given to the user throughout the virtual experience. Here users are provided with the necessary tools to modify and create new content in the VW. The only limitations users face when developing new content to enhance their virtual experience are their imagination and in some cases the rules of the VWs. A visit to an open culture VW is like a visit to a multicultural neighborhood, since all users have the power to modify and create the world in order to express their individuality. This is precisely what has caused their fast proliferation and growth in the recent years.

The freedom that users have to express their creativity in the VW promotes another key characteristic of open culture VWs: economic activity. As in real-life, trade is a very important element of an open culture VW experience. Users exchange their virtual creations or acquisitions for other virtual objects, services or money.

Linden Lab's Second Life and Makena Technologies' There are two of the most successful open culture VWs available. These two VWs focus on providing the user an alternative environment in which the opportunities are endless. Both of these VWs have agreements with a number of commercial organizations that have realized their potential.

The great modeling capabilities, accessibility and social network support of open culture VWs have made them ideal for the development of special purpose applications and VWs. One of the areas that are actively exploring the benefits these worlds have to offer is Education. In section 2.2.2 many of the educational uses of open culture VWs are presented.

2.2. Current educational uses of open culture VWs

Just as the business applications in VWs have proliferated so has the education oriented ones. The use of simulations is nothing new in education. What VWs provide that other simulations do not is the accessibility for simultaneous distance learning of a large number of students. This particular need of modern education is covered by the virtual learning environments, which basically bundle up a series of text based tools that facilitate distance learning, but that emphasizes individual learning rather than group learning.

Current educational uses of VWs are concentrated on the open culture ones, since these provide more flexibility than their counterparts. These worlds are being used as an alternative venue to hold lectures and conferences that promote distance collaboration. The creative power provided to the users in these worlds make them ideal for the development of educational virtual experiences. A number of universities have established a VW presence. Some like Harvard University chose Second Life as their platform for their virtual schools. Others have opted to develop their private worlds like is the case of the New York Law School that with the collaboration of There.com established the State of Play Academy.

A number of non-profit organizations are also making use of the available VWs to get their message across to a larger and more diversified audience. Organizations like the National Oceanography and Atmospheric Administration (NOAA) and the National Aeronautics and Science Administration have established a presence in the Second Life VW. These organizations have developed an interesting series of educational simulations. They also use the VW to hold conferences and informal meetings with interested users.

2.3. Group emergence in VWs

The visual characteristics and spatial orientation of the technologies used to create VWs assist in the development of online communities [2]. The user's visualization of the group and their roles with the group through VW technologies facilitates the effective accomplishment of the collective work. [2]. Many researchers have pointed to the community building opportunities that VWs provide as one of their most attractive features. Large numbers of users that do not know each other but with similar interests and goals get together day after day to share and collaborate. VW groups emerge from the desire of a group of users to achieve a particular goal in the world. These groups hold together by more than the sense of belonging the members have, but by their shared purpose in the VW [2]. Emergent groups in VWs engender a high level of collaboration among their members.

2.3.1 Group formation in game oriented VWs. Virtual groups in game oriented VWs arise from the desire of successfully accomplishing the world's challenges. Communities of users in these worlds, called guilds, are formed following the storyline of the world. Users that have a specific common interest in the VW, like they all control avatars that belong to a specific in-world "race" or social group, get together and form a group. The members are responsible for managing the guilds, and establishing and enforcing the rules to be followed by all the members. It is precisely the shared purpose and interests of the members that generate the group culture and allow the continuous existence of the group [2].

The main incentive for becoming a member of this type of virtual group is the in-world collaboration that is derived from membership. This collaboration enhances the experience of the involved users. It is through collaboration that a large number of users get to exchange ideas and objects, and learn how to interact efficiently with the VW.

Guilds maintain websites outsides the VW and in some cases they even hold meetings in real life, extending the role playing and collaboration beyond the VW [6]. Even though most of these guilds have a presence outside the VW their collaboration efforts are centered in supporting in-world activities.

2.3.2. Group formation in open culture VWs. Open culture VWs offer even more community building opportunities than game oriented VWs. In these, users get together with the goal of supporting their in-world activities and interests, but they can also create groups around their real-life interests. A very good example of this is the very active community of real-life educators that uses Second Life to support and expand their academic activities through the use of VWs [19].

