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Distance Education in the 21st Century Through 3D Virtual Learning Environments

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This work is dedicated to my father Michael Joseph Annetta, who left us on December 25, 2008. This untimely passing away came at the time we were completing this book. This unfortunate event delayed and almost stopped the completion of writing. However, my father instilled in me to never give up regardless of Scrappy, what I called him since I was a little boy, was amazed at the transformation of technology through his life and my work using 3D environments was just another link in the lineage of technology growth in his lifetime. Although he only earned an eighth grade education, my father instilled in me, and my siblings, the critical need for education. He would tell us that nobody could take what we put between our ears. These are words to live by for anyone who reads this book. Regardless of how you learn, it is the learning that will always stay with you. I will sorely miss you Scrappy and thank you for pushing me to be an upstanding, educated man and a person who can teach others the intangibles of life. God bless you!

Foreword

“Hello, I’m [Sally Doe] and I’m taking an online class with the Regents Online Degree Program [Tennessee Board of Regents, (RODP)]. I’m locked-out of my Biology course and I need to gain access immediately... I’m feeding my newborn and will have about 4 h to complete and submit my assignment before he wakes-up. Can you please help me get access immediately so that I can use this time to . . .?!” It was *the* definitive moment for me. A key aspect of the eLearning value proposition realized – expanding access to higher education, and specifically, to the non-traditional student. It was so exciting to see all of the strategic planning, marketing campaigns, demographic targeting, course (re)design, and tactical support converge. I thought to myself, “How rewarding is this?” And this is one of thousands of examples that followed that I (and others in this industry) could reference since the fall of 2000.

This was a time when eLearning (a form of Distance Learning) was starting to show considerable adoption rates in higher education, and the use of Course Management Systems (CMS) to facilitate the eLearning process was gaining greater traction, as institutions came to grips with the fact that the CMS was as important as the Student Information System (SIS). However, in a lot of cases, some didn’t know why. Although the majority of institutions had or planned to implement a CMS in 2000, faculty adoption rates varied widely with regards to their application of this tool and eLearning in general. This was due to many factors, including the questions of eLearning efficacy, institutional culture, and pure change management to support what constituted a paradigm shift for traditional, tenured, and “seasoned” faculty members who didn’t have the prerequisite technology or online pedagogy skills.

The question of hybrid versus completely online was emerging as one of the key considerations when planning an institution’s online initiatives. In 2000, in my humble opinion, hybrid was a way of dipping your toe into the eLearning water without departing too far from institutional culture and allowing the institution to ride the fence, while this eLearning thing shakes out. While there were, and are today, pedagogically sound reasons for offering hybrid classes during this time. Additionally, institutions were asking themselves, is it within the mission of our institution to provide this form of learning? Well, 9 years later, I think the higher education clientele, students, are driving the answers to these questions. Although not purely consumer-driven today, institutions are certainly heeding the call.

While online enrollments continued to grow in the United States and abroad between 2000 and 2009, so did the learning technology enterprise, which has evolved and expanded to provide enhanced and new learning technologies to support the online and hybrid learner and those who teach via this medium. Today, there are upward of 20 different categories of learning technologies that are widely adopted or emerging as permanent fixtures in the higher education learning technology enterprise. For example, course management systems, ePortfolios, student information systems, learning content management systems, and 3rd party learning materials (assessments, quizzes, simulations, etc.) are all providing the online instructional designer with greater options to enhance the online learning environment.

Although not widely adopted, but certainly edging its way into the learning technology enterprise is the Virtual Learning Environment (VLE). A leader in providing VLE, Linden Labs – Second Life, reported in February of 2009 that approximately 200 universities are using Second Life for varying purposes. While CC International which promotes the application of virtual reality for educational purposes has a membership of ~4,200 participants, Second Life Educators (SLEDs), created in October of 2005, has greater than 4,700 participants in its community (e-mail list) who are interested in or actively engaging in delivering education via VLE (http://www.campustechnology.com/articles/2009/02/18/real-life-teaching-in-a-virtual-world.aspx).

So, why is the VLE early adopter community growing and what is the appeal of VLE for higher education institutions? Well, I think the answer varies based on institution-specific objectives associated with the VLE. For example, VLE is used to enhance the distance learning and bricks and mortar educational experience by providing an immersive learning experience for students. A class facilitated completely or supplemented by VLE, as described by Dr. Annetta and many other educators using this tool (K-12 and higher education), provides an environment in which students can role-play, collaborate, and provide feedback on discussion topics and peer assignments, conduct experiential learning activities, and simply create a more engaging, interactive, and fun environment ("edutainment") for student learning (http://www.youtube.com/watch?v=CWfvqkkk0yM). The use of avatars to represent the learner and faculty is an important feature of VLE as it introduces personality into the learning experience and environment. This immersive environment goes far beyond the current features and functionality offered by the CMS, which is primarily used to manage the online and hybrid learning processes, whereas the VLE actually creates an enhanced, 3D learning environment, creating greater learning stimuli for the 21st century learner, while also providing tools to manage the learning process.

Higher education institutions and K-12 schools and districts are also using VLEs for recruiting students and providing a greater sense of community for faculty, students, and other constituents such as alumni (donors). The Ernst and Young Foundation, through its competitive University Fund Grant program, has recently awarded North Carolina State University with $500,000 to continue its research and leadership activities in the area of VLE (http://www.carolinanewswire.com/news/News.cgi?database=0001news.db&command=viewone&id=711&op=) – a strong data point that the education market sees value in the adoption and application of this form of learning.

And while the portfolio of learning technologies continues to expand, a subtle, yet crucial, change is occurring with respect to integrating these various learning technologies through the application of learning technology interoperability standards. Such standards created by the IMS Global Learning Consortium (www.imsglobal.org) enable learning technology product providers to develop their products to not only integrate with other components of the learning technology enterprise, enabling them to share/pass administrative, student, and learning data (e.g., CMS and ePortfolio integration), but also help to create integrated online environments. These interoperability-enabled learning environments enable integration of rich digital content and ancillary digital learning resources, creating and providing an enhanced learning experience. In parallel, and in some cases, in front of the learning technology enterprise evolution curve, IMS GLC has developed 20 or so interoperability standards (http://www.imsglobal.org/specifications.html), enabling integration of many of the learning technologies comprising the learning enterprise of today. K-12, HE, and Learning technology product and service providers who comprise the IMS GLC membership (http://www.imsglobal.org/members.html) and affiliates (http://www.imsglobal.org/Affiliates.html) work together to define and develop these standards so that as the market continues to evolve, products are developed to meet not only the administrative needs but the true educational or pedagogical functions of a given learning system.

It is easy to see how virtual gaming has been enhanced through technological innovation, creating enriched environments for gamers that retain their interest and excitement – and lead to greater revenues for the vendor. Establishing sound distance learning pedagogy, specifically in the VLE, is critical to guiding vendor product development, as it provides a framework for innovation, competition, and, most importantly, results in an enhanced learning environment for the student.

Dr. Annetta was one of the first adopters of VLE in distance learning and his expertise and experience in this arena are noteworthy. Hats off to Dr. Annetta for providing educators and VLE product providers with a roadmap for infusing sound pedagogy into VLE-facilitated instruction and development of new product features and functionality, respectively!

Chief Program Strategist, IMS Global Learning Consortium John Falchi

Acknowledgment

Because of the nature of the book, everything we present will be in the context of video games and virtual learning environments. We would like to acknowledge several people for the success of this book in supporting our research and development efforts along with supporting the LEARNING in distance learning.

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Contents

Chapter 1
Distance Learning in the 21st Century

Distance learning has evolved over time from tribe elders sending henchmen to competing tribes to learn and return, to correspondence classes, to today's instructional technologies delivered through a connected web of information. The juxtaposition of the latest technologies has raised concern as to which technologies are most effective in terms of cost, reach, richness, and, most importantly, learning. With some 3.5 million students in the United States alone taking courses from a distance, the time has never been more critical to find a common set of standards and the most effective means by which education should be delivered from a distance. This book will provide concrete examples of how 3-dimensional virtual learning environments, not unlike those found in popular video games, have been used for distance learning and how this platform can flourish in the new millennium if we learn from current experience. To understand why using 3D virtual learning environments for teaching online is important, we must first understand the target audience today and 5, 10, and even 15 years from now.

What are the skills needed to succeed in the new millennium? This question is at the forefront of research in education, economics, learning science, and content areas of the like. This thrust is beginning to form the learning characteristics of tomorrow's students. As distance learning continues to explode at all levels of education and in the corporate sector, it becomes more critical that we delve into the crux of how people learn when not in a traditional classroom. The challenge is not to look down at our feet as we develop online courses but to look far into the future. This chapter will begin to give insight into the current definition of 21st Century Skills and will conclude with the distance learning factors of cost, reach, and richness.

21st Century Skills

It can be argued that the ultimate goal of education, at any level, is to prepare the learner with the skills needed to succeed in life. In this new economic environment (aka *New Economy*) education plays a critical role in maintaining prosperity and stimulating economic growth (Stevens & Weale, 2003). Certainly in higher

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education those skills are defined more narrowly as the expertise needed for the learner to succeed in his/her respective occupation. Markets in the *New Economy* are rewarding those who have high educational achievement and technical skills (Task Force on the Future of American Innovation, 2005). CEOs are looking for those students who can think quickly, adapt to their surroundings, and respond to unforeseen problems in a just-in-time manner. Taking an epistemic viewpoint, an educator might call this the foundation of problem-based learning. That is, given a problem with a clear goal or goals, the learner must adapt to his/her surroundings quickly by analyzing new situations and interacting with others with expertise that they themselves do not possess.

In the United States, jobs once sought (such as engineers, programmers, and telecommunicators) have now been outsourced. *The Flattening of the World*, as described by Thomas Friedman, has caused a shake-up in the economy. For a geographic region, state, or country to compete in the *New Economy*, the aforementioned problem-solving skills must be possessed by as much of its general workforce regardless of its geography, trade laws, research labs, and patents. And critical to that competitive advantage are the education and skills training adults acquire in primary and secondary schools. The Organization for Economic Co-operation and Development (2001) cited that the application of information technology at the core of business operations has caused a profound change in the needed skills and talents of *New Economy* workers. Distance learning has the potential to address these issues not only through course content but also through the forced use of technology used to deliver the course content.

In the 21st century, income and wealth (i.e., success) come from applying technology and new ideas to create new products and processes. Adding value to products and processes is the key to growing jobs and incomes in this *New Economy* (Aubert & Reiffers, 2004). Simply put, workers need to be technologically literate and savvy but most importantly problem solvers.

In the United States this issue has never been more critical to address in the institutions of learning. The Committee on Science, Engineering, and Public Policy (2006) described this dire situation very clearly. Here are some examples provided in their report:

- For the cost of 1 engineer in the United States, a company can hire 11 in India.
- Thirty-eight percent of the scientists and engineers in the United States holding doctorates were born abroad. Yet, when asked in the spring of 2005 what the most attractive places in the world to live are, respondents in only one of the countries polled indicated the United States.
- Chemical companies closed 70 facilities in the United States in 2004 and have tagged 40 more for shutdown. Of 120 new chemical plants being built around the world with price tags of $1B or more, one is in the United States. Fifty are in China.
- In 1997, China had fewer than 50 research centers managed by multinational corporations. By 2004, there were over 600.

- By the time this book is in press, the most capable high-energy particle accelerator on earth will reside outside the United States.
- The United States today is a net importer of high-technology products. The U.S. share of global high tech exports has fallen in the last two decades from 30 to 17%, while its trade balance in high tech manufactured goods shifted from a positive $33B in 1990 to a negative $24B in 2004.
- In a recent international test involving mathematical understanding, U.S. students finished in 27th place among the nations participating.
- About two-thirds of the students studying chemistry and physics in U.S. high schools are taught by teachers with no major or certificate in the subject. In the case of math taught in grades 5 through 12, the fraction is one-half.
- In one recent period, low-wage employers like Wal-Mart (now the nation's largest employer) and McDonald's created 44% of all new jobs. High-wage employers created only 29%.
- In 2003, foreign students earned 59% of the engineering doctorates awarded in U.S. universities.
- In 2003, only three American companies ranked among the top ten recipients of patents granted by the U.S. Patent Office.
- In Germany, 36% of undergraduates receive their degrees in science and engineering. In China, the corresponding figure is 59%, and in Japan it is 66%. In the United States, the share is 32%. In the case of engineering, the U.S. share is 5%, as compared with 50% in China.
- The United States is said to have over 10 million illegal immigrants, but the number of legal visas set-aside annually for "highly qualified foreign workers" was recently dropped from 195,000 per year down to 65,000.
- At a time when the world's nations are clamoring to obtain science and engineering talent, U.S. law will grant a visa for outstanding foreign students to attend U.S. universities only if they promise to go home when they graduate.
- In 2001 (the most recent year for which data are available), U.S. industries spent more on tort litigation and related costs than on research and development.

