Enhancing the Distance Learning Experience: Designing Virtual Classroom and Laboratory Environments

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Abstract – New virtual environments are evolving to a point where academics can visualize the benefits of these more socially interactive distance media. A first step in evaluating these virtual environments is to build virtual classrooms, meeting spaces, and laboratories that look to improve the distance student's ability to collaborate and interact. The next step is to identify new ways to interface with existing classroom and lab materials. The goal is to accelerate the process of building out new virtual course offerings and also provide distance-based class platforms for further study and analysis. Finally, evaluating the effectiveness of these newly built virtual classrooms and laboratories is critical to any proposed pedagogical presentation.

Current efforts have focused on the building of several classroom and laboratory environments in the Second Life virtual space. Discussion includes efforts to identify, design and develop virtual environments that enhance the learning experience for distance students. Further observations describe the conduct of several other academic events conducted in these newly established virtual spaces including holding office hours, completing lab assignments, giving group presentations, working with student project teams, and conducting class lecture meetings virtually.

This paper documents courses of action taken by the authors in the development of virtual classrooms, meeting spaces, and learning labs in the realm of Second Life where students and faculty can conduct effective and meaningful academic activities.   Key discussion areas include choosing a virtual environment, virtual classroom and meeting room design considerations; virtual lab and workspace design considerations; preparations for successful initial virtual meetings; and a look toward future virtual design efforts.

Keywords: Virtual Environments, Distance Learning, Second Life

INTRODUCTION

With the ever-increasing demand for distance education one of the key challenges facing faculty is not only delivering effective instruction through both lecture-style and laboratory means, but also giving students an environment with a sense of presence. The key challenge here is to improve on the distance student's capabilities for interaction and collaboration thereby enhancing their ability to work in more group and team settings. In short, virtual environments present distance students with exciting new forums for meeting and sharing their thoughts and ideas in real-time. With today's virtual environments like Second Life (SL) game play is replaced by open-ended opportunities for exploration and invention. This has broad reaching implications for faculty, allowing for the delivery of course content in stimulating and highly engaging manners.

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BACKGROUND

The recent growth of SL as a virtual media has energized several new efforts within various educational institutions to evaluate its possible value to the academic process. However, before academia can evaluate this relatively new environment, there needs to be a plan and an approach to facilitate the building of new educational virtual spaces for use in discussing and identifying new pedagogical approaches for study and analysis.

Since SL's unveiling in 2003, scores of educators from over 130 colleges and universities have begun to evaluate SL as an educational platform. Developing new media delivery mechanisms, especially as it relates to distance education, has to undergo a process of building, evaluation and assessment. Recently, academics having begun using SL in various distance-education classes indicate that "communication among students actually gets livelier when they assume digital personae. Anthropologists and sociologists see the virtual world as a laboratory for studying human behavior. University architects use it as a canvas on which to explore design. Business professors see it as a testing ground for budding entrepreneurs [Foster, 3]".

There are several aspects to building out virtual classroom and laboratory spaces for use by distance educators. If the college or university has not selected an environment already, choosing an appropriate virtual environment should be an initial step in the process. Once selected, the virtual land area needs to be built out to enable students to meet and begin to interact. Once the environment is ready for student activities then assignments need to be developed that familiarize the students with their new educational spaces and get them acclimated with the tools enough, so that they can benefit from the experience. Finally, these spaces need to be evaluated for effectiveness as a tool for enabling the distance instructor to meet course goals and objectives.

CHOOSING A VIRTUAL ENVIRONMENT

There are a growing number of online virtual environments and deciding on which one to evaluate for distance educational use can be challenging. Although daunting, there are several environments that do stand out from an academic perspective. Three of the most popular platforms for educational projects today are Active Worlds, Never Winternights, and Second Life [Kemp, 7].

Active Worlds

Active Worlds is a comprehensive platform for efficiently delivering real-time interactive 3D content over the web. Active Worlds currently only supports Windows operating system platforms. Active Worlds has been around since the 1990s [Active Worlds, 1].