The possibility of modifying the virtual environment and creating user specific content produced the opportunities for the emergence of a group centered in trading activities, where buying and selling user created content is the shared interested. Other groups fostered by the creative power of the users in open culture VWs are: collaboration centered groups where users that are interested in collaborating in the development of new content get together to share ideas and mentoring groups where the interest of members is to help other users to effectively use the VW features.

The customizable nature of open culture VWs provide a new forum for real-life groups to establish a VW presence that enables them to spread their message to a wider audience, as is the case of the Better Island in Second Life. The facilitation of community emergence in open culture VWs can generate all kinds of collaborative efforts among the users.

3. Engagement

Engagement is a topic of interest to researchers in many areas. The game industry has been able to develop a level of engagement so high that it borders addiction as it can be appreciated with the widely publicized cases that claim game addiction was responsible for some type of family or relationship dysfunction [18]. The ability of game designers to engender high levels of engagement leaves educators and other interested parties in awe. As a result educational video games have proliferated

immensely during the last decade. An additional byproduct of the achieved levels of engagement by the video game industry is the increased interest of behavioral researchers trying to tap into the users' motivations for such engagement as well as other research in the serious use of games [29, 23].

3.1. What is engagement?

The term engagement refers to the situation in which an individual's attention is completely focused on a particular task [22]. The game industry focuses on engagement as a tool to sustain the participant's interest in the game in order to increase the game popularity and the associated income. As a result their center of attention is the game features that help achieve the flow state in the user's experience.

The state of flow is the psychological state of enjoyment and satisfaction and sense of control experienced by a user when his or her attention is entirely absorbed in the pursuit of the activity at hand [24]. A user that experiences "flow" overcomes all distractions loses track of time and achieves maximum performance levels [4, 14]. In other words a person that experiences the state of flow is highly engaged.

3.2. What engenders engagement?

To be able to foster engagement "it is necessary to understand all of the formal, social and cultural factors" that has an impact on the experience [24]. Flow is the maximum level of engagement a user can experience and is what game designers strive for. The flow state is an individual condition and what engenders it in a user might not work with another. Even though there is no element or feature that will facilitate its universal achievement, Csikszentmihalyi [8] identified eight conditions that make flow possible: (1) a challenging activity that require skills, (2) concentration on the task at hand, (3) clear goals, (4) direct feedback, (5) the merging of action and awareness, (6) the paradox of control, (7) the loss of self-consciousness and (8) transformation of time.

An activity facilitates the development of flow in the user's experience if it requires the user's active attention. That is, it results challenging enough to the user, requiring some specific skill to successfully perform it. It should allow the user to deeply concentrate on the activity at hand by having clear goals and providing direct and immediate feedback to the task that was executed. When experiencing flow the user's absorption in the activity fades the user's awareness of externalities to the experience, they become so deeply involved that their actions become spontaneous or automatic. At the same time users are given control over their actions which provide them with a false sense of control over the situation. Loss of self-consciousness in the experience of flow refers to the user's identification with the experience that he or she becomes a part of the activity and the concern for the self becomes unimportant. Finally, the state of flow or complete involvement alters the user's sense of time, stretching or shrinking it according to the activity [8].

Not all of these conditions need to be present for achieving flow. In order to develop the experience of flow for a wide number of users a balance among these conditions need to be incorporated, which has been the strategy of video game designers [7].

3.2.1. Engagement in game oriented VWs. LeBlanc [17] identified eight principal sources that assist in the development of engagement through a player's gaming experience. The identified sources are: Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression and Submission.

Sensation as a source of engagement refers to the design of a gaming experience that is rich in sensorial input in order to generate enjoyable emotions in the participant. The next source, Fantasy, achieve the goal of engagement through the creation of an alternative reality to which the user is exposed throughout the course of the gaming experience, exploiting that way the pleasure that individuals derive from make-believe or from temporarily escaping reality. The use of narrative is very common in video games. The goal of this practice is to capture the user's attention by adding drama to the experience. Similarly to Csikszentmihalyi's conditions of flow LeBlanc's sources of engagement propose the use of adjusting levels of challenges as a tool for the development of user engagement. Fellowship provides user engagement by incorporating tools that take advantage of the users desire to connect with others and facilitates the emergence of a social network through the game experience. Another source of engagement in the design of VWs is addressed by supplying the users with enough content so that they feel a desire to explore and discover the virtual environment. The design of an environment that allows the users to express themselves through the experience also engenders engagement. Finally, an experience that promotes the user's submission to it is another way to foster user engagement. [17].