It is clear that the way U.S. students are being educated from birth through graduate school is lacking, to say the least. It can be argued that the United States has not been challenged since the launch of Sputnik some 50 years ago. It can also be disputed that the impact of the fall of the nuclear family has contributed to pacifying the discipline, work ethic, and integrity once considered the foundation of skills needed for workforce success. The primary challenge for U.S. education is to transform children's learning processes in and out of school and to engage students' interest in and competency of 21st Century Skills and knowledge. Education must align curriculum and learning to the new economic model. Linking economic development, educational evolution, workforce development, and strengthened social services is essential to meeting this challenge.

The United States has benefited greatly from being the global leader of innovation in the development and use of advanced technologies. However, erosion of this leadership is becoming a major threat not only to its economy but also to the way of life of its citizens. The United States is not developing its workforce with skills in expert thinking and complex communications to meet the needs of the 21st century, global, knowledge-based economy (Levy & Murnane, 2004).

A recent report entitled *Tapping America's potential: The education for innovation initiative*, issued by the Business Roundtable (2005), expressed "deep concern about the United States' ability to sustain its scientific and technological superiority through this decade and beyond" (p. 1). The report calls for a sense of urgency and for immediate action to secure a prosperous future for the United States and its children. This is not unique to the United States. The transformation of learning in many other countries provides models to consider how linking education and the economy benefits students, businesses, and society (Kozma & Voogt, 2003). The use of sophisticated information technologies in every aspect of education can provide a powerful lever for this transformation (Jones, 2003b). To catalyze this transformation, the Business Roundtable provided some motivation supported by stating there needs to be an increase in international competition and an increased reliance on and reduced availability of foreign talent to work in the United States. Although United States fourth graders score well against international competition, they fall near the bottom or dead last by 12th grade in mathematics and science, respectively.

As for distance learning, rapid advances in ICT have reshaped the learning styles of many students. In a study in which partnered with Dr. Chris Dede, Harvard University Professor of Learning Technologies, explained quite clearly the new millennial learning styles and how technology is impacting how students learn. By its nature the Web rewards comparing multiple sources of information, individually incomplete and collectively inconsistent. This induces learning based on seeking, sieving, and synthesizing rather than on assimilating a single "validated" source of knowledge as from books, television, or a professor lecturing. Overall, the Internet-based learning styles ascribed to "millennial" students born after 1982 are increasingly true for many people across a wide range of ages, driven by the tools and media they use every day.

Simply stated, all other responsibilities that may seem to be put on economics, government, and business are possible only if education succeeds in providing the foundation for a prosperous future. This does not mean that education for economic development is privileged more than other objectives. However, those who want education to succeed in resolving major concerns (e.g., equity, developing moral citizens, preparation for self-realization) need to incorporate perspectives about preparing the 21st century workforce into their planning.

Do you know a teenager? If so, are you amazed with the seemingly lack of focus they radiate? Many children with this apparent lack of focus are being treated for Attention Deficit Disorder (ADD) or Hyperactive Disorder (ADHD). The reality is that you are witness to a new learning style, a 21st Century Skill commonly known as multitasking. Teenagers are masters of this skill. They do their homework by reading a textbook, listening to an MP3 music player, receiving and sending e-mail, navigating a Web browser, and conversing with classmates via instant messaging or text (SMS) messaging. Whether multitasking results in a superficial, easily distracted style of gaining information or a sophisticated form of synthesizing new insights depends on the ways in which this learning strategy is used. Certainly, at some number of simultaneous tasks, this strategy results in cognitive overload and concomitant loss of effectiveness (Dede, Korte, Nelson, Valdez, & Ward, 2005). However, the overindulgence of Ritalin^{TM} and similar pharmaceuticals used to counteract ADHD might be actually detracting from this masterful learning style.

So what are these 21st Century Skills? Many have been feverishly working to clearly define them. The Business and Higher Education Forum (2005) stated that workers of the 21st century must have science and mathematics skills, creativity, information and communication technologies (ICT) skills, and the ability to solve complex problems. To date, Henry Jenkins, an MIT professor of Media Studies, might have the most refined definition of 21st Century Skills in his 2007 report. The new skills include the following:

Play: The capacity to experiment with one's surroundings as a form of problem solving.
Performance: The ability to adopt alternative identities for the purpose of improvisation and discovery.
Simulation: The ability to interpret and construct dynamic models of real-world processes.
Appropriation: The ability to meaningfully sample and remix media content.
Multitasking: The ability to scan one's environment and shift focus as needed to salient details.
Distributed Cognition: The ability to interact meaningfully with tools that expand mental capacities.
Collective Intelligence: The ability to pool knowledge and compare notes with others toward a common goal.
Judgment: The ability to evaluate the reliability and credibility of different information sources.
Transmedia Navigation: The ability to follow the flow of stories and information across multiple modalities.
Networking: The ability to search, synthesize, and disseminate information.
Negotiation: The ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.

As we move through this book, we will revisit Jenkins' definition of 21st Century Skills and we will begin to see how using 3D virtual learning environments in distance education can be the platform of the *New Economic* era. The goal and further definition is less clear and more complex than stated here. This is the tip of the iceberg and it is up to the educational researchers to converge their talks with those in engineering, business, etc., to work as a team to fight the educational epidemic and give our students the skills that they will need to prosper in this time of unprecedented global economic competition. Some believe the timeline for completing this task could take a half-century. If the human genome was mapped in 13 years, then this problem should be rectified in a quarter of that.

Roger Bybee, former director of BSCS, recognized that the metaphor of global competition is not entirely appropriate. He said, "The global economy is not a 'zero-sum game.'" Another country's gain is not automatically a loss for the United

States – there can be, and frequently are, win–win situations. Nevertheless, to take advantage of the opportunities that will arise, our workforce will need the proper skill set. Stated in less neutral and more value-laden language, we need high-quality teachers, rigorous content and coherent curricula, appropriate classroom tests, and assessments that align with our most valued goals (Bybee & Fuchs, 2006). It might be that simple.

Issues with Distance Education Today

In 2004, in an article published by the *Online Journal of Distance Learning Administration*, I asked the simple question, "Is the money allocated and collected from institutional distance education getting the results on the back end in terms of student achievement?" In other words, is there really LEARNING in Distance Learning? If so, then what are the critical methods that need to be studied to make learning more effective from a distance? The response from this article was somewhat overwhelming. Some educators wanted to know how we can truly answer this question, other higher education administrators challenged the very thought, while economists asked for the formula I would use to solve the problem. Although the article was not meant to cause such a stir, I am glad it has. I am an educator so the challenges from higher education administrators and from economists are admittedly out of my area of expertise.

What is in my area of expertise is learning. For the purposes of this book, I will revisit the main ideas supporting the reason for asking the aforementioned question. There are three factors contributing to the economy of distance education: *Costs* (institutional and student costs), *Reach* (the geographical limits of a course), and *Richness* (cost to the student (i.e., LEARNING)). A synopsis of a study we did produced evidence regarding the relative effectiveness of three distance education strategies (*live*, *video*, and *Web*) for enhancing the science learning of 94 Midwestern elementary school teachers who were participating in a 5-year professional development project and began to shed light on why this question was important to ask. The results of the study suggested there might be a sliding scale when looking at cost, reach, and richness in distance education. That is, as one of the three factors grows, the other two shrink. Published in 2006, the results of the study suggested the most effective means of learning from a distance is with synchronous, real-time interaction as the foundation of any course delivered from a distance.

I often wonder why it has not been asked more and if it has, why is it not present in the literature. The answer might have been in the General Accounting Office (GAO) Report of 2005. It was stated that distance education brings with it the possibility of high student enrollments, and therefore greater revenue, but the questions regarding student learning outcomes in various delivery strategies of distance education are a critical piece missing from the puzzle. The GAO report gave details on the importance of student learning citing agencies such as the Council for Higher Education Accreditation and the Congressionally appointed Web-based

Education Commission calling for accountability for institutions on student learning outcomes. There is, however, a problem with the call for accountability. There are seven different agencies in the United States that are accrediting institutions that offer distance courses. All of them have varying standards and benchmarks for accreditation. Interestingly enough, the GAO report stated the results of their study were outcomes from four questions that formulated guidelines for accreditation. One of the four asked specifically for evaluation of student learning outcomes.

Now, in 2007, IMS Global chartered the Learning Technology Advisory Council (LTAC) to establish a common set of standards by which distance education programs should follow and be evaluated on. The thrust of this group is to develop a Technologically Enabled Flexible Learning (TEFL) platform for student introduction (i.e., setting expectations, preparation, and induction) into the e-learning environment targeting both new and experienced e-learning students, addressing issues of completion, retention, and persistence during this most vulnerable phase of the student life cycle. This initiative might be the key component to evaluating the richness of distance learning and the cost that comes with it.

Cost of Distance Education

Let's spend some time defining the three terms I brought to the conversation: *Cost, Reach*, and *Richness*. It makes sense to start with *Cost* as it is arguably the driving force for some, both in and out of higher education. The focus of distance education has been toward *Web* instruction due to its perceived financial benefit. Simple economics would tell you that more students paying tuition and fees would equal more capital to run an institution's infrastructure. Because it is exclusively Internet driven, Web-based instruction is viewed as cost-effective for institutions and time effective for the learner since the information can be accessed at any time of the day from any location that has an Internet connection. This is the essence of asynchronous instruction. Much of the analyses in the current literature on asynchronous learning can be misleading. Studies that examine the comparative costs of distance education to traditional education have been done worldwide. There is considerable variability in these studies. Some studies examined per-student costs, some studies focused on costs per learning hour, and some studies have looked at the net costs of setting up a distance education experience (Perraton, 1997). This disparity might be explained in terms of the difficulty in making precise comparisons between cost of media, audiences, and geography. Cost can be further unpacked and referred to as institutional costs, student costs, and the inevitable hidden costs.

Institutional Costs

Institutional costs are defined as cost the institution incurs. University administrators are seemingly putting many, if not all, of their eggs into the distance education basket to help control overall institutional costs (Dibiase, 2000). They are operating under the untested, unproven assumption that the asynchronous, Web-based mode of instruction is the most cost-effective approach to delivering content that would otherwise be delivered in a traditional classroom setting (Kozma, 1994). Jackson (1998) suggested distance learning is neither less expensive nor easier than a traditional course. Distance education has a lower per-student cost than traditional education but with high attrition rates, the cost per graduate in distance education is considerably higher than that of their traditional student counterparts (Rumble, 1997). Vicky Phillips, founder of *Geteducated.com*, a consulting agency for distance educators, estimates the online student dropout rate at around 35%. This is compared to the average attrition rate for college freshman at U.S. universities which is around 20%. One explanation for this attrition might be the fact that much of what passes for online education today would put most of us to sleep (Svetcov, 2000). Moreover, administrators often think that distance courses are cheaper than resident courses because they don't factor in the cost of physical space, time, expertise, and technology required (Taylor, Parker, & Tebeaux, 2001). A study conducted by the Colorado Department of Education reported that "the cost per student of a high-quality online learning program is the same as or greater than the per-student cost of physical school (i.e., traditional) education" (Branigan, 2003, p. 1).

The start-up expense of a distance program is generally the most significant (Jones, 2003a). For example, in the mid-1990s, a Midwestern university decided to convert some of their traditional classes to distance classes using compressed video over a telecommunications network. The start-up equipment was a static $80,000 and the leasing of an established T-1 line infrastructure was another $1200 per month (Weber, 1996). During my dissertation study in 2002, the network administrators proposed to raise the cost of leasing the T-1 lines from $6,400 to $18,000 for 32 hours of live, teleconference usage. This immense figure was used to deter live instruction in favor of the seemingly less expensive asynchronous instruction. The network administration justified this by saying they would not have to pay engineers with the technical expertise for circumventing problems with compressed audio and video and could use fewer people with less technical knowledge if the science content sessions that we offered were delivered asynchronously. These costs can appear to be static to the laymen, but upgrades were frequent and costly. To circumvent these costs, institutions are creating partnerships with other institutions and companies to share technology and to produce and deliver courses (Dunn, 2000).

Student Costs

Administrators must decide whether it is more important for the delivery strategy they choose to promote meaningful learning or whether it simply benefits the institution financially. What I have found in my research doesn't suggest that the *Web* is necessarily more cost-effective and certainly does not suggest that it is more learning effective.