Never Winternights

Never Winternights is a computer game set in a huge medieval fantasy world of Dungeons and Dragons. This role-playing game (RPG) puts you at the center of an epic tale of faith, war, and betrayal. This may not be the best environment for conducting educational academic collaboration [Never Winternights, 9].

Second Life

SL is a 3-D virtual world created by its Residents. Since opening to the public in 2003, it has grown exponentially and today is inhabited by millions of Residents from around the globe. As of November 2008 there were 15.8 million users [Second Life, 15]. Similarly, the growth of SL in the education arena has been wide-spread and global. One of the largest educational-based organizations working in SL is the New Media Consortium (NMC). The NMC is a non-profit consortium of over 300 colleges, universities, and museums operating a large campus-base in SL with over 135 colleges and universities from around the globe and nearly 10,000 regularly active users [New Media Consortium, 10].

SL Environment - Creating an Avatar and membership in SL is currently free. Owning land in SL does however incur a monthly charge. The price of owning land is based on the "size" of the land purchased [Second Life, 15]. In 2007 the University purchased a parcel of land for the building of a virtual campus; University faculty and staff were then invited to attend a ten-day class on building and teaching in SL. Now less than a year later, the University now has a robust virtual campus where students and faculty can meet and collaborate.

Hardware and Software Compatibility - As with any new technology, the tendency to maximize resources is there. SL is no exception as it too pushes the limits of typical computer resources. However, as the average computing

power increases more rapidly so do the skills of those behind the keyboard; the culture of computing and digital literacy is becoming more receptive to virtual environments and more conducive to each users potential [Stevens, 18].

SL can run on Linux, Mac OS, and Windows 2000 or newer - A high speed Internet connection such as Cable or DSL is also required. Quick rendering of the 3D graphics used in SL requires lots of video memory. Using a graphics card with less than 512 MB of video memory is found to produce significant lag in rendering images and negatively impacts the user's experience. Current minimum system requirements can be found on SL's support page at http://secondlife.com/support/sysreqs.php.

VIRTUAL CLASSROOM AND MEETING ROOM DESIGN

There is a fine line between similarity to the real world (RW) and to the development of a virtual world (VW). The idea that we in academia might utilize the capabilities of current technologies in unique settings such as classroom and laboratory instructional settings is not a new one. Hiltz & Turoff noted early on that fundamental to maximizing the capabilities of computer mediated communication systems is the ability to tailor human communication processes to the application and the group undertaking its application [Hiltz, 4]. With virtual environments, the focus upfront centers on the need to develop virtual classroom and meeting room environments that not only replaces the actual real world academic experiences, but also maximizes the inherent functionalities that the new virtual environment provides.

Rajasingham borrows an interesting metaphor here from the building trade that describes the current Western educational paradigm to "… a two by four by six activity. It is contained within the two covers of a book; takes place within the four walls of a classroom; and happens during six periods of the day, captives of clock and calendar." She adds that traditional education has been place-based and book-paced. People had to travel by foot, rickshaw, buses and cars to education, just as they had to travel to shop, bank and work. These transactions take place at prescribed times where students are in lockstep with everyone else in their age group [Rajasingham, 12].

Design Fundamentals

The fundamental constructs of instructional design do not change with any given delivery media such as SL; however, changing the delivery media requires new production processes and makes attainable some learning outcomes that were previously not considered possible. As an example Kemp and Haycock note that in a web based, online class an instructional developer would decide on intended learning outcomes, create and upload documents, design enrichment activities and arrange a communal learning space. In the web based environment, the media content is usually the equivalent of pieces of paper, flat and usually sequential, that limits potential learning outcomes. However, the production process in a virtual environment is quite different; unlike with web based developments, skilled virtual instructional developers focus on building structures, walkways, and interactive objects that allow for creative interaction between students and instructors [Kemp, 7].

Participants in a virtual environment typically come together based on their interests in a specific subject and it is suggested therefore, that the development of virtual class environments be dedicated to specific disciplines verses general usage facilities [Rajasingham, 13]. This fits with Terashima's definition of virtual classroom environments as technical environments where coactions between reality and virtual reality are based on a shared domain of knowledge [Terashima, 19]. One caveat here involves student expectation; although more study is needed in the area, students new to virtual environments find a degree of comfort and ease of assimilation into their new virtual settings when the classrooms, laboratories and other supporting facilities have some semblance to the Real Life (RL).