Game oriented VWs rely on the incorporation of the characteristics of an engaging experience in the design in order to achieve user engagement. The principal characteristics of these worlds that produce engagement include: the use of narratives describing the fantasy that surrounds the world; the incorporation of various challenges that requires different skill levels to be achieved and which outcome vary according to the skill level used; support of user communities activities and provide a limited amount of choices to give a degree of control of the experience to the user.

3.2.2. Engagement in open culture VWs. Open culture VWs offer a different experience to their users, a more flexible experience than their counter parts. As a result their sources of engagement are different. They do not limit the user experience throughout the use of narratives or a limited fantastic setting. These worlds give the users the opportunity to create their unique experience, eliminating this way the need to incorporate challenges in the design of the VW. Each user incorporates the desired level of challenge to the experience. Providing support for the emergence of social networks and a wide variety of choices that contribute to offer a customizable experience to the user are sources of engagement that are present in both game oriented and open culture VWs, but in which the last rely more heavily.

An additional and very important source of engagement of open culture VWs is the set of features that allows the user to exercise their creativity by modifying and creating new content to customize and enhance their experience in the VW. The processes of customizations and creation are some of the means that people use to achieve their general desire of self-expression.

Open culture VWs provide true creative power to the users while game oriented VWs only support object crafting. To craft objects in these worlds the users need to follow the directions and resources provided by the designers. Objects produced through crafting are not the result of a creative process; they do not add anything new to the world. Creation is only supported when users can add value to existing content and generate completely new content [2]. Open culture VWs take advantage of its creative features to engender user engagement.

3.3. Learning and engagement

Achieving student engagement has been one of the main issues in education throughout time. Lots of attention has been given to the subject by education researchers and many alternatives have been suggested. But is the huge success of video game engrossing quality that has primarily call their attention.

With the proliferation of e-learning initiatives the issue of engagement becomes even more relevant. It is known that a complete education not only provides the necessary knowledge to individuals but also support the development of the basic skills needed for professional success. One of these skills is the ability to collaborate with others in an efficient and effective manner.

Educational activities need to be able to engage the students in order to successfully meet the learning goal. Developing sustained engagement in learning activities is a challenge. Collaboration is a common tool used to increase student engagement. Group projects provide more than just content learning, it promotes human interaction and help develop the communication, planning, management and social skills of the students [16]. Engaged learning is a very important factor for student's motivation to learn and it assist in the enhancement of the students creative, problem-solving, reasoning, decision-making and evaluation skills.

3.4. Relationship between engagement and presence

The concepts of engagement and presence are closely related and critical to the essence of VWs. The design of a VW incorporates features that support both concepts. Engagement makes reference to the focus of a user's attention on the task at hand, while presence refers to the psychological sense of being in the virtual environment that envelops an engaged user [27].

Engagement and presence are often used as synonyms, but a group of virtual reality researchers believe that it is important to differentiate among them. They argue that the user engagement is required before a sense of presence can be developed. It is important to explain this notion since it seems to contradict intuition. In real world environments a person has to be physically present before engagement in the activity arises, in fact a person can be physically in a classroom but not even remotely interested in the activity. In the case of virtual environments presence is defined as the user's psychological state of being in the virtual environment rather than in a real world location. A user that is deeply engaged in the activity that is performing in the virtual environment will be able to develop a sense of presence in the virtual environment whereas a not engaged user will always perceive it as a technological creation and would not be psychologically transported. Therefore in VWs engagement is a pre-condition of presence.

Presence is a very complex concept composed of multiple aspects. These aspects are classified as; automatic, environmental, and subjective. Automatic aspects of presence make reference to the involuntary responses the user have to the virtual environment. The environmental aspects of presence have to do with the concept of immersion through sensory information provided by the virtual reality technology. Finally, the subjective aspect is concerned with the user's perception of presence [13].

3.4.1. Social presence. Due to the complexity of the concept presence is generally divided according to the origin of the features that support the sense of presence. A common classification scheme divides it into three: physical, social and environmental presence [10].