Federal funding through the still existent e-rate initiative of 1996 and presently *No Child Left Behind* is contributing financially to the hope that information technologies as a whole will answer the call for a cost-effective alternative to traditional, on-campus instruction. Interestingly, it is the promise of lower per-student costs that is driving distance education technologies (Rahm & Reed, 1999) rather than the quality of instruction and the learning opportunities for the students. Many universities are aiming at cost control, improved quality of instruction, student satisfaction, and persevering in a competitive distance education market.

Riley, Hollerman, and Roberts (1999) stated, "The quality of Internet access is critical. Broadband access will be the standard. Slow, unreliable connections that cannot support interactivity or multimedia content will no longer be efficient or acceptable." Viewing streamed video, animations, and other graphics through *Web* instruction (i.e., PowerPoint™ presentations, digital images, etc.) requires a high-speed, reliable connection. High bandwidth is limited by cost and location.

These authors were prophetic in that the way we deliver distance education, through 3D multiuser virtual environments, generally does require high bandwidth but more importantly it requires better hardware from the end user. That is, students who take my classes must have an above-average graphics card (integrated graphics can't render the 3D objects) and minimum RAM and processor speeds to handle the large chunks of data being sent over the network. Later in this book we will revisit this idea and explain how the technology is beginning to adjust to these network and system requirements.

Many instructors of online courses are now able to create multimedia packets for the learner to better understand the content without synchronous interaction with the instructor. The use of streaming video is an added bonus for the visual learner in the asynchronous mode but the expense to produce digital video is significant, albeit getting cheaper if the instructor has the knowledge of creating the video himself/herself. If not, however, the average cost of digitizing video taken from standard VHS videotape is $150 for the first 5 min of video and $22.50 for each additional 30-min block. The catch to these costs is that it doesn't factor in additional costs for editing or adding sequences such as titles or transitions. If the aforementioned expenses accrued over six classes, it would cost $240 per session and $1,440 total. That is VERY significant to an institution's bottom line if every online class incurred such an expense.

Hidden Costs of Distance Education

Hidden costs are seemingly symbiotic with the increase of technology and the commitment to distance education. However, there are unseen time and human costs that are generally not budgeted and that often detract from the effectiveness of the distance education design.

Human capital is an expense that can be easily underestimated (Ng, 2000). *Time is money* and that holds true in the realm of distance education as well. Training instructors on how to use distance education technologies costs the institution money for the time spent by both the instructor being trained and the trainer. A class that has multiple instructors or a single instructor with multiple support personnel requires time for virtual office hours and circumventing unseen or unpredicted technical difficulties. This is most apparent in the asynchronous mode of communication since the class is effectively open 24 hours a day, 7 days a week. The technicians who need to be in place in case the inevitable technical difficulties occur cost money as well.

A major economic advantage for institutions that offer distance education is that it doesn't require lengthy full-time residence on campus. This might explain why established institutions have barely broken even financially when implementing distance education courses. The start-up costs and the human capital are added expenses to the day-to-day operating costs at most institutions. The success of such accredited institutions that are exclusively Internet driven lies in the fact that they have zero expenses for housing, food service, utilities, etc. As Cairncross (1995) suggested, "The death of distance as a determinant of the cost of communications will probably be the most important economic factor shaping society in the first half of the new century." As the world gets flatter, distance may have lost some of its enchantment and it can be argued that information technologies are solely responsible for this loss.

Reach

Weigel (2000) defined *reach* as the number of people involved in the exchange of information. As more universities are creating distance courses, the notion of reach is at the forefront of many curricular designs. Web-based distance learning is forcing institutions of higher education into competition with for-profit organizations to reach those who are looking for quick and efficient degrees (Armstrong, 2000).

The idea of larger numbers of students generates further ideas of increased tuition, value-driven benefits, and value-added benefits. Cukier (1997) defines *value-driven benefits* as increased access, flexibility, and ease of use of institutional courses and technology. Value-added benefits are such things as reduced traffic and parking on campus and the potential for new markets. While value-driven benefits are important to a university's community, value-added benefits are what is driving many of the current integrations of Web-based courses.

Richness (Cost to the Student)

Richness is the overall quality of information provided (Weigel, 2000). If there is high quality in the delivery of information, then meaningful learning should be occurring. Learning is arguably the most important cost to students. This is not a monetary cost, but rather a cost of an intrinsic nature. My research implies that more effective learning of science occurred in the *live* mode, over and above the *Web* and *video* modes. However, many administrators see *Web* (asynchronous) instruction as more cost-effective and therefore there is a need to find the best way to deliver *Web* instruction so the *Web* student outcomes outperform *live* instruction.

A Case for Synchronous Instruction

An argument needs to be made for *live* (synchronous) instruction. There has been much research that states that "Rich" distance education needs to contain two-way communication where instructors can provide immediate feedback to their students, but maybe more importantly has embedded instructional immediacy (humor, using student name, encouragement, gestures, smiles, etc.) (Hackman & Walker, 1990; Muirhead, 2000; Romiszowski & Mason, 1996; Sproull & Kiesler, 1986; Tresman, Thomas, & Pindar, 1998; Gorham, 1988). Although Chizmar, Walbert, & Hurd (1999) proposed that the use of technology can in fact provide immediate feedback through chat rooms and online quizzes, the human touch of non-verbal cues is almost always lacking in asynchronously delivered courses. The good news is that it was almost 9 years ago and technology has begun to change the instructional immediacy of online courses. Chat rooms have now metamorphosed into immersive 3D worlds where chat and quizzes, among many other tools, are built into the platform.

The most successful math and science reforms of the 1960s were not just those that emphasized the active nature of the learner through manipulatives and hands-on inquiry, but instead those that provided opportunities for the students to talk and to question while they were engaged in the process of learning (Parker, 1999). Learning theory has not changed much, if at all, since the 1960s. We still know that students learn most effectively when there is two-way communication with the instructor and are actively engaged in the content. This is the essence of synchronous interactions and thus synchronous online instruction.

There is a problem with both students and teachers of distance courses not being prepared for teaching and learning through distance education formats. Cornell (1999) suggested that students often feel isolated due to lack of teacher feedback, technical difficulties, and time management in asynchronous classes. Teachers felt the same as students but also felt a sense of diminished control over the course. We can surmise that this is a reality because synchronous instruction is how humans have been conditioned or possibly hardwired to communicate. It is how students have learned and teachers have taught throughout their academic lives. Until asynchronous instruction is incorporated into the primary and secondary grades, the reality of students changing their attitudes toward and learning within asynchronous instruction is unlikely.

Meaningful Learning

Garrison (1990) stated, "Passive access to information is not sufficient; there must be active participation in the educational experience for information to become meaningful knowledge." It is critical that instructors of distance courses take the approach that it is more important what the students learn as opposed to an emphasis on reaching the masses. “Even though it contradicts most of the tenets of high-yield instructional technique, the large lecture persists—mainly because it is cheap and pragmatically useful: the economics of scale generate a surplus that supports low teacher-student ratios in major classes” (Foreman, 2003, p. 12).

Inquiry instruction has been argued to be the best way to teach critical thinking skills and promote deep understanding of subject matter. Meaningful learning, which anchors learning new matter in cognitive structures, not rote learning, is the goal of inquiry instruction. Inquiry teaching is taken to mean facilitation of learning. Individualization of teaching and learning, encouragement of critical thinking, and far-reaching student autonomy are integrated with this view of learning and teaching (Holmberg, 1989). These intangibles to the teaching and learning process are closely related to the affective domain of the learner. Designing distance courses requires what Cukier (1997) calls *performance-driven benefits*. Examples of these benefits are student/teacher satisfaction, learning outcomes, active discussions, and a perceived return on investment by the student (Swan, 2001).

In the 2003 article, I wrote about five components to a rich, cost-effective distance learning delivery. The acronym **PUPIL** was used as a guide for distance education administrators to follow as they design courses and a subtle reminder that the pupil is the most important aspect of any educational setting. **PUPIL** can be deciphered in the following manner:

P – Production
U – Upkeep
P – Personnel
I – Infrastructure
L – Learning

*Production is comprised of the teaching and technical support staff. These people develop and implement the learning tools for a distance course. They are the critical cogs in a perfectly delivered program. The instructor(s) deliver the content, while the technical support staff guides the students through the technology.

*Upkeep is the cost related to maintenance, repair, and upgrades to the delivery systems. In the digital age, upgrades are prolific and the price of upgrades can increase drastically.

*Personnel are the office administration. When *reach* increases, the traditional office staff cannot usually handle the volume of enrollments, billing, general questions, etc. There needs to be extra assistance for distance courses. This is yet another cost that is commonly not accounted for.

*Infrastructure deals with the network over which the course is delivered. In a synchronous learning environment, by today’s technology standards, it is critical there be broadband connection from delivery point to learner. Whether it is over a telecommunications network or through telephone lines, the design needs to take the student’s geographic location into account.

*Learning is self-explanatory. Simply, it is meaningful and will remain in long-term memory.

This chapter has laid the foundation for why it is important to rethink how distance learning is offered today. It is also served as a platform for you to begin to think about how 3D multiuser environments and video games can lend themselves to distance education. In the next few chapters we will discuss today's students, tomorrow's students, and how gaming applications are currently being used for college distance learning.

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Chapter 2
Millennials and Why They Fail in Distance Learning Environments

Distance education in U.S. colleges and universities expanded dramatically in the late 1990s, according to a nationally representative survey taken in 2000–2001 (U.S. Department of Education, 2003). Both enrollment in for-credit distance education courses and the number of courses offered more than doubled from 1997–1998 to 2000–2001: enrollment grew from 1.3 to 2.9 million, and course offerings grew from 47,500 to 118,000. In 2000–2001, 56% (2,320) of 2- and 4-year institutions offered distance education courses, up from 44% three years earlier. However, percentages were much higher in public institutions. Almost 90% of public 2- and 4-year institutions offered distance education courses; 16% of private 2-year and 40% of private 4-year institutions offered such courses. Still, fewer than 10% of students in science and engineering fields took courses through distance education (National Science Board, 2004).

In fall of 2006, online offerings in the United States were up by19.8% since 2002. Two-year colleges have seen the most growth as almost 2 million students are now enrolled in associate degree programs. With these staggering numbers, mind you almost 8-years old, most educational institutions have not changed their distance education delivery model. What distance education units have seemed to be missing the boat on is the target population and what makes them tick. We should be developing models of distance learning driven more by personal interests than by the technology (Pazos-Arias & Lopez-Nores, 2007).

In the 2007 book entitled *Online nation: Fives years of growth in online learning*, nearly it was reported that student access issues lead the reasons why institutions offer online courses and programs. Those institutions with online offerings, either courses or fully online programs, were asked to rate the importance of various factors in their decision to provide online offerings. Increasing student access was by far the most frequently cited reason for offering online courses, with 63% of institutions saying this was Very Important and an additional 30% rating it as Important. Another access-related issue, attracting students from outside the institution's traditional service area, was the second most cited reason. More than one-half (53%) of all institutions said this was Very Important to their decision and 28% said it was Important. Several other factors were cited as Very Important or Important by at least two-thirds of respondents, including growth in continuing/professional education,

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increasing degree completion rates, enhancing the institution's brand value, and providing pedagogic improvements.

Many of these academic leaders are very positive about a number of aspects of online education, including a belief that students are at least as satisfied with online instruction as they are with face-to-face classes and an increasing majority perspective that the quality of online education as the same or better than face-to-face instruction. Future growth in online enrollments will most likely come from those institutions that are currently the most engaged as they enroll the most online learning students and have the highest expectations for growth (Allen & Seaman, 2007). However, I would contend that institutions who are most engaged know and understand their current and prospective students.

Generation and Gender Lines

Generation G, the net generation, the millennials, however one might classify them, learn in fundamentally different ways than have students of the past. They have matured in a connected world where information is on their fingertips and entertainment and learning are beginning to become somewhat symbiotic. The growing use of Web 2.0 (the definition of user-generated Web sites such as wikis, blogs, and such sites as youtube™) and social networking (i.e., Facebook™, MySapce™, and Bebo™) is changing how we must deliver instruction.

Summarizing a panel of millennials (today's students), questions about campus culture were asked. In an article written in The *Chronicle of Higher Education* (2007) summarizing a panel of millennials' views about campus culture, the needs and perspectives were quite telling. When asked about distance education, the panel generally said they didn't like it because "it was a language and literacy experience." However, when asked about comparing it to face-to-face, students reported they liked it better because you can say things online that you wouldn't normally say in the seated class. Some said they liked asynchronous platforms (i.e., WebCT™, Blackboard, and *Moodle*©) better then a Web-cam class because of the anonymity. These students want more bells and whistles to liven up the lecture and administrators and faculty must begin to listen. This is the line drawn by 3D virtual learning environments that we will continue to draw through this book.