Size and Layout

Technology continues to redefine the environment in which we exist; Senge describes a learning organization as "…a place where people are continually discovering how they create their reality, and how they can change it" [Senge, 17]. So to define guidelines for size and layout of virtual classrooms and meeting rooms requires the consideration of creative building and collection.

In laying out classrooms and meeting rooms openness and spaciousness are a must. Avatars tend to need room to move, build and pan their camera perspectives around to get the most out of their virtual experience. Most island areas (Sims) are limited to the number of avatars that can be present at one time, so do not plan on more than 25 to

30 students being in one area at the same time. Simple seating arrangements enough for all students will help to control movement when desired. Floor-to-ceiling windows are great and allow others to look in but also can be a distraction to your class if there's a lot of activity outside the classroom.

Although lighting can be controlled by each client, ensure that enough ambient light is let in to illuminate the room. Wide entry points allow for easier movement of groups of avatars in and out of a space. Doors tend to be an annoyance unless there is enough activity outside to warrant having one to reduce the distraction.

Virtual Class and Meeting Room Content

The flexibility and adaptability of virtual space should be considered when placing content within class and meeting rooms; virtual spaces have the distinct advantage of adding or deleting content on the fly. If more seating, presentation screens or browsers are needed they can easily be added. Unlike conventional RL academic spaces, virtual classroom and meeting spaces should be considered dynamic, yet present enough of a visual that it lends itself to some degree of familiarity to maximize student expectation and comfort levels. Whiteboards, presentations, audio and video clips are all familiar classroom tools that can easily be incorporated into virtual classroom and meeting room designs.

Whiteboards **-** In a virtual environment, the relationships between knowledge and problem domains propose an important contrast to RL classroom processes. In a RL classroom the application of knowledge to problems are expressed symbolically, through alphanumeric notation and two-dimensional still pictures. Regardless of whether it is in a RL classroom or a virtual classroom, a whiteboard which acts as a short term memory of an instructional event is one of the most basic and powerful instructional devices and should be available in a virtual environment [13]. Current whiteboard technologies allow for several modes including presentation of text chat activity, basic slide presentation, basic surveys and polling, and presentation of text from prepared note cards. Having multiple whiteboards within close proximity of other image screens can provide faculty and student presenters with multiple simultaneous visual media presentation.

Presentations and Images **-** Lectures for virtual courses are available in various video formats and as bandwidth to the home increases, videos will become more relevant in the virtual classroom and lab. In an effort to conserve the bandwidth however, many faculty design lectures as a combination of picture slides and audio files. The students are able to view the lecture slides ahead or in synch with the instruction allowing students to amend or append to these lecture notes where appropriate [Turoff, 20]. The value then of presentations such as PowerPoint slides and instructor notes is to consolidate lecture information and reduce bandwidth demand.

Video and Audio **-** Currently, the SL environment does not allow land owners to store various audio and video media within the environment. However, if the video or audio files/feeds are available by Universal Resource Locator (URL) or hyperlink then a land owner can present them within their virtual class or meeting room.

- *Using video in class or meeting rooms* - In order to see the videos SL needs to know which surface area within your room that you want to display the video on. Since surface areas use textures, this is done by designating a texture as the "media texture." Make sure to designate a texture that you do not use elsewhere on the same land since doing so will cause any surface set to display that texture to become a video screen. Once the media texture is set, all that is required is to apply the same texture to a surface that is designated as the movie screen.

  – Once a streaming video URL set, a small "Play" button with volume slider appears on the users screen. The student would then press "Play" to view the video. At this point the video file (currently SL supports QuickTime .MOV format) loads into the student's memory and then plays.

  – Currently, SL limits each parcel area to one video, so to have multiple video options the class or meeting room must be broken into multiple parcels. The limit here is that a student's avatar is only able to see what video is streaming in the parcel that the avatar is actually located in. So therefore, simply dividing a single class or meeting room into different parcels without providing some sort of visual barrier, wall or partition can be confusing. At this point it is recommended that each class area be limited to one specific video feed.