Social presence addresses the user's perception of the virtual environment as suitable for social network. This aspect of presence is addressed by incorporating factors of

social behavior to support virtual social encounters. These encounters can be with avatars representing other users or computer agents. Regardless of the type of avatar encountered, the interaction should resemble a real life social encounter for social presence to emerge in the mind of the user.

VWs incorporate many of the factors that support social presence such as body and head movements of the avatars, simultaneous representations of users, representations of agents, verbal and text communications, and gestures. Designers use these indicators of social presence as a source of user engagement as well as to provide the user with a virtual environment that supports a sense of social presence. The next section discusses a number of factors that help in the development of a sense of presence through a VW experience.

4. Presence in VWs

VWs strive to engage users to the point of developing a sense of presence in the world, a feeling of being part of the virtual environment. To achieve this, they not only apply the previously discussed sources of engagement but they also emphasize the environmental and social aspects of presence in their design. VW designers exploit the available technology in order to immerse the user's senses in the experience and ultimately develop a sense of presence.

4.1. Presence factors in VWs

Many researchers have attempted to identify the main factors affecting presence [25, 20, 28, 14]. These factors have been classified in broad categories following the conceptual similarities among the elements of experiencing presence. This paper will use Witmer & Singer's [28] categories of factors to present the factors affecting the sense of presence. These categories are: sensory factors, control factors, distraction factors, and realism factors. The first group of factors, sensory factors, incorporates all those factors that involve sensorial information. Control factors refer to those that are related to functionalities and manipulation of the virtual environment. The next group of factors, distraction factors, incorporates all aspects that affect the degree of attention of the user. Finally, the realism factors refer to the characteristics of the virtual environment and medium used that facilitates rendering a vivid representation.

4.1.1. Sensory factors. The appropriate use of sensory information is very important for the emergence of a sense of presence [14]. This category consists of all the elements related to the development and transmission of sensorial information in VWs. Generally, it is expected that as more sensory information is provided by the virtual environment the higher the sense of presence that arises. To engender a higher sense the virtual experience should stimulate the senses by providing as much sensorial information as possible. These stimuli should be transmitted without conflict through various senses and be relevant to the goal of the experience [12].

4.1.2. Control factors. The feeling of presence reported by the participants is tightly coupled to their feeling of being in control of the experience. Participants tend to feel more present when they have a significant amount of control in the mediated experience. As a result a successful VW should incorporate various features to assign the desired control to the user without affecting its ultimate goal. Some of the control features that if provided to the users enhance their sense of presence include: controls over the interface [9, 26]; and prompt and appropriate feedback to the user's actions in the VW [3].

4.1.3. Distraction factors. To achieve a strong sense of presence the user should have the perception of a non-mediated experience have been widely discussed in the virtual environment literature [27, 23, 20], this requires that distractions from the experience be minimized. To minimize distractions from the VW the use of special equipment and devices should be natural and non-obtrusive [10, 11]. Actively engaging the user's senses in the virtual experience also help reduce distraction and increase presence.

4.1.4. Realism factors. This category of factors is related to the characteristics of the technological medium used to provide the virtual environment. It also incorporates characteristics of the virtual environment design and how these facilitate or obstruct the portrayal of a realistic virtual environment. The goal of the combined use of these factors is to develop perceptual realism. Realism of the environment representations and their consistency with real world versions are important considerations in the development of a sense of presence in VWs.

4.1.5. User factors. The level of presence experienced by the participants in a virtual environment is not only affected by the characteristics of the environment's design. Presence is the psychological state of the user at a particular point in time. Like any psychological phenomena, its manifestation or lack thereof is dependent on a wide range of personal variables. In this case the reported strength of the sense of presence experienced will be the result of the interaction of both, the virtual environment characteristics and the individual's characteristics. Therefore, in order to properly account for the role of each of the previously discussed factors in the development of a sense of presence is necessary to account for the individual's characteristics that may influenced it.

Some of the users variables identified in the literature include: the user's immersive tendencies, prior experience, knowledge of the experience medium, selective attention, susceptibility to anxiety and disorientation, and demographics.

4.2. Group presence factors in VWs

Another set of factors that influence the sense of presence are associated with the social dimension of virtual environments. These social factors regulate the levels of immediacy and intimacy that participants feel towards other avatars, real or agents, in the VW. Social richness in a VW increases the strength of presence while interacting with others trough a virtual experience by facilitating the user's perception of a "sociable, warm, sensitive, personal, or intimate" [20] environment. These factors assist in the transmission of the social, symbolic and non-verbal cues that complement human communications. The incorporation of social factors in VW empowers the user to control the general level of intimacy of the interactions with others.