Students who fail in distance education generally lack some fundamental skills needed to succeed in this course generally because of how the courses are delivered. The learning strategies from a distance include questions students need to ask themselves such as what motivates you? How do you think about your learning tasks and which activities are more conducive to your learning style? Saba (2004) said there is a gap between traditional and online learning in such areas as follows: lack of face-to-face feedback from instructor, absence of an immediate peer group, learning in isolation, and learning at home or in an environment where distractions are plentiful.

So who are these millennials? It's true that students are arriving at college with greater abilities in online learning and an expectation to learn that way. But, what is even more intriguing is that these students also arrive with brains that are more likely to have been shaped by very visual, rapid movement, hypertexted, and gaming environments (Healy, 1999). Almost 63% of the game console market is over 18. Women outnumber men in Web-based game play. Young women build upon the strong women represented in games as a means of building their own confidence in confronting challenges in everyday life. Almost 60% of gamers play online with friends, 33% play with siblings, and 25% play with spouses (Jenkins, 2006). This is the world they live in and education has, for the most part, not entered this world. There are approximately 80 million people classified as Generation G. This is closely compared to the numbers of the baby boomer generation.

College students are heavy users of the Internet compared to the general population. Use of the Internet is a part of college students' daily routine, in part because they have grown up with computers. It is integrated into their daily communication habits and has become a technology as ordinary as the telephone or television. One-fifth of today's college students began using computers between the ages of 5 and 8. By the time they were 16- to 18-years old all of today's current college students had begun using computers – and the Internet was bedrock in their lives. Eighty-six percent of college students have gone online, compared with 59% of the general population. About 85% of college students own their own computer, and two-thirds use at least two e-mail addresses. College-aged Internet users are twice as likely to use instant messaging on any given day compared to the average Internet user. Nearly four-fifths of college students agree that Internet use has had a positive impact on their college academic experience. Almost half of college students agree that e-mail enables them to express ideas to a professor that they would not have expressed in class, but, some interactions are still primarily face-to-face: Only 19% of students said they communicate more with their professors via e-mail than they do face-to-face. This is primarily due to the reality that professors have not adapted to this generation and have not completely embraced technology. Nearly three-quarters of college students say they use the Internet more than the library information searching. Forty-two percent of college students say they use the Internet primarily to communicate socially. The most relevant statistic to this book is that half of the students who took an online course said they believed they learned less from the online course than they would have from an on-campus one. Based on these findings, it is clear that for students already enrolled in traditional college courses, online education has a long way to go before it might challenge the traditional classroom education (Jones, 2002).

These students are also known as expert multitaskers. That is, they can do many different things at one time using almost all of their senses and filling their cognitive capacities to the max. Digital media and interfaces encourage multitasking: Many teenagers now do their homework by simultaneously skimming the textbook, listening to a MP3 music player, receiving and sending e-mail, utilizing a Web browser, and conversing with classmates via instant messaging. Whether multitasking results in a superficial, easily distracted style of gaining information or a sophisticated form of synthesizing new insights depends on the ways in which this learning strategy is used. Certainly, at some number of simultaneous tasks, this strategy results in cognitive overload and concomitant loss of effectiveness (Dede, Korte, Nelson, Valdez, & Ward, 2005).

Teens still watch much more TV (16+ hrs/wk) than playing video (1.5 hrs/wk) or computer games (1.5 hrs/wk). This is still less than the time spent reading (2+ hrs/wk) or listening to music (7.26 hrs/wk). Girls are superior in multitasking and do it more than boys. Girls actually prefer to multitask. Video (41% of the time) and computer (67% of the time) games are multitasked with other stimuli. Gaming is visual, auditory, and very interactive which consumes more than other media. TV and video games share the proportion of time reported as a sole activity (55%); only do one or the other but not both simultaneously (Foehr, 2006).

Why Games and VLEs are Important to Education

Ultimately we educate and get educated to earn work in a given field. In the 2004 book entitled *Got game: How the gamer generation is reshaping business forever*, Beck and Wade report from 2,500 people surveyed in corporate United States about how gamers and non-gamers feel about work; game players, regardless of age, possess desired skills wanted by most corporations. By 2010, there will be 10 million more jobs than workers and industry and schools have NO CHOICE but to find ways to channel millennial strengths and adapt to the work environment. Eric Klopfer (2005) from the MIT Media lab suggested that adults can and should play games. Games will give you insight into how children are learning through game play. Thomas Friedman also implored United States to rethink how we deliver education to the millennials. "The locus of ownership of both the process of constructing and sharing knowledge, and of knowledge itself, is shifting. Learners are not only willing to participate in the construction of knowledge; they are starting to expect to."(Friedman, 2005).

Virtual learning environments and gaming platforms are becoming the norm in social networking by people from all ages. We have adapted to these environments and other can and should do the same as a means to reach the millennials. Currently there are 9 million registered players of the popular Massively Multiplayer Online Role Play Game, *World of Warcraft*©; most of whom are adults. Linden Labs platform, *Second Life*©, boasts 8.6 million registered users and even the virtual environment *Club Penguin*™, which targets children between ages 6 and 13, has 12 million users (Alter, 2007).

Conclusion

Students are more likely to achieve if attempts are made to make the learning environment more congruent with that preferred by students (Faser & Walberg, 1991). This notion has not changed and most likely will never change. The millennials are not a one shot influx of learners but rather a trend that will continue to evolve over time. For example, in the Gates Foundation Civic Enterprise Study, it was reported that high school dropouts had the minimal grades to graduate. Ninety percent of whom had passing grades when they dropped out, while 70% of the students polled were confident they could have graduated if they had been more challenged and engaged. The simple reason is that these students are 2.0 learners and it is all about interaction and engagement for them. Teachers have been trained and schools continue to support passive reception of knowledge.

James Paul Gee has been writing for the last number of years about how video games embed pedagogical strategies and how gamers are learning from the games they play. Although the conception is slowly changing, gaming platforms need to be used more in distance learning because certain genre of games (i.e., MMOs) lend themselves to the online pedagogy. With voice over Internet Protocol (VoIP) and the ability to represent oneself through avatars, real-time, synchronous instruction that address the distance learning student issues, mentioned previously in this chapter, is not only possible but also becoming more easy to create.

Online enrollments have continued to grow at rates far in excess of the total higher education student population, albeit at slower rates than for previous years. The 9.7% growth rate for online enrollments far exceeds the 1.5% growth of the overall higher education student population. Nearly 20% of all U.S. higher education students were taking at least one online course in the fall of 2006. Virtually all types of institutions of higher education have shown substantial growth, but with some clear leaders. Two-year associate's institutions have the highest growth rates and account for over one-half of all online enrollments for the last 5 years. Improving student access is the most often cited objective for online courses and programs. Cost reduction is not seen as important. All types of institutions cite improved student access as their top reason for offering online courses and programs. The appeal of online instruction to non-traditional students is indicated by the high number of institutions that cite growth in continuing and/or professional education as an objective for their online offerings.

Change is not easy; especially for well-established faculty. Faculty acceptance and the need for more discipline on the part of students are the most common concerns expressed by faculty. Higher costs for online development and delivery are seen as barriers among those who are planning online offerings, but not among those who have online offerings. Academic leaders do not believe that there is a lack of acceptance of online degrees by potential employers.

Young people are competing and collaborating on a global scale. New technologies, or at least new to education, provide the opportunity to rebuild the collaborative social structures that we have begun to lose in our educational communities. When people become so immersed in a virtual environment, such as the virtual marriage in Second Life© between two people who never met in real life, it is high time to rethink how learning is transmitted.

Distance learning programs have not evolved to a state where integration of emerging technology is accepted. Distance learning administrators and faculty generally use the Internet as an educational tool supplementing traditional classroom education, and it may be difficult to convince them to abandon the traditional setting for a virtual setting after they have had the kinds of attention afforded them in the college classroom. However, I must reiterate that the high degree to which today's college students perceive the Internet as something used for fun means that they will not limit their use to work or learning. College students are a group primed for interactive entertainment. Although most did not report the Internet as being a primary entertainment device in their lives, the degree to which they use it for socializing makes the Internet an important leisure activity (Jones, 2002).

We must also take into account the different learning styles of the millennials. As computers and telecommunications continue to evolve, new forms of "neomillennial" learning styles are emerging. As previously mentioned, the millennial learners think in much different ways than educators are used to seeing from their students. Research on sophisticated interactive media suggests that the following may emerge as cross-age learning styles (Dede et al., 2005):

- Fluency in multiple media, valuing each for the types of communication, activities, experiences, and expressions it empowers
- Learning based on collectively seeking, sieving, and synthesizing experiences rather than individually locating and absorbing information from some single best source
- Active learning based on experience (real and simulated) that includes frequent opportunities for reflection
- Expression through non-linear, associational webs of representations rather than linear "stories" (e.g., authoring a simulation and a Web page to express understanding rather than a paper)
- Codesign of learning experiences personalized to individual needs and preferences (Dede, 2005).

It is crucial we understand the audience and the state of current distance education before delving into the virtual learning environment abyss. Now that we have established the foundation for who the audience is today and who the audience might be in the near future, we will justify why gaming platforms are the next great implementation into distance education and how we have been using them at North Carolina State University.

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Chapter 3
The Power of Serious Games in Education and Why We Are at a Critical Crossroads in Distance Education

Since Roy Trubshaw and Richard Bartle created the first multiuser adventure game accessible in cyberspace, Multi-User Dungeon (MUD) in 1979, the power and potential of multiplayer online games was born. The transition from MUD to Role Play Games (RPG) has taken the player from watching the main character to becoming the main character in a rich learning environment. Although learning may not have been intended at its outset, it is clearly at the apex in these games. This chapter will begin to explain why these emerging virtual games are so engaging and powerful, and why educators at all levels may be left behind if they choose not to embrace them.

The Power of Multiplayer Games

"Some young person is going to spend $50 on this, yet they won't take 50 minutes to learn algebra; I wanted to know why." (James Gee). Games are not just played, they are talked about, read about, "cheated", fantasized about, altered, and have become models for everyday life and for the formation of subjectivity and intersubjectivity. There is a politics, an economy, a history, social structure and function, and an everyday lived experience of the game (p. 651) (de Castell & Jenson, 2003). Upon the advent of Serious Games, the non-entertaining virtual platform has been used in many training situations. Serious Games are being successfully used by the military and fire fighters (Dugdale, Pallamin, & Pavard, 2006; Harmon, 2003; Macedonia, 2000), medical professionals (Cosman, Cregan, Martin, & Cartmill, 2002; Hmelo, 1999), and business higher education fields (Bos, & Shami, 2006; Whitehouse, 2005). To date, however, educational research has focused primarily on students in K-12 (Eck, 2006; Moshell & Hughes, 1996; Oblinger, 2006; Randel, Morris, Wetzel, & Whitehill, 1992; Shaffer, Squire, Halverson, & Gee, 2005; Soderberg & Price, 2003). Although online gaming is a relatively new area of activity, its success at engaging large groups of remotely located users has meant that early research projects and military training organizations have already begun to use multiplayer online role-play gaming approaches as a means for engaging and retaining large remotely located learner groups, and for supporting collaborative learning objectives and communities of practices (de Freitas & Griffiths, 2007).

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In 2004, Constance Steinkuehler clearly explained why virtual worlds work in education. She stated "the virtual worlds of games are powerful because they make it possible to develop situated understanding" (p. 105). Situated understanding of any concept or content is critical in the learning process. If we as educators train our students to think through authentic problems in real-world situations, then those students will learn to apply knowledge in a more meaningful manner. Clearly videogames are at the forefront of entertainment for the neomillennial learners. Though 9 million people are playing the Massively Multiplayer Online Role-Play Game (MMORPGs) *World of Warcraft* and learning in medieval situations, to date there has not been an education equivalent created by a commercial game company.

At North Carolina State University, we have used a few platforms to try to create these situated learning environments for our students. These platforms will be discussed in detail in future chapters, but the crux of our studies has been to work and learn with commercial game companies, so that we can design authentic, distributed learning environments for all students. Designing virtual learning environments is not merely a matter of getting the curricular material right, but also a crucial matter of getting the situated, emergent community structures and practices in place. Synchronous communication and interaction can occur to facilitate these communities of practice. This is the critical piece to the puzzle of designing MMORPGs that are educational in terms of concepts and content delivered from a distance, regardless of the curricular domain. Although we do this in science and science teacher education, the pedagogical structure we have established can be used by anyone at any level.