- *Using audio in class or meeting rooms* - To incorporate audio feeds in a virtual class or meeting room setting the Land Owner is required to enter a streaming audio URL. Keep in mind that the higher the bit-

rate listed against it, the more bandwidth it will need. Once the URL is entered for the land parcel where the class or meeting room is located, the student should see a small volume control and "Play" button on their screen. Leaving the parcel area requires the student to push the audio "Play" button again.

One final point, a parcel in SL has no vertical limit so placing class or meeting rooms one on top of another can be problematic from not only an audio and video perspective, but also when utilizing voice chat. One way to avoid this would be for each avatar to pre-set their audio distance (chat range) to a closer limit.

Seating and Viewing Areas - Although class sizes of thirty or more avatars can be conducted in world, the current SL system and bandwidth constraints generally limit class sizes to less than 40 avatars in one session. Small teaming areas for 6-8 students may prove to be more effective. Although most experienced SL avatars prefer to stand and move around, it can be a challenge for students to keep camera angles on key players if there is a great deal of movement; having enough seating for a given class session is recommended. The key in classroom development is to ensure that there is enough unobstructed visual space in the room to change and maintain needed camera views. Positioning of multiple slide presentations, session notes on conference tables, and viewing all attendees are some examples of the camera views that will be needed.

Consensus and Polling Platforms - There are several approaches to incorporating consensus and polling activities in SL. One simple method involves laying out an area on the floor that labels sections for Yes, No and Maybe, where avatars can move and stand on one or the other; this can be a very effective teaming tool. There are also virtual whiteboards that incorporate this functionality.

Doors, Windows and Ceilings - Since avatars can not only walk and run but also fly and teleport around the campus area, the concept of doors, windows and ceilings take on a new significance. Generally, lecture style class sessions tend to be more closed and therefore, having other wandering avatars flying into your room from overhead may prove to be a distraction to the session. On the other hand, more open class sessions may welcome roaming visitors to the class discussion. If the class sessions are focused strictly on a specific group of students then building spaces with limited accesses may be appropriate.

VIRTUAL LABORATORY DESIGN

As with classroom spaces, work and lab spaces should be considered dynamic as well. Although many elaborate lab schema's are being developed in SL the inherit nature of the environment lends itself to constant development and redevelopment over time. That said, providing creative work areas for student individual and team development can add real value to the learning experience in many distance courses.

Size and Layout

Similar to laying out virtual class and meeting rooms, virtual laboratories and work spaces require openness and lots of space to move, build and interact. A virtual lab in SL has unlimited possibilities. Virtual laboratories and work spaces are areas where students are allowed to build and show off their own creations. These spaces can also be 3-D mock-ups of any imagined or RW situation or place that can be explored and experienced by students. Considerations for lab spaces are the size and area allotted for each working space. Virtual laboratories and work spaces need to be large enough to accommodate the building and moving activities by multiple students. Students in a lab will be communicating via chat and voice as they build and explore. To avoid interference with other classes or groups in the virtual campus, placement of the lab space out of chat range, 50m, of other labs or classrooms will limit crossover-chatter situations. Virtual spaces can be indentified as large open areas of land, as a separate large building, or as areas on a floating platform. If privacy is a concern, installing a script to issue a message to visitors explaining a privacy policy may be considered; creating walls and ceiling all around that provide obvious visual barriers that requires avatars to teleport into and out of a lab area is another option here.

Sample Expected Student Virtual Lab Activity and Outcome

Students can work either individually, in pairs or in teams to design and build objects that will enhance the virtual labs. Items built will have learning and educational value for other students. Students can spend time at the beginning of the semester becoming familiar with SL and the virtual lab space. They can meet in SL to brainstorm ideas on what they would like to contribute to the lab and then coordinate the building activities amongst themselves. Once their idea is approved, students can spend the remaining part of the course actually building and testing their creations. As an end of project presentation, they could hold a demonstration in SL with each team of

students evaluating the creations of the other teams. This provides the students with a living project of sorts. Students can further make their contributions to the lab and have an opportunity to improve and expand on the creations of previous students.