A VW that allows and promotes frequent interaction among the participants of the virtual experience evokes a higher sense of presence in the users than those that do not support it. To enhance the sense of social presence a VW should provide mechanisms and easy to use tools that make the users feel acknowledged by the other users and the environment. To develop a feeling of co-presence among the VW users is necessary that the environment allow for the representation of the signals used to communicate without using words, also known as body language.

5. How to make group collaboration engaging using VWs

As previously mentioned one of the main issues encountered in e-learning endeavors lies in the difficulty of fostering effective group collaboration among the participants. The use of VWs can help address this gap in e-learning.

Effective group collaboration requires that all participants commit to the group activity and the existence of an appropriate working environment, an environment that make all group members comfortable and fosters their participation. This is increasingly important in distance group collaboration due to the lack of face-to-face contact. The development of the appropriate working environment for the group and the effective achievement of the goal is one of the most important steps of any collaborative work endeavor. For that reason it is generally one of the most time-consuming phases of a collaborative effort. Failure to develop the desired environment will negatively impact the outcome of the group effort.

Achieving the goal of an appropriate working environment for collaborative work in e-learning poses an additional challenge which is that it has to be achieved very swiftly, since the group work have to be performed in a very short period of time. It is precisely here where VWs could potentially benefit e-learning by providing an engaging platform that can support multiple users and collaboration among them.

The study of VW's dynamics is full of rich examples of how countless strangers with a shared interest in the world or particular aspect of it have come together to form very large communities in a very short period of time. The goal of these communities of users generally is to stand out in their VW's experience. To achieve that goal they come to a collaboration agreement of using each other's virtual skills to achieve the highest benefit for all parties involved. VWs are purposely designed to achieve user engagement. Some of these design characteristics also support group engagement that result in group collaboration.

Group members need to be engaged in the required task in order to effectively contribute to it. A successful collaborative environment will support user engagement. To achieve the required level of engagement in the participants it is necessary that the users feel some level of familiarity with their collaborators. Collaborative efforts that require some type of face-to-face encounters of the members overcome the engagement issue more easily than efforts in which face-to-face is not required or supported, since there is an actual physical association with them. The reason for this is that by visually identifying the other parties a sense of belonging evolves faster, as do the trust among them. In addition visually identifying collaborators helps in the group management of roles and responsibilities. Future interactions among team members will build upon the face-to-face meeting results. The relationship is considered more personal or natural by the users since they have already met the other parties. This physical acquaintance allows for the achievement of a sense of group presence even when the parties are not in the same place. That is, that they have the psychological sensation that their collaborative efforts bring them to the same place.

In the e-learning scenarios this is not true. Normally students are from different locations with different backgrounds and are not in the least acquainted with each other and the face-to-face promotive interaction that effective collaborative learning requires [15] are generally not feasible. Through the tri-dimensional visual interface provided by VWs team members in an e-learning course can easily become familiarized with each other, achieve higher levels of engagement and group presence during

the collaborative task, which is expected to enhance their performance.

As mentioned earlier one of the main characteristics of VWs that engender social presence is the availability of a virtual body to represent each user. Available virtual learning environments do not provide support to developing group or social presence among students while using the environment. The virtual body of a classmate in a VW type learning environment would be easy to identify and visible whenever he or she is interacting with the environment or other classmates. It is expected that this will allow more communication and interaction among students than through the available environments in which it is difficult to see and identify others. Since only when the students activate some of the communication tools are they able to see a list of other users that are in the system and using the communication tool at the same time. That means that the user must willingly choose to participate in a "conversation" with his or her classmates in order to see who is available. For that reason a large portion of the communication that takes place among e-learning students is through e-mail, rather than other more active communication tools like chat or instant messaging. The use of a list of active users in the learning environment may achieve the goal of facilitating identification, but does not necessarily engender collaborative behavior among the users. The visualization of users through the use of avatars rather than just a line of text (or nickname) allow the users to see themselves and their classmates as a community and act as a community [2].