Can video games change the way we teach? Subsequently, can videogames change the way students learn? These are the questions at the forefront of our work. To answer these questions, we have spent considerable time and energy paying close attention to detail, knowing that video games are most powerful when they are simultaneously personally meaningful, experiential, social, and epistemological for the student. We must critically evaluate the future of learning, and look beyond traditional teaching and learning epistemologies to the emerging arena of videogames and synchronous online teaching and learning. This is a very important, albeit frightening, endeavor if educators are truly concerned with teaching not just facts or isolated skills, but embody particular social practices as well. Most educational games to date have been produced in the absence of any coherent theory of learning or underlying body of research. We argue here for such a theory, first proposed by Shaffer et al. (2005), and for research that addresses the important questions about this relatively new medium.

Internet-based learning styles ascribed to the neomillennial students (those born after 1982) are increasingly true for many people across a wide range of ages, driven by the tools and media they use every day. Of the 9 million subscribers to *World of Warcraft,* most of them would not be tabbed as neomillennial learners. In addition, as computers and telecommunications continue to evolve, new forms of neomillennial learning styles are emerging. Chris Dede (2002), Harvard professor of learning technologies, suggested that in the next decade, three complementary interfaces of information technology will shape how people learn:

- The familiar "world-to-the-desktop" interface, providing access to distant experts and archives, enabling collaborations, mentoring relationships, and virtual communities-of-practice. This interface is evolving through initiatives such as Internet2.
- "Alice-in-Wonderland" multiuser virtual environments (MUVE) interfaces, in which participants' avatars interact with computer-based agents and digital artifacts in virtual contexts. The initial stages of studies on shared virtual environments are characterized by advances in Internet games and work in virtual reality.
- Interfaces for "ubiquitous computing," in which mobile wireless devices infuse virtual resources as people move through the real world. The early stages of "augmented reality" interfaces are characterized by research on the role of "smart objects" and "intelligent contexts" in learning and doing.

As these interfaces become more mainstream, it is likely that more students will be drawn to these platforms. By 2008, the United Kingdom's goals are to have all schools using learning platforms, all students using personalized learning spaces, and "universal access" to technology, wherever and whenever students need it, Brown said. That access could require laptops, personal digital assistants, Sony PlayStation Portables, tablet computers, or whatever technologies school leaders choose. In the United States, statistics supporting this notion are beginning to emerge:

- 69% of U.S. heads of household play computer and/or videogames
- 31% of game playing population is under 18, with an average age of 33
- 25% of game playing population is over 50
- 62% males and 28% females play games
- 49% of the game sales are for games rated E, 4% rated E10+, 32% rated T, and 15% rated M
- 30% of video game sales by genre are action/adventure, 17% sports, and only 8.7% shooter
- 31% of computer game sales are strategy, 20% family and children, 14% shooter, and 12% role-play
- 89% of the time parents are present when games are rented or purchased
- 61% of parents reported believing games are a positive part of their child's life
- 87% of the time children get parental permission before renting or purchasing a game
- 73% of the regular voting population are game players
- 47% of parents who play games are women
- Game players spend about 7 h/week playing
- 79% of game players report exercising or playing sports on average 20 times/month
- 93% of gamers reported reading books or newspapers on a regular basis
- 44% of game play is online, up from 19% in 2000
- 58% of online gamers are male and 42% female

- 52% of online games played are puzzle/board/game show/trivia/card
- 32% of game play is now on ubiquitous computing (Essential facts about the computer and video game industry, 2006)

So who are these neomillennial learners and game players? Defining the typical gamer, Beck and Wade (2004) that gamers believe it's all about competition, relationships are structured, young people rule, and people are simple. Beck and Wade continue by stating that gamers produce the most quality work because their experience with games has made them more passionate about adding value. They also show a greater sense of loyalty to their peers and the organization as a whole than their non-gaming counterparts. Furthermore, they say that gamers have a strong belief in competition and prefer compensation based on performance. Arguably, these are all characteristics designed in employees in the workplace.

Insofar as gamers are concerned and how to motivate them, it is important to understand gamer expectations in the real world. Gamers are used to being heroes. Business professionals who have also been gamers intuitively understand that their personal success depends on adding value to the enterprise and they actually expect to deliver an outstanding performance. Beck and Wade emphasize the need to tap into their instinct for heroism, using the game generation's "selfish" drives to inspire great performance, while being careful not to dismiss gamers' ability to concentrate and quickly move between tasks and help members of the group work between generation gaps.

There is a clear trend suggesting that the more time young professionals spend playing video games, the more sociable they report themselves to be. Based on the data, Beck and Wade recommend three types of possible changes to make the most of the gamer generation's innate sociability. By providing structure, goal-directed tasks, and standards by which all workers must follow, the gaming generation will succeed in their respective jobs. They further suggest setting up two-way mentor relationships in which the technologically savvy but structure-dependent gamers learn some of the things they might not have had time for learning – such as how to conduct small talk on a sales call – while perhaps passing along some of the digital expertise that seems to be so innate. The most important finding here is that, where we might have expected isolation, the data instead reveal that gamers care more, not less, about connecting with other people.

When designing curricula around 3D worlds and games, a study of computer games for entertainment by Becta (a government agency in the United Kingdom) provides information about aspects of games that might usefully be incorporated into software for schools. For example, motivation is one aspect of games that is often cited as a reason for use of information and communications technology to help learners to achieve their aims. The features of game software that encourage motivation can be identified and can become part of the design of software for schools. Games for entertainment may provide environments in which learners develop key skills such as strategic planning, visualization, and memorization. Genres of computer games (i.e., fantasy, action adventure, sports) provide specific strategies to win and little consequence in making mistakes, while keeping the enjoyment in the playing of the game. They further embody educational concepts commonly used in today's classrooms such as Bloom and Gagne's taxonomies. Richard Van Eck (2006) aligned types of games with learning taxonomies. Action player games where the player is constantly moving and using quick reflexes with hand–eye coordination are aligned with Bloom's knowledge, comprehension, and application levels. Simulations and role-playing which can fulfill the players' fantasy of what he/she can do in reality can encompass all of Bloom's and Gagne's taxonomy levels.

Games support and encourage both players and teachers in various ways. Games encourage the player to continue trying to win, master the contents, and make rational choices in a safe play environment. Games support adventure, cooperative learning, and structure for the teacher in terms of lesson planning and management. However, it is critical to note that games can be disengaging if not properly created. It is important to keep the level appropriate to the learner so that motivation does not decrease. Further consideration should be wrapped around the addictive qualities of play, gender relations, scaffolding with reflection, and the use of Voice over Internet Protocol if the game is multiplayer.

Video games immerse people in alternate worlds and make them rely on problem-solving skills to reach defined goals. In a well-designed game, people can learn new skills and see the consequences of their knowledge, or their ignorance, as their scores climb or fall. As we will describe in a later chapter, collecting students decisions in the 3D environment can be programmed in the design phase to assess learning, critical thinking and other indicators of learning. Game players often study the game's content over and above that which is embedded in the game so they can master the competition and ultimately win. "The power of these games is not the clicking. The power is being able to extend your mind and body into this virtual space, and in that virtual space being able to take on an identity that you can think about in comparison to the real world" quoting James Gee (Carlson, 2003).

When deploying game technology in distance education, we (and others) have critically been analyzing components of these games. Specifically, Massively Multiplayer Online Games (MMOGs), which allow people to interact across the globe in real time. We will briefly discuss them in this chapter and then elaborate further in future chapters of this book.

Presence, Identity, Community, and Play

MMOGs differ from other kinds of games in that they are deeply social in nature. Online and social online presence have been areas of distance learning that have been being studied for some time. We have come to understand that contextualizing learning in online worlds is difficult but ascertaining strong indicators of learning, such as presence, identity, and community, can greatly shed light on the relative effectiveness of an online course. As it relates to online games, and thus online virtual environments, Turkle stated, "Playing one's character(s) and living in [these virtual worlds] becomes an important part of daily life. Since much of the excitement of the game depends on having personal relationships and being part of [the] community's developing politics and projects, it is hard to participate just a little" (1995, p. 184). Gee (2005) suggested that games can provide a sense of "embodied empathy for complex systems" and provide "embodied experiences", giving a player the feeling that they are inside the system they are analyzing.

Games allow for the "play of imagination," the means by which people are able to learn and experiment without the risks associated with real-world decision-making. For educational psychologist John Dewey, play is not a product but is instead, a process of discovery and learning, the means by which all learning is made possible. "Were it not for the accompanying play of imagination, there would be no road from a direct activity to representative knowledge; for it is by imagination that symbols are translated over into a direct meaning and integrated with a narrower activity so as to expand and enrich" (18:2) (Dewey, 1916). We sometimes neglect or reject the notion of play in education, especially as the student population grows in age. It is our contention, that play invigorates the imagination and allows the mind to work in ways that innovate and deeply engage memory.

The Critical Crossroad in Distance Education

In 2001, Becta called for educators to rethink the way they teach and how games could be part of that redirection. Much of our work, and what we will elaborate upon in this book, is grounded in this call from Becta. They emphasized if computer games are to be used in education, the following must be researched: making multiuser interfaces, permanent record of play for analysis and reflections, relationship of players cognition and social skills, stereotyping roles in games, reasoning skills, development of language and math skills, and perceived goals of students.

We have become acutely aware that games teach learning, constructivist theory, and problem-based learning. Most game-based learning has been geared toward using the game as a host where curricular content can be embedded. However, simply introducing a game element does not make learning fun, nor does it make it an attractive activity for students. Just by holding class in a 3D virtual world does not embody the power of video and computer games. A well-constructed virtual world for distance learning embeds mini games in the world, while keeping interaction and communication synchronous. The power of these mini games is that they allow the learner to experience not only the happenings of a scientist such as evaluating facts, concepts, and theories, but also actions, interactions, values, dilemmas, and decisions. Game-informed learning builds upon the experience of game play to facilitate learning so that the learning process resembles key components of game play (Begg, Dewhurst, & Macleod, 2005). James Gee contends that students learn in games, even if they are mini games or missions, when they can use creativity to work toward complex goals, when lesson plans incorporate both thinking and emotion, and when the consequences of actions can be observed. He argues that an immersive, interactive digital environment provides opportunities for education in three key contexts.

1. Situated cognition: Human learning is not just a matter of what goes on inside people's heads, but is fully embedded in (situated within) a material, social, and cultural world as well.
2. New Literacy Studies states "that reading and writing should not be viewed only as mental achievements going on inside people's heads but also as social and cultural practices with economic, historical, and political implications."
3. Connectionism "stresses the ways in which human beings are powerful pattern-recognizers" and argues that people "think best when they reason on the basis of patterns that they have picked up through their actual experiences in the world," not when "they attempt to reason via logic and general abstract principles detached from experience."

Maybe the most compelling reason to adopt gaming technology is that it improves critical thinking and literacy. Players must take on new identities, solve problems through trial and error, and gain expertise or specific types of literacies to be successful in a game. A player learns to think critically while at the same time gaining embodied knowledge through interactions with the environment. He states that "video games situate meaning in a multimodal space through embodied experiences to solve problems and reflect on the intricacies of the design of imagined worlds and the design of both real and imagined social relationships in the modern world" (Gee, 2003a).

By representing the simulations through gaming conventions, educators can potentially increase engagement, while fostering deeper learning, as learners engage in critical and recursive game play, whereby they generate hypotheses about the game, develop plans and strategies, observe their results, and readjust their hypotheses. Further justification for using games for education can be found through the Federation of American Scientists report of 2006 where they called video games the "next great discovery", as they offer a way to captivate students so much that they will spend hours learning on their own time. However, video games developed by private industry focus primarily on first-person shooter and sports games – not on education. Henry Kelly, President of the Federation of American Scientists, said, "This is an investment that private industry is not capable of taking." There is a need for the federal government to drive the movement forward with support for this. In general, we argue that game technology has a great potential to be useful in getting people to learn and think in important social, cognitive, and moral domains. Thinking reflectively and effectively about complex systems is a crucial skill for the modern world where workplaces, communities, government, global institutions, and the environment are all complex systems.

Also part of the critical crossroad is empowering women and minorities. There is an unfounded mindset that women do not play games and thus this book does not pertain to women. This could not be further from actuality. Clearly, women actively play certain genres of games. Those games that employ strong conversation and human interactions seem to be the enticing factor for women to play games. MMOGs have a great deal of conversation and interaction and allow the player to live in fantastic worlds where they can meet and cultivate friendships with others throughout the world. This is, in my opinion, the 21st century pen pal. Today's gamers no longer write letters to peers in foreign countries, they interact with them in virtual worlds.