Floating Lab Spaces

Since SL is a three dimensional world where gravitational forces are controllable perimeters, both horizontal and vertical space is available for building. Temporary or permanent floating laboratory and work spaces can be built at any altitude giving students and faculty plenty of space to build and interact. Although there is typically default flying altitude limitations, there are devices and attachments that allow avatars to fly at an unlimited altitude. Teleport modules can also be used at key locations on campus to move students to and from these spaces. Additionally, giving students a Second Life Universal Resource Locator (SLURL) that enables teleporting directly to the labs location can make finding floating labs a great deal easier.

When choosing a floating platform to serve as a class lab space several considerations should be made. First, the platform should be large enough to accommodate the work or the projects that the students will perform. Some type of railing or wall should be in place to prevent avatars from inadvertently walking or falling off the edge of the platform. Building a lab area at heights above 165meters (the current default maximum flying height of an avatar without an attachment) allows for some degree of privacy and fewer trespassers; however, since media streams are confined to parcels that extend infinitely vertical, it is best not to have the platform directly above a parcel with a media stream.

Extending Existing Web-based Lab Spaces

With basic web browsing capabilities, SL can provide virtual access to an existing web based lab. Providing access to existing technologies maximizes use of current resources. The SL environment adds a unique value here by providing a common environment for two or more students to share in the web lab experience. An example of this is available at http://immersivespaces.com where Linden Labs in partnership with Rivers Run Red offers an Immersive Workspaces product that allows an enterprise to use the SL Grid platform to create a public or secure private space using virtual world technologies. This is one example that provides the ability to create a virtual world experience using the SL Grid and tie it to existing web based technologies.

Samples of Lab and Workspace Activities

SL's virtual 3-D arena provides students with a tool that has endless possibilities. Virtual lab and workspaces should consider the aspects of teaming and interaction as a fundamental opportunity when building new area for course activities. Some early virtual lab and work space uses have included learning a new language with the help of other students who are versed in the new language, designing a new line of clothing and modeling them for their classmates comments, developing the concepts for a new virtual business in a business course, or they are building sample billboards for a marketing class [Second Life Grid, 16].

Some early computer networking virtual labs have generated 3-D computer networks complete with PCs, routers, and switches. The virtual networking displays are interactive, by touching a device students are sent virtual note cards explaining how the device is configured. Incorporating existing web-based networking labs is one of the next steps being considered.

Virtual Labs can be used to create virtual environments for students to experience things that they may not otherwise be able to experience. Here are some further virtual labs settings to consider when designing spaces:

- Paramedic students in London are trained in how to respond to emergency situations. Student avatars are placed in a series of scenarios and situations that allow them to learn how to respond. They also work in small teams of three or four to treat virtual patients. From a design perspective, note the use of space and the ability to quickly change the scenarios that are presented [EHealth Europe, 2].
- Dr. Douglas Danforth at Ohio State University has built a large-scale 3-D model of the human testis in SL for his undergraduate and medical students [Werner, 21].
- IBM has created a virtual Data Center in SL; this center gives participants a firsthand look at a 3-D version of the actual Data Center. The complexities of layout, furnishings, and systems availability are all viewable in this virtual lab presentation. The 3D datacenter can be used as a simulation or it can be used to manage

real datacenter devices. This is also a good example of the types of content, space allotment, and use of walls, floors and ceiling that could be incorporated into a floating lab space [IBM Business Center, 6].

INITIAL CLASS MEETINGS

Imagine bringing history to life by taking groups of students on a virtual tour of Athens, Constantinople, or Troy; or teaching architecture by building a medieval cathedral outside the classroom and modeling several different types of arches to see the artistic effect [Poole, 11]. Concerts, seminars, job fairs, simulations, focus groups, modeling and prototype testing are just a few of the applications that are already being applied to this virtual environment [Rymaszewski, 14]. The possibilities here are truly endless with the key concept here focusing on enabling the students to create and experience.