The physical visibility, even if it's virtual, of all the users that are logged into the system simultaneously is another characteristic of VWs that may foster group engagement in e-learning collaborative efforts. In a VW just by signing in users are highly visible to one another through their virtual bodies. This visibility facilitates the emergence of a sense of presence among participants. Being able to immediately identify who is available at the same time will facilitate communication and interaction among students in a VW learning environment resulting in higher levels of user engagement. Not requiring the students to launch a different tool of the environment in order to see the availability of other students or to communicate with team members enhances the student's overall experience with the learning environment facilitating his or her engagement. Easier communications among users is expected to benefit each individual group's performance as well as enhance the general performance of the class.

The support of voice communications through the virtual learning environment can also be considered a critical factor in enhancing group collaboration. Voice adds a personal element to the communications. When you're able to hear the voice of a person, for example through the phone, the physical distance between the parties is psychologically shorten, at least for the duration of the conversation. Allowing for voice communications, supported by the environment, among e-learning students will increase their sense of being in a shared space with their classmates and will be more engaged in activities necessary to successfully achieve the collaborative goal. The voice support should be through the learning environment and not through a separate communication tool to avoid the possibility of disrupting the experience due to the need to manipulate the tool. A disrupted experience will result in a lower level of engagement of the student. This will in turn decrease their sense of presence and negatively impact their collaborative efforts.

Related to the availability of tri-dimensional virtual bodies of the students is the ability to manipulate these virtual bodies. Manipulation of virtual bodies allows the students to enrich their experience by supporting their communications through the appropriate manipulation of the virtual body. Manipulation of the virtual body can facilitate the student's transfer of knowledge in VW learning environment by providing more than words to support it. That is, in a VW students can have verbal and written communications with others but in addition common non-verbal signals can be used to support an important message or action. Available e-learning environments do not support this type of communications. The use of these supporting non-verbal signal or gestures can help enhance the student's feeling of being in a face-to-face meeting with the team members or the whole class.

The visibility and tri-dimensionality of avatars coupled with the avatars customization and manipulation tools that VWs provide make them a very good instrument for swiftly developing an environment that engenders a sense of familiarity among the users and facilitate communications and collaboration. In other words, the use of avatars in a virtual learning environment is expected to foster the development of a communication and collaboration environment that best approximates face-to-face communications and satisfy the "face-to-face" interactions requirement of effective collaborative learning.

The infinite levels of creativity that open culture VWs provide its users make them idyllic for a wide variety of learning applications. When interacting with a VW teachers as well as student face very few limitations in terms of the use they can give to the world's resources. The support of creativity has long been shown to be a critical factor in achieving student engagement [16]. The high level of creativity in the activities and things that can be developed that a VW supports opens a whole new world of opportunities for students and teachers that is currently not available in other learning environments, opportunities that facilitate the development of the student's active engagement in the required tasks.

Effective group collaboration requires that members are able to communicate directly with each other [15]. VWs address this need by providing instant messaging, text and voice chat features. The use of objects that provide a virtual shared working space and the use of gestures also support the direct communications and rapid feedback needs of collaborative learning efforts.

The use of a virtual shared working space object in VWs coupled with their creative and visual powers helps to address the need that participants in collaborative efforts have for synchronizing their efforts and support and encourage each other in the learning process, a critical element of collaborative learning [15].

Managing the various features of a VW in order to have a useful collaborative experience goes beyond the mechanics of the technology; it requires the use and development of the user's teamwork and social skills an additional element of valuable collaborative learning [15].

Finally, the visibility and easy identification of users that VWs provide facilitates the achievement of the users' recognition of their accountability and responsibility towards the group required in effective collaborative learning. Researchers argue that having a visual representation of group members facilitate the user's development of a sense of responsibility within the group as well as internalize the group's set of rules, norms and procedures [2].

Other requirements of effective collaboration are the common understanding of the required activities to achieve the common goal as well as each member's contribution to it. More importantly a collaborative effort requires that all members work together to achieve the common goal. The challenge here is developing and measuring group engagement. Is necessary to determine what else needs to be present to achieve the desired level of group engagement for effective collaborative work and how to measure it. It is important to note that this requires more than simply assigning specific tasks to each team member and the subsequent performance, it requires group engagement.