By developing these relationships, we can create multicultural experiences in our classes simply by the nature of the students who enroll. Video game technology can allow us to create rich worlds in which learners act, interact, make decisions, and learn in order to accomplish goals. Having students with different perspectives interacting in a virtual world can further reward exploration, non-linear thinking, re-thinking goals from time to time, and not always following instructions or the most obvious thing to do. We are now beginning to critically evaluate these learning components as they pertain to the new medium of 3D virtual online worlds.

Conclusion

We as educators know aspects of learning and ways in which students operate, however this knowledge is sometimes overshadowed by testing and measurement which can lead to neglect of students. Students prosper when the subject matter challenges them to the extent of their abilities. Making lessons too difficult causes student frustration. Making lessons too easy causes student to become boredom. Cognitive psychologists call this the *Regime of Competence* principal. The same can be said for video games. An easy game is not engaging and subsequently not fun, whereas a challenging game seemingly cannot be put down. This is not unlike an engaging movie or book. There is a balancing act when playing complex games. It involves cognitive juggling of multiple objectives, choosing what to prioritize and when, and what to defer. These decisions effect decisions on other conceptual and psychomotor levels such as what buttons to press, how to interact with other characters, and which areas of the virtual environment a player may choose to explore. Infusing these constructs in distance education may not only increase enrollments and sustain those enrollments (arguably the more important factor), but in fact may also teach at levels in which assimilated learning is paramount.

Its success, however, does not depend on better technology or better instruction by faculty alone, but depends on a massive reorganization of the university in the scale of what business and industry managed to achieve during the 1990s. In other words, using post-industrial technologies, within the confines of an industrial organization, are not going to show any beneficial results, and it may even intensify the current problems and damage the institution (Saba, 2001). It is our hope this book strikes a nerve with some of its readers and serves as the agent for change in distance learning.

If improving education is an important venture, then faculty need to use the body of teaching, learning, and student-development research results at hand to build on this evidence about what works (Bok, 2006). Further, we must disseminate those results so as to impact policy. Recently, Representative Congressman Mark Kirk from Chicago looked to ban *Second Life©* in all schools and libraries who seek funding through e-rate (a U.S. Federal initiative started in 1996 to insure Internet connectivity throughout the country). His concern is that the potential dangers in the form of sexual predators and sexually explicit content can be exposed to children of all ages. This is because Second Life© does not require age verification to many of its islands (Broache, 2008). Representative Kirk needs to be informed that online virtual environments can be secure and free of sexually explicit content and predators. However, it is up to us, the faculty teaching in these environments to research and report how, why, and what we've learned. Creating courses without research and dissemination is simply not acceptable if innovative teaching and learning practices are to reach the masses.

If we don't report our findings and inform the population at large, we run the risk of supporting a methodology and curricular policies that not only support 20th century skills but also impede cognitive growth and engagement of our 21st century students. As we learn more about how learning occurs through game play and virtual environments, even more opportunities will exist to use emerging technologies and engage students in meaningful ways. Moulder (2004) said about virtual worlds, "Why read about ancient Rome when I can build it?" To this we say why read about Rome if I can interact with the aspects of Rome in a fun, challenging, and immersive way?

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Chapter 4
Use of Virtual Learning Environments in Distance Education

Introduction

It is the first day of EMS 731 (Fundamentals of Research in Science Education). Students enter the classroom and greet each other with waves and hugs. They ask one another how their winter breaks were and tell stories of their holidays. Each mentions that the break was too short, but they are ready to get back into the swing of school. After a few minutes of chitchat, Dr. Smith walks in and the class starts. He shows a PowerPoint presentation on different research methods they will be discussing this term. In addition, he goes over the major assignments in the class, spending the most time on the poster presentation that will be due at the end of the semester. Each week the students meet and discuss various reading from the class Web site. On the last night, they all present their posters to Dr. Smith and their classmates explaining their research design. This may sound like a typical graduate class, but in reality this class was taking place all within a 3D VLE where students interacted using their avatars. Each night the classroom changed depending on the mood of the class from a faraway castle, to the beach, to a traditional classroom. The students were in various states and often the professor was on the road traveling during their class sessions. This is just one of the many examples of distance education courses available today.

In 2001, Serdiukov reported over 70% of all U.S. universities or colleges offer distance education courses. Today the percentages are higher. In addition, many of the traditional higher education courses have an online component associated with them, whether it is simply submitting assignments through e-mail or checking a Web site for class notes or other materials. The Web, and more specifically Web 2.0, has become a central part of education in many places and will continue to become even more so in the coming years. Serdiukov (2001) mentioned how technology has moved from being a support tool to an integral part of education and in many ways has begun to shape and give birth to new forms of education. He uses terminology as example of this change. Earlier courses used to offer *computer-assisted learning*, while today they offer *computer-based* or *Web-based* courses. Today, the Web is the central method for distance education courses, but there are many avenues educators and students can use for delivery of information, including a wide range of

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virtual learning environments from a more traditional learning management system to holding class in a 3D virtual world (e.g., *Second Life*©).

What are virtual learning environments? Virtual learning environments are simply software programs or systems designed to assist teaching and learning in an educational setting. Some of the more commonly used virtual learning environments are learning management systems (LMS) or course management systems (CMS) (e.g., *Blackboard*© and *Moodle*©) that place a collection of tools in one software program for the instructor and/or student to use. Tools include grade books, online quiz makers, calendars, forums, etc. But a virtual learning environment also can be a virtual world or online game, in which students attend class or do work.

Creating an "Ideal" Online Distance Education Course

In order to determine the best delivery method for a course, it helps to determine what an "ideal" online course is. According to Carr-Chellman and Duchastel (2000) there are six key components:

- A study guide
- No online textbook
- Assignments
- Examples online
- Course communications
- Interactive skill building

The study guide should be the student's main reference to course content, structure, and activities. The study guide should include information traditionally found in a syllabus (e.g., course aims and learning objectives), additional learning resources (e.g., textbooks, book chapters, journal articles, and Web sites), assignments and projects, and finally assessment criteria. The main difference between a study guide and a traditional syllabus is the level of detail provided. A study guide should be a stand-alone document about which students should not have additional questions to clarify any part of the content. This will help move a traditional course toward a more student-centered and activity-based learning environment, which is more appropriate for distance education.

Online courses generally should not have the primary learning resources online. Although Carr-Chellman and Duchastel (2000) suggested this, students may feel differently. Many successful online courses provide the primary reading materials online in the form of electronic journal articles and PDFs, which in many cases saves students a significant amount of money with rising textbook costs. Textbook costs have risen over 6% in the past 3 years (Falchi, 2007). Used textbooks may appear to offer discounts, but also are the reason for higher prices on new textbooks. Publishers try to compensate for the loss of revenue from the sale of used textbooks by increasing the cost of new ones. Seventy percent of the revenue generated from textbooks comes from the first year of sales. Digitized versions of textbooks are widely available from publishers, but are not widely used or promoted by bookstores and instructors. These digitized textbooks would be a good alternative for distance education to help reduce the cost and offer a good secondary source of information for the course. Being able to download the textbook would also make the book available almost immediately and save the student from having to wait for a textbook to be shipped to them. Carr-Chellman and Duchastel's (2000) reasoning against no online textbooks was that computer screens offer a poor interface for reading, but the quality of computer monitors has advanced in the past 8 years as well as the software programs in which these documents are displayed. In addition, people often have the option to print the materials and read them as hard copies, which in many cases is still cheaper than most textbooks. Carr-Chellman and Duchastel's (2000) other complaint was concerning the portability of online documents versus a traditional textbook. However, many students today have laptops that are used in classes, and if the textbook or select text is printed out this is not an issue. Another alternative is having textbooks available on ubiquitous computing devices (e.g., iPods, PDAs, and cell phones). Of course all students are not this fortunate, so portability may still be a factor in some cases. Carr-Chellman and Duchastel (2000) also mention that one of the benefits to online documents is the availability of new research or materials that have not yet made it into a textbook, printed, or e-textbook.

Student tasks should be the center of an online course. They constitute the learning experiences in which the students will engage. Student tasks can be designed to be independent or collaborative assignments just as in a traditional course. The goal is to help the student master the learning objectives of the course through these assignments. Preferably, this would switch the major acquisition of information from lectures to the application and use of information in real- world settings. There should be a level of authenticity and a focus on searching for relevant information to the student's own learning goals in these tasks. Both of these components will help keep students engaged with the subject matter. One final and important element related to students' task is prompt feedback from the instructor, which will help refine their learning experience as well as correct any developing misconceptions.

Online examples should accompany the student tasks. Examples help to clarify and communicate to the student the level of effort required for an assignment as well as the standard quality of work that the instructor expects. Examples should cover a range of levels to demonstrate both acceptable and unacceptable work. It is important though to maintain anonymity of the examples. Current students can be encouraged to post their assignments online to share with their peers as another method of online examples. This allows for a more open nature to the course and encourages students to collaborate, but could also discourage students who prefer a more competitive way of learning.

Interactive communication is the key to any distance education program. Communication exhibits three different patterns: student–content interaction, student–student interaction, and student–instructor interaction (Moore & Kearsley, 1996). Although we will discuss this more in depth in Chapter 7, we will briefly define them here. Student–student interaction is encouraged because it is believed to make the course feasible for larger numbers of students by reducing the emphasis on student–instructor interaction. Student–student interaction is normally encouraged through asynchronous discussions in online forums. Online forum discussions allow for intellectual discussion to occur that is profitable to all. Asynchronous discussions allow for students to participate in a flexible manner. There are two other methods of communication also valuable to distance education – synchronous communication through chat rooms or Voice over Internet Protocol (Voice over IP) and e-mail communication.

Synchronous communication is real-time conversation. This form of communication is beneficial for a number of reasons. Instead of students reading lecture notes from a Web site, they can participate in an actual lecture, which allows for questions to be asked and comments made or clarified. Students working on group projects can hold sessions to discuss, plan, and assemble their project instead of relying on e-mail or other methods of communication, which could slow down the process. Many chat programs that are available for free on the Internet, such as MSN Web Messenger©, allow for the exchange of documents to individuals or the group in the chat session making group collaboration easier and efficient. Synchronous communication can also be in the form of videoconferencing.

Many informal educational institutions like museums and science centers are starting to offer distance education programs or courses for schools. These types of programs offer an inexpensive alternative to field trips. These programs use VoIP technology which requires special equipment on both ends, making this type of technology not as feasible for traditional distance education. As a cheaper and better alternative to the Internet, software like *Elluminate*© or Adobe Connect© allows for videoconferencing with no special equipment other than a Web camera. Many of these programs also allow document sharing and whiteboard technologies for sharing ideas and work. Synchronous communication can make students feel like they are in a traditional classroom while sitting at home. For working individuals or individuals with families, it isn't always easy to attend class at a certain time each day or week, making non-synchronous courses more popular for these students. However, we must reiterate the price of learning, or lack thereof, for these students (Annetta & Shymansky, 2006).

E-mail communication is the final form of communication used in distance education. This is probably the most common method of communication between instructors and students. This allows for private communication concerning grades, assignments, and progress. E-mail is also beneficial for administrative communication that is important to be received in a timely manner or in an emergency. Most individuals check their e-mail more often than they check the course Web site, meaning they may miss an important announcement if it was only posted on the course Web site. Many learning management systems have a messaging or e-mail tool built into them, but unless there is the ability to forward them to an instructor's or student's traditional e-mail address, checking the course Web site frequently is still an issue. E-mail is also commonly used, as mentioned earlier, on collaborative group projects to exchange information.

Interactive skill building is the last key component Carr-Chellman and Duchastel (2000) recommend. The software technologies used for interactive skill building have come a long way since Carr-Chellman and Duchastel's (2000) article was published. Java and other computer applications today allow students to have real-time interactions in distance education that they might find in a traditional science lab or computer lab. These types of applications allow for a narrower learning experience that is important for building certain skills. Through these types of applications, students can participate in dissection, observe chemical reactions, or play the stock market.

Finally, distance education has two instructional facets that should be addressed: engagement and adaptiveness (Carr-Chellman & Duchastel, 2000). Engagement is concerned with keeping students' interest in the information and social setting involvement, while adaptiveness is concerned with the availability of information (i.e., having the right information at the right time). All of these components make up just one part of an ideal course. Other instructors or students may have vastly different ideas as pointed out with synchronous versus asynchronous communication or the use of textbooks versus online materials. As technology continues to advance and improve, the "ideal" distance education course also will continue to change, but some components (e.g., the study guide) will stay the same. Now that we have a better idea of what an "ideal" distance education course involves, let us take a closer look at some of the different types of virtual learning environments that could be used.