Prior to conducting that first virtual session with students, there are several considerations that should be taken into account. Class-size, avatar naming conventions, basic skill-level assumptions, and general expectations in the form of either guidelines or formalized rules of engagement should all be addressed up front.

Student Orientation & Basic Skill-set

To conduct a productive and meaningful meeting in the virtual environment students need to have a basic set of skills that enable them to function effectively in the environment. This is akin to having basic computer and internet skills before taking online courses today. Time must be given before the first class session for students to become oriented to the virtual environment. These basic skills can be learned by the student a week or two prior to the first meeting by: visiting SL's Help Island where new users can learn the basics of getting around in SL; visiting the students campus where a mentor can show them around; and visiting other virtual campuses and interacting with other students and faculty.

Sample First Assignment - SL Avatar Setup **-** This is a participation assignment. Prior to a specified date each student must go into Secondlife.com, create an avatar and complete the basic learning tutorials on SL's Help Island. The basic skill-sets needed should include:

- Basic avatar movements (walking, running, flying)

- Changing avatar appearance

- Communicating via text chat & audio

- Use of gestures

- How to make or track friends

- Managing camera views

- Basic use of the avatars inventory

Once the student has completed their Help Island activities the student then emails the instructor with their avatars name and indicates completion of the tutorials. Upon receipt of the student's avatar name, the student will be offered a friendship by the Instructors avatar {INSTRUCTOR AVATAR NAME} so that the student's avatar can be teleported directly to the classroom site.

The student is then given a {DATE} and {TIME} that the class demo session in SL will be conducted. If the student hasn't done so already, they are told to accept the friendship that the instructor's avatar has offered. For the first session, the students are teleported to the virtual classroom where the rest of the online session is conducted.

Rules of Engagement **-** As important as understanding how to function in the virtual world, students must also know and understand the "rules for engagement" or "codes of contact" for the virtual meetings. Since the virtual campus is an extension of the real campus, students should know that the same rules and codes apply. However, there are some additional considerations that may be unique to the virtual campus.

- *Avatar Appearance* - To avoid distractions to other students, avatars should be a humanoid and adhere to the same dress standards as the real campus. Students should not show up as the Kool Aide Man, a Robot, a Transformer, etc. However, having a space on the virtual campus set aside for students to experiment with their creativity would be encouraged.

- *Communication, Sounds, and Gestures* - Just as in a real classroom, students should not disrupt the class. Since many gestures have sounds which can be distracting to others, students should avoid most gestures during meetings. The exception should be for basic head nods that indicate 'yes' or 'no' or hand gestures such as raising a hand or pointing when a student has a question or comment. These gestures can be very effective, minimizing chat and allowing the instructor to recognize students at the appropriate time. Finally, having text chats or sending Instant Message (I/M) sessions should be used as a back up when voice chat is the primary means of communication. Texting or I/Ming on the side can be distracting by the typing sound that accompanies texting and there is also the possibility of accidentally sending the I/M to the local chat instead of the private session.

- *Handling Griefers* - Although harassment is rare in the areas of SL that are devoted to academic pursuits, it can happen. When an SL avatar behaves in a harassing or threatening manner to others, he or she is referred to as a "griefer" and can have their avatar banned from the virtual campus or region. Unfortunately, there is nothing to prevent the real person from creating a new avatar and reentering with a new face and name, virtually reincarnated as it were [Ludlow, 8]. Just as in RW situations, students are encouraged to notify faculty or technical staffs if this activity occurs.

Avatar Naming Convention - Faculty should have a well defined naming convention for student avatars so the avatar can be quickly associated with the student it represents. Because SL uses only predefined last names, the avatar's first name is the only thing that students can use to identify themselves accurately. One suggested naming convention is 'real first name_real last name' then the SL last name. Here is an example of what mine would be: John_Pickard Ezvalt with Ezvalt being the SL selected last name.

Naming an avatar is not the same as an anonymous chat name. Students should avoid using their email prefix, as well and whatever the first name is, it should be speakable and not some cryptic like 'MRE01234' since it is difficult to converse using voice chat with an avatar that has a cryptic name. Having a first name that is similar to the student's real name will also make early interactions more effective as classroom expectations are generally open and upfront and not anonymous endeavors.