Group engagement requires that all participants get fully involved in the whole process. Students should be aware of the status of their contribution at all times as well as that of their collaborators in order to corroborate that the final result will indeed comply with the shared vision of the expected outcome. It also requires that team members assist and support each other in the performance of their individual tasks and in the understanding of the goal and outcome throughout the duration of the collaborative effort.

A variety of tools that can be used to model the required activities or steps of a collaborative endeavor exists. For example a PERT diagram can be used to describe how the required steps contribute to the overall goal of the group and what each team member will individually contribute. This type of model misses a key element of effective collaborative work, the group engagement. There is no specific tool that can be used to model or measure the level of group engagement experienced by the participants while performing the required tasks. Throughout this article it has been proposed that user engagement engenders communication among participants. Therefore, a reasonable approximation to the assessment of group engagement in collaborative efforts would be the frequency of communications among team members while performing the required tasks. Frequency of communications refers to the number of communications as well as the time that passes between these, where a higher frequency of communications should reveal that a higher level of group engagement is experienced by the student.

Let's discuss an example to better illustrate the collaborative potential of VWs. In this example a group of three students is required to model a Barn Raising situation in a VW. The activity requires that the students perform at least the following activities: lay the foundation of the barn, build the walls, roof, doors and windows and erect them in the corresponding order and paint the barn. There's no difficulty in identifying the required steps, the order in which they need to be performed and who is mainly responsible for performing it. If the students simply perform their task individually then there is no group engagement, since each performed their task separately. Group engagement emerges when the students participate in the whole process, that is, even if their task is already fulfilled they continue to participate. They stay from beginning to end and actively support their team members.

The previous example clearly exhibits the potential benefits that VWs have for e-learning collaborative activities but its illustrative power for group engagement is limited by the structured nature of the activity. The goal of structured activities can be visualized and achieved even if the group engagement is not there. The quality of the outcome will probably be negatively affected in such cases, but it can still be achieved. The success of more challenging collaborative endeavors, like problem solving situations, depend heavily in the effective development of group engagement and this is specifically where e-learning collaborative activities can greatly benefit from the VWs ability to swiftly develop group presence.

6. Conclusion

This paper presents the conceptual foundation that leads the current research of one of the authors on the relationship among VWs, group presence and performance on collaborative e-learning efforts. The study attempts to support the hypotheses that social or group presence in e-learning situations using VWs will foster higher levels of

student engagement than other e-learning environments, and as a result performance in collaborative efforts should be enhanced as should be the overall student's performance. Future research can be designed to test the role: of real time virtual visualization of other students, real time communications, the use of non-verbal signals and the creative tools offered in VWs in collaborative in the sense of social presence and in collaborative e-learning performance. Furthermore additional research could be designed to test whether virtual worlds are more suitable for problem solving collaboration, and how these activities might result in higher engagement levels than in structured activities

7. References

[1] Arbaugh, J.B., and Benbunan-Fich, R., "An Investigation of Epistemological and Social Dimensions of Teaching in Online Learning Environments", Academy of Management Learning and Education, Vol 5 No 4, 2006, pp. 435-447.

[2] Balkin, J.M. and Noveck, B.S., (Eds.), The State of Play, New York University Press, 2006.

[3] Barfield, W., and Hendrix, C., "The effect of update rate on the sense of presence within virtual environments", Virtual Reality: Research, development and application, Vol 1 No 1, 1995.

[4] Bartle, R.A., Designing Virtual Worlds, New Riders Publishing, 2003.

[5] Benbunan-Fich, R., and Hiltz, S. R., "Mediators of the Effectiveness of Online Courses", IEEE Transactions on Prefessional Communication, Vol 46 No 4, 2003, pp. 298-312.

[6] Castronova, E., Synthetic Worlds: The Business and Culture of Online Games. University of Chicago Press, 2005.

[7] Chen, J., "Flow in Games (and Everything Else)", Communications of the ACM, Vol 50 No 4, April 2007, pp. 31-34.

[8] Csikszentmihalyi, M., Flow: the psychology of Optimal Experience, New York: Harper Collins Publishers, 1991 in Salen, K., and Zimmerman, E., Rules of Play: Game Design Fundamentals, The MIT Press, 2004, pp. 336-339.

[9] Fontaine, G., "The experience of a sense of presence in intercultural and international encounters", Presence: Teleoperators and Virtual Environments, Vol 1 No 4, 1992, pp. 482-490.