Learning Management Systems

The most common form of Web-based distance education currently takes place in a learning management system or course management system; WebCT© and BlackBoard© are two of the more commonly used LMS on the market. After the companies merged, they covered over 75% of the LMS market (Mullin, 2005). LMS and CMS are basically the same – the only difference being the manufacturer's classification preference. Sometimes LMSs are considered to be predominately used for corporate training programs in the United States, while CMSs are used for higher education; however, the terms are often interchangeable. The decision to choose a particular product depends more upon the tools, the overall friendliness of the environment, and the tech support that the program offers. Learning management systems are designed to help organize and manage course content and learners. Unfortunately, LMSs don't always consider the needs of the faculty or learner (Siemens, 2006). In most cases, the actual learning experience takes a backseat to the management functions of the software. There is limited research that has been done on students' experiences and efficacy of the LMS tools. Most LMSs promote asynchronous learning rather than synchronous with the use of forums and e-mail as the most common forms of communication between students and the instructor. The level of the instructor's and students' knowledge of the particular LMS being used can greatly influence the learning environment for the students. Siemens (2006) comments that "the 'management' aspect of a learning management system creates another problem: much like we used to measure 'bums in seats' for program success, we now see statistics of 'students enrolled in our LMS' and 'number of page views by students' as an indication of success/progress (p.5)." He says that the underlying assumption by administration is that if the students are exposed to the content, learning will happen, which isn't always the case.

Let us compare a course offered at North Carolina State University via BlackBoard© to Carr-Chellman and Duchastel's (2000) "ideal" distance education course components. The study guide for the course was split over several different documents in several different locations in the LMS, creating confusion about where to find information. A traditional course syllabus was easy to find and had the majority of the information the student needed, but assignment descriptions, due dates, and final project information were all found in different locations. In this case there was a problem associated with not having a physical textbook, but instead using the units within the LMS. This created a problem when the server was down for problems or maintenance, which occurred several times throughout the semester. Another problem was the ability to look at multiple sections of the LMS at one time. For example, if the student was working on a forum assignment, he/she could not have the forum and the assignment description, and text from which the assignment or discussion was coming open at the same time. He or she could have the forum and one other window open, which for some assignments required the student to do a lot of flipping back and forth between virtual pages of text. If for some reason the student accidently closed the forum page where they were typing the assignment, they lost all their work. So in this case it would be beneficial to have a textbook or printed material, if possible, in this particular LMS.

The assignments included forum discussions where students were asked to comment, give real-life examples, or answer questions related to the material that was covered in each section of the course. In some cases, the students did not have real-life experiences in the subject discussed and therefore felt uncomfortable doing the assignment. In this particular course, the title and description made it sound as if it were an introductory course with no experience needed, yet in some of the assignments it assumed the students had real-life experiences. For example, it asked the students to relate some of the teaching issues they had experienced as an educator. Some of the students had never taught, so the instructor asked them to relate experiences they had encountered as a student. Other assignments included student reflections, students being asked to interview others, and a final project. For online examples of the assignments, the instructors had the students briefly summarize their current work in the forums for the rest of the class. They also included examples of past final projects, but forgot the importance of anonymity; however, this wasn't too much of a problem in this case. All were examples of excellent final projects and access to the LMS was limited only to the students in the course. Course communication was limited to asynchronous forum discussions and e-mails. The instructor encouraged students to post questions or problems in the forums so that all could see, but the delay in response to the question or concern was often much longer than if the instructor had been directly e-mailed, in some cases the delay was several days. The advantage to posting a question or problem in the forums is that students could often help each other. Finally, interactive skill building was used in some of the assignments and the final project.

Some of the other issues that arose with the use of the LMS included no drop box for homework assignments, minimum interaction between faculty and students, and general lack of understanding on where to find information for the course. Grades in the grade book consisted only of the points given for forum discussion, but not the actual assignments that were submitted to the instructor, which were located in another tool associated with assignments.

The faculty and many of the students were new to BlackBoard©, which may have contributed to over half the class dropping the course.

There are pros and cons to this type of virtual learning environment. In one central location students can work at their own pace with little guidance and have all the information they need for the course, while faculty can handle grades, manage groups, and post class announcements. One of the main disadvantages with an LMS can be the lack of instructor interaction, which is instructor-dependent. In this particular case, the instructors often checked the forums once or twice a week, while students may post questions for the instructors daily. Whereas in a normal classroom, the students could get many of their questions answered before or after class if not during the class period. In the end, the students often ended up answering each other's questions before the instructor replied. This is not meant to criticize the course, but to demonstrate some of the potential problems associated with an LMS especially from the student's perspective. Many of the problems were corrected as the instructors became more comfortable with the LMS. This case simply demonstrates the need for proper training and support for faculty teaching in distance education. There are many courses offered through corporate training centers, community colleges, universities, and other institutions using learning management systems that do not have these problems as in the case of Rio Salado College.

Rio Salado College in Tempe, Arizona, has had a distance education program since 1978 using correspondence and telecourses (Scarafiotti, 2003). This community college was an early adopter for using the Internet for distance education, which helped enrollments surge from 10% of the total college full-time enrollment equivalents (FTEE) in distance education in 1995 to 48% of the total FTEE in 2003. This approach allows Rio Salado College to offer courses and programs for both individual students and organizations or institutions, such as the U.S. Army, that send students to Rio Salado College's online program. Unlike most higher education institutes Rio Salado College offers online courses every two weeks instead of once a semester and students can complete the 14-week courses early with faculty permission to speed up their time to complete their program. This may seem like a lot of work for faculty, but in reality the college has adopted a "one course, multiple sections" policy where a complete master course is designed for the faculty, most of whom are adjunct instructors. This allows for consistent course content and guarantees online courses will contain navigation that is functionally predictable and consistent. This is just one example of the successes of the Internet in distance education and some of the benefits that distance education can offer an institution by increasing enrollment and benefit the student by creating flexibility not offered in many traditional courses.

LMS systems were originally designed for distance education, but are becoming more popular for use in blended learning environment, which eliminates the problem of minimum interaction between instructor and student. Blended learning environments are becoming more commonly used in courses. LMSs are being used with more traditional on-campus classes for the submission of assignments, posting of class announcements, posting to forums to continue discussions started in the classroom, or start new ones or for viewing grades through the grade book tool, etc.

K-12 schools are also joining the ranks of blended learning environments. Many public and private schools are hardwired, allowing teachers and students access to various educational Web sites. In addition, many teachers now have Web sites for their classes giving students information on homework assignments and projects, class announcements, and a class calendar. This is also a place where parents can go to see what is happening in their child's classroom. Using Web sites in this manner and hardwiring our schools create a better communication dynamic between the teachers, students, and parents as this has the potential to improve the overall learning environment.

Alternatives to LMS

Two alternatives to LMSs are personal learning environments (PLE) and social software. PLEs are designed to address some of the limitations of an LMS by allowing individuals to take control and manage their own learning with a more contextually appropriate toolset so that at the same time, there is reduced structure in management and implementation of learning (Siemens, 2006). One of the main differences between a PLE and LMS is that a PLE is a concept for e-learning and not a product where LMSs are a product (Wilson, 2007). Ongoing research is being conducted at several universities around the world on PLS. Social software is often used as some of the tools for PLEs (Siemens, 2006). Social software includes blogs, wikis, social bookmarking sites (BlogMark.net, de.lirio.us), social networking sites or affinity spaces (MySpace©, FaceBook©), podcasts and video cast tools (You Tube©), search engines, e-mail, and Voice over IP. The one problem with these types of tools is the lack of integration and the control required by many universities (Siemens, 2006). Integration is becoming less of an issue as many of these sites allow users to link information from other types of sites like videos from You Tube©. There are several educational blogging and wiki sites today that allow users to post bookmarks to other Web sites, videos from a number of different sources, podcasts, etc., using the blog or wiki site as the way to connect all these tools together for better management making these types of sites more of a possible alternative to LMS.

Educational Games and Virtual Worlds

Looking at the different types of virtual learning environments, learning management systems were considered the way to use the power of the Internet in the 1990s and 2000s. What will be the choice of the future? The Horizon Project in 2007 identified two possible alternatives – virtual worlds and Massive Multiplayer Educational Gaming (MMEG; New Media Consortium & EDUCAUSE Learning Initiative, 2007). The Horizon Project started in March 2002 and is still ongoing. This project seeks to identify and describe emerging technologies that are likely to have a large impact on teaching and learning in higher education. The 2007 *Horizon Report* identified six trends in technology. They predicted a significant impact on higher education in the next 1 to 5 years (Appel, 2007; New Media Consortium & EDUCAUSE Learning Initiative, 2007).

The six trends identified were as follows:

- User-created Content
- Social Networking
- Mobile Phones
- Virtual Worlds
- New Scholarship and Emerging Forms of Publication
- Massive Multiplayer Educational Gaming

The 2006 *Horizon Report* included educational games as one of the trends, which included both Massive Multiplayer Educational Gaming and virtual worlds (New Media Consortium & EDUCAUSE Learning Initiative, 2007). We will refer to virtual worlds as 3D VLES. Many of the trends and tools listed relate the idea of personal learning environments. User-created content incorporates blogs, wikis, and on-line photo sharing sites. Social networking sites include MySpace© and FaceBook©. Today, cell phones allow individuals to access the Internet, chat, and download podcasts or videos making the educational opportunities almost limitless. The new scholarship and emerging forms of publications include blogs, wikis, and other document sharing or open comment types of sites. Authors may choose to write in a blog or wiki to get immediate feedback from other professionals or readers to help make changes along the way rather than at the end. These types of tools allow for easier collaboration for groups of individuals who may not even know or be located near one another. Many of the technologies listed can be applied to distance education. In this chapter we will mainly focus on the virtual worlds and Massive Multiplayer Educational Gaming (MMEG) even though many of the other trends can be associated with these two types of environments.

Why would virtual worlds or Massive Multiplayer Gaming even be considered for educational purposes? In *A Field Guide to Educational Simulations* Aldrich (2002) states

> The next generation of learners, roughly those age thirty and younger, have grown up playing computer games. These once and future learners have learned how to learn through interactions with computers. They expect to be engaged on multiple levels simultaneously, in a fast feedback, graphical, high stimulation, extremely immersive user-centric environment. As a result they're utterly bored in traditional classrooms (p. 1).

Research has been done for years on the advantages and disadvantages of using video games in education. One conclusion upon which most researchers agree is that players learn something from video games (Shaffer, Squire, Halverson, & Gee, 2005). The negative arguments in many cases are the same as any new form of entertainment technology. Many of the same arguments were used against talking movies and TV in educational settings (Squire, 2003). It is a matter of use in moderation and in an appropriate manner. One of the main things about 3D VLES and MMEGs that will benefit education is that they allow the players to experience the technology firsthand. As Gee (2005) points out, much of success in school is based on being able to understand complex academic language like vocabulary found in textbooks. When students only understand the verbal language, they may be able to interchange words into their own definitions and pass written exams, but they cannot use it in real-world problem solving. 3D VLES allows students to experience problems for themselves and apply them in trial and error methods to the world around them. These worlds can be used to experience anything from the effects of gravity to triaging patients in an emergency room.

Gee (2005, p. 20) listed six reasons for explaining that video games are good for learning:

1. They can create an embodied empathy for a complex system.
2. They are action- and goal-directed preparations for, and simulations of, embodied experience.
3. They involve distributed intelligence via the creation of smart tools.
4. They create opportunities for cross-functional affiliation.
5. They allow meaning to be situated.
6. They can be open-ended, allowing for goals and projects that meld the personal and social.

He warned that video games do not necessarily do all these things by themselves, but it depends on how they are used and the learning systems of which they are a part.

Educational simulations have been used for years in schools. Many of these are scientific simulations where the student watches the monitor from an outside role as an observer. 3D VLES and MMEGs are also simulations, but instead of being an outside observer the student is part of the simulation, allowing them to explore, discover, and create goals of their own within the simulation (Gee, 2005). Industries,

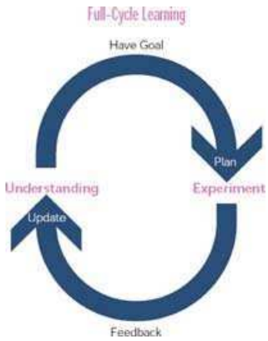

Fig. 4.1 Full-cycle learning model (Aldrich, 2002)

governmental agencies (e.g., U.S. Army, NASA), and commercial airlines have successfully used first-person simulations to train their personnel. These types of simulations use full-cycle learning whereby the student understands a system, has a goal, receives feedback, and updates their knowledge (Fig. 4.1) (Aldrich, 2002; Gee, 2005).