Classroom Management - The tasks associated with managing classroom and laboratory spaces in virtual spaces are similar to those clerical and administrative tasks found in RL; essentially, these tasks focus on what is necessary to ensure that a classroom operates efficiently. It is natural to expect a virtual classroom to have automated toolset to minimize the workout for both students and faculty. Although these management tasks vary from course to course or even for different instructors of the same course, they can include:

- *Student tracking* - Checks student progress.

- *Time-tabling and scheduling* - Ensures all students know when, where, and what they are expected to do.

- *Class promotion* - Ensure a minimum enrollment and clarifies purpose and requirements of the class.

- *Student counseling* - Provides the help students might need in completing their studies.

- *Information management* - The retrieval, update and management of student personal and academic data.

- *Assignment management* - Submitting, distributing, grading and moderating assignments.

- *Grades collection* - Moderation and distribution.

- *Archiving* - Retention of class-related information and records [Hsu, 5].

Manageable Group Size - There are several aspects to this issue, not the least of which is system performance limitations and the ability of faculty to manage the activity of the group.

- *Performance* - The performance of the SL virtual world can be impacted by the number of primitives (Prims) or objects in a SIM and by the number of avatars in a SIM. With this in mind, group size should be limited to a point that it does not affect the performance and thus, the learning experience of the student.

- *Group Management* - The better prepared the students are for interaction in the Virtual world and the more detailed and defined the "rules of engagement," the larger the manageable size of the group.

- Sitting vs. Moving - Having virtual seating for avatars can help to minimize the perceived effect of lag in the virtual environment.   If avatars are all moving around they will bump into each other and their perceived movements will look choppy. This is distracting to the students. Encourage or require that they all sit.

- Seating arrangement - To maximize your view of the student's avatars so you can see raised hands, etc. Try using seating in rows (like an auditorium) and place your point of view of podium in front of the rows.

A BUILDING PLAN FOR THE FUTURE

Students are faced with practical problems where their human perspective of time and space often limits their comprehension of the problem domain. As an example, motorists may sense the size and speed of their vehicle in relation to that of other road users, but they cannot see the way they use the road from the perspective of the other drivers. In the same way, researchers today conduct experiments to test relationships between a given theory and the problem it addresses; the process is then analyzed, described and reported in text using words, numbers and diagrams. The ability to collect objects and case studies as virtual realities from multiple perspectives suggests a new methodology for research [New Media Consortium, 10]. Building environments that provide for these collections should prove beneficial to furthering the educational process and maximizing the virtual environmental spaces academic utility.

Student Assessment - A Next Step in the Building Process

Evaluation of the student's early interactions within these newly developed virtual classrooms and labs is clearly next steps in this design process. Understanding the virtual experience background of each student as well as the level of effort to gain basic interaction skills will provide a baseline understanding of what it takes for the average student to utilize the new medium.

The SL environment provides academia with a communication and collaborative tool as well as a creative tool that provides the added value as an outreach tool for remote, distance education students. From the communication and collaborative perspectives, these early student interactions can glean new insights into areas where the SL virtual environment provides improved online media options over other current online tools. And from a creative perspective, understanding the initial student reactions to the ease of building and creating within a virtual environment will be of potential value.

Further Development Evaluations

Based on these early virtual classroom and laboratory developments the next step in evaluating these efforts should bode the question: how can virtual classroom and laboratory spaces be built to maximize the SL environment as an effective tool for academic delivery? Furthermore, the virtual environment functionalities and limitations notwithstanding, in the end, the moving forward question has to be: do these virtual classroom and lab developments amplify the capabilities of the SL environment as a viable pedagogical tool or not?

Although academics are there to provide the framework for meeting each educational goal, each student has their own unique settings for maximizing their learning process. Virtual environments give us the tools now for not just instructors but also students to build their own learning environments. Creating classrooms, meeting spaces and laboratories that give students the freedom to explore and build their own learning environments is truly leading us into new uncharted territories.

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