[10] Heeter, C., "Being There: The Subjective Experience of Presence", Presence:Teleoperators and Virtual Environments, Vol 1 No 2, 1992, pp. 262-271.

[11] Held, R., and Durlach, N., "Telepresence", Presence: Teleoperators and Virtual Environments, Vol 1 No 1, 1992, pp. 109-112.

[12] Hoffman, H.G., Prothero, J., Wells, M., and Groen, J. "Virtual Chess: Meaning Enhances Users' Sense of Presence in Virtual Environments" In International Journal of Human-Computer Interaction, Vol 10 No 3, 1998, pp. 251-263.

[13] Huang, M., and Alessi, N., "Presence as an emotional experience" In J. D Westwood, H. M. Hoffman, R. A. Robb, & D. Stredney, (Eds). Medicine meets virtual reality: The convergence of physical and informational technologies options for a new era in healthcare. Amsterdam: IOS Press, 1999.

[14] IJsselsteijn, W.A., De Ridder, H., Hamberg, R., Bouwhuis, D., and Freeman, J. "Perceived depth and the feeling of presence in 3DTV", Displays, 18, 1998, pp. 207-214.

[15] Johnson, D.W., Johnson, R.T., and Smith, K.A., "Cooperative Learning: Increasing College Faculty Instructional Productivity", ASHE-FRIC Higher Education Report No.4. Washington, D.C.: School of Education and Human Development, George Washington University, 1991, In Gross, B., Tools for Teaching, Jossey-Bass Inc., 1993.

[16] Kearsley,G., and Shneiderman, B., "Engagement Theory: A Framework for technology-based teaching and learning", 1999 [http://home.sprynet.com/~gkearley/engage.htm] (accessed March 2007).

[17] Kelly 2, R.V., Massively Multiplayer Online Role-Playing Games, MacFarland & Company, Inc., Publishers, 2004.

[18] LeBlanc, M., Game Developers Conference, 2000 in Salen, K., and Zimmerman, E., Rules of Play: Game Design Fundamentals, The MIT Press, 2004, pp/334-335.

[19] Livingstone, D. and Kemp, J., (Eds.) Proceedings of the Second Life Education Workshop at the Second Life Community Convention, San Francisco, USA, August, 20, 2006.

[20] Lombard, M., Ditton, T. B., Crane, D., Davis, B., Gil-Egui, G., Horvath, K., et al. "Measuring presence: A literature-based approach to the development of a standardized paper-and-pencil instrument" In W. IJsselsteijn, J. Freeman, & H. de Ridder (Eds), Proceedings of the Third International Workshop on Presence, Eindhoven University of Technology, Eindhoven, The Netherlands, 2000.

[21] MMOGChart.com "MMOG usage data as of June 2006". [http://www.mmogchart.com] (accessed March 2007).

[22] Quinn, C.N., Engaging Learning: Designing e-Learning Simulation Games, Pfeiffer a John Wiley & Sons corporation, 2005.

[23] Ryan, R.M., Rigby, C.S. and Przybylski, A., "The Motivational Pull of Video Games: A self Determination Theory Approach. Motivation and Emotion", Vol 30, 2006, pp. 347-363.

[24] Salen, K., and Zimmerman, E., Rules of Play: Game Design Fundamentals, The MIT Press, 2004.

[25] Schubert, T., Friedmann, F., and Regenbrecht, H., "The experience of presence: Factor analytic insights", Presence: Teleoperators and Virtual Environments, Vol 10, 2001, pp. 266-281.

[26] Sheridan, T.B., "Musings on Telepresence and Virtual Presence", Presence: Teleoperators and Virtual Environments, Vol 1 No 1, 1992, pp. 120-125.

[27] Slater, M., Usoh, M.,and Chrysanthou, Y. "The influence of dynamic shadows on presence in immersive virtual environments" In M. Goebel (Ed.). Proceedings of the 2nd Eurographics Workshop on Virtual Reality. Monte Carlo, Monaco, January 1995.

[28] Witmer, B. G., and Singer, M. J. "Measuring presence in virtual environments: A presence questionnaire" Presence: Teleoperators and Virtual Environments, 7, 1998, pp. 225-240.

[29] Yee, N., "A model of Player motivations" March 13, 2005. [http://www.nickyee.com/dedalus/archives/001298.php] (accessed February 2007)