Simulations are best used according to Aldrich (2002) in three situations.

1. Simulations can be used for developing ideas and concepts that which only experience can strengthen its understanding.
2. Simulations are good for giving people practice in decision-making before they are faced with real-life situations that can be dangerous or critical, or for issues that deal with time or scale.
3. Simulations allow people to experience a time or place that they are unlikely to experience directly.

3D VLES and MMEGS incorporate all of these types of simulations allowing limitless possibilities for distance education.

In their report, the New Media Consortium and EDUCAUSE Learning Initiative (2007) stated 3D VLES are a trend that would not come about for 2 to 3 years, but many courses are already starting to use them. 3D VLES can be applicable to almost all disciplines because they are generalized rather than contextual (New Media Consortium & EDUCAUSE Learning Initiative, 2007). Settings can be created that pertain to any subject or area of interest. Issues with scale in real life can be handled by virtual environments allowing students to visualize physical objects that normally occur at cosmic or nanoscales. Virtual worlds also allow for social interaction, which can be beneficial for role-playing and scenario-building, allowing students to go the extra step to assume the role or responsibilities of a paramedic, architect, or biologist without having to worry about real-world consequences.

3D VLES can be either public or private allowing for students to interact with any number or types of individuals. Second Life© is a public virtual world that many universities use for classes. Students in Second Life© can interact with a number of other users from different universities and institutions as well as their own classes. Some classes choose to do projects observing and/or interviewing the public members of the world, while other programs like *Active Worlds*© allow institutions to buy private worlds or participate in public ones.

Multiplayer educational gaming offers many of the same benefits as 3D VLES and vice versa because MMEGs are developed in 3D VLES. One of the main differences is some virtual worlds can be experienced as an individual without coming into contact with other people. MMEGs are designed for people to interact with one another on some level. Because it is a game, there are storylines and goals already set for the player before even entering the world, whereas virtual worlds can rely more upon the goals of the individual and/or class. MMEGs normally do not allow students to create objects nor do MMEGs allow students to develop land. Students can accomplish these actions in 3D VLES.

One of the main benefits to multiplayer educational gaming is the way it better engages learners (New Media Consortium & EDUCAUSE Learning Initiative, 2007). Massively Multiplayer Online (MMO) games have attracted and retained over 16 million people worldwide (Fig. 4.2) (Woodcock, 2008). These types of games also allow for both discovery-based and goal-oriented learning. Development of teambuilding skills is probably one of the biggest benefits to MMOs. The designed activities of MMOs cannot be completed by a single player, requiring individuals to work together as a team. The group must strategize, develop a solution maximizing their various talents, and execute the plan to succeed. The group can be from 2 to over 40 people allowing for a variety in teambuilding experiences. In addition to teambuilding skills, MMOs allow people to develop leadership, communication, and management skills. More experienced members can also take on a tutoring or mentorship role to newer members and share their experiences and

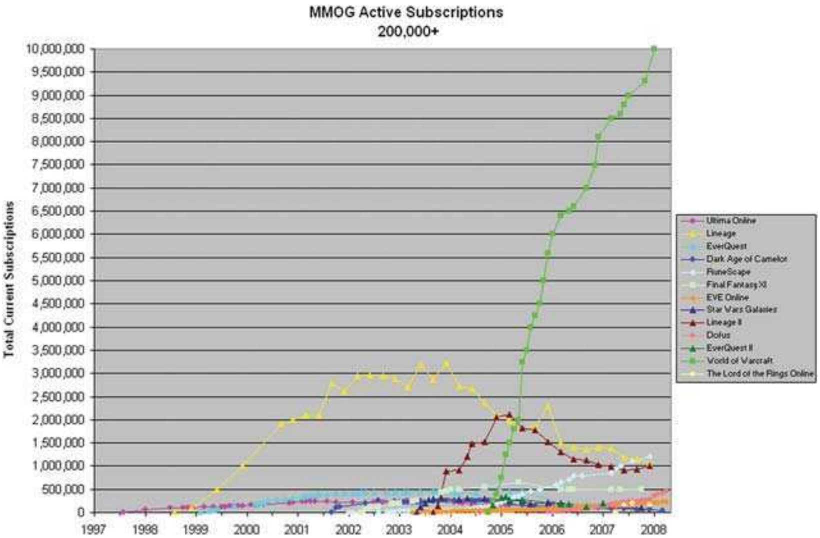

Fig. 4.2 MMOG active subscriptions 1997–2008 (Woodcock, 2008)

knowledge. Teambuilding is seen as a critical skill by most hiring agencies of college graduates

Learning from Massively Multiplayer Online Role-Playing Games

Before delving too far into multiplayer educational gaming, let's look a little closer at one of the most popular Massively Multiplayer Online Role-Playing Games currently on the market, *World of Warcraft*© Online (WoW), and the educational benefits it offers players. Currently, over 10 million people around the world play WoW (Woodcock, 2008). WoW is a fantasy-based game with most of its story-lines coming from previously released single-player computer games based in the world of Azeroth. Players create a character from one of nine races (e.g., Night Elf, Undead, Tauren, Human, etc.) and choose to play one of 10 classes (e.g., Mage, Warlock, Warrior, Priest, etc.) to play. After personalizing the characters' appearance, players join the game at level 1, where they must learn skills and professions that will help them progress to level 80. As players move through the game, they interact with other players through casual conversation in chat channels, joining together for quests, instances,[1] battlegrounds, or raids,[2] and interacting through buying and selling materials and goods. Players in WoW earn and spend money just like people in the real world, except their currency is gold, silver, and copper.

Although, this game was designed for entertainment purposes, it can teach economics, math, science, as well as teambuilding skills (Gee, 2005; New Media Consortium & EDUCAUSE Learning Initiative, 2007), leadership skills (New Media Consortium & EDUCAUSE Learning Initiative, 2007; Yee, 2003), and social skills.

Supply and demand is demonstrated in WoW just as it is in real-life situations. Items can be sold at an auction house to other players or on trade chat channels. Rare or harder to find items are sold for hundreds or thousands of gold, whereas common items that are easily acquired may be sold for a few copper. Prices increase or decrease in response to the level of demand. A common item like "netherweave cloth" (sold in stacks of 20), used for many skills (e.g., making bandages for first aid) and professions (e.g., tailors use it to make many types of armor), normally sells for 4 gold, but may be sold for 8 gold if there are only a few currently on the auction house. However when the auction house is overrun with this item, it may go for half its normal price, or 2 gold.

[1] Instances – Dungeons designed so that each group of players has their own version of that particular dungeon. Normally, they are designed for 5–40 players, depending on the particular dungeon (Blizzard Entertainment, 2008).

[2] Raids – Large scale attack by a group of people on an area (e.g., dungeon or town) (Blizzard Entertainment, 2008).

This is similar to looking for sales in the real world, as some players even monitor the auction house on a regular basis, not unlike people do on EBay©. Players know what the normal prices of common goods are and wait for periods when the auction house is overrun with these goods, or when a player is desperate to sell and places an item at an extremely low price. These players then buy the goods and wait for a later date to sell them at a profit, much like stock market brokers. Players that truly know the market are able to make lots of gold simply by buying and selling items at the auction house. As in the real world, WoW currency holds power.

The game encourages a player to work individually as well as part of a team (Fig. 4.3). Most players' quests can be done on their own, allowing them to learn how to play their classes and develop their own skills as players, but there are a variety of times when players are required to work as a team, as in the cases of raids or battlegrounds. These group environments require the team to work together by developing strategies on how to conquer obstacles in their way. The 2007 *Horizon Report* says in MMEGs that it is possible to design certain activities that cannot be completed alone, so "a group must work together to strategize, develop a solution, maximize the various talents of the team members, and execute their plan in concert to succeed" (New Media Consortium & EDUCAUSE Learning Initiative, 2007, p. 26). This is demonstrated in WoW when players assume certain roles on a team and either do not perform their role correctly or try to act as individuals. As a result, the

Fig. 4.3 Example of 25 individuals working together to bring down Illidan in Black Temple

team will fail. Groups may consist of only a couple of people or up to 40 people working together simultaneously.

WoW also teaches players how to adjust strategies as needed. A strategy may work for one group of characters, but when group dynamics change, it may not work the same way, causing players to learn how to adapt. This is the case in battlegrounds where players are competing against other players to take over their respective bases. Each battleground is unique with different types of characters played by individual players. This teaches the players to work together as a team through communication with one another. When communication fails, there is no organization or strategy and, thus, the group fails. The team with the best communication and ability to work together is the group that usually wins. Communication can become a problem when groups of individuals who know each other, and how each other operates, decide to stay together as a team through these instances, raids, and battlegrounds instead of grouping with random people they don't know.

Along with teambuilding skills, come leadership skills. As in any group situation, some people are leaders and some are followers. WoW allows anyone to become a leader. It is up to the player if he or she wants to put in the effort to become a leader, whether it is acting as a mentor to other players with less experience, being a guild leader or officer, or running a raid as a raid leader. Leaders often make decisions that others don't want to make, such as kicking out a member from a guild, battle

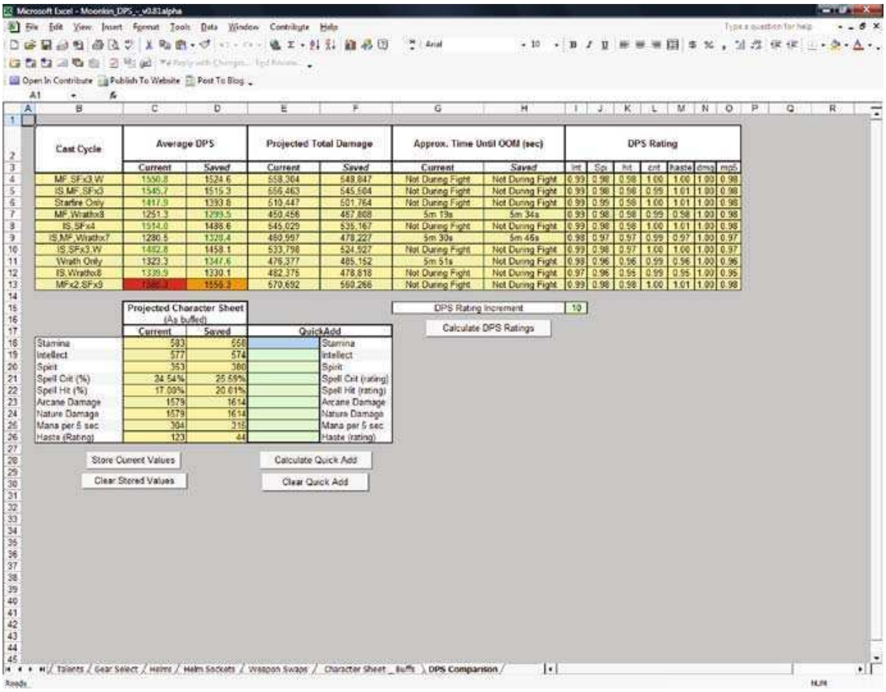

Fig. 4.4 Moonkin DPS spreadsheet (FileFront, 2008)

resurrecting an individual during a fight, or giving away a trade secret to another player in order to help them. Yee (2003) specifically looked at four leadership skills: mediation, persuasion, motivation, and leadership. His goal was to see if players felt they had improved their knowledge or ability in certain skills in MMORPGs. Out of 2,804 people sampled, over half felt they had learned a little or a lot in mediation (55.2%) and leadership (50.3%) and just under half felt they learned a little or a lot in persuasion (43.8%) and motivation (48.4%). In an environment like WoW, mistakes will be made without any real life consequences, giving individuals a chance to learn and explore their leadership skills. In the end, these players will learn skills they can apply to real-life situations, like how to research strategies for certain situations or delegate responsibilities to members of a team.

In many cases, social skills coincide with the teambuilding and leadership skills, but there is more. The game world has its own rules of acceptable behavior that players are expected to follow or they will face consequences. For example, players working together as a team have the possibility to earn gear or items they need to advance. Normally, it is worked out among the players who will get what gear by determining who has the ability to use an item, or the items are distributed fairly to be sold. But in some cases, players take an item without permission which is considered being a "ninja" or a thief. This unacceptable behavior is often broadcast in public chat channels or players ignore this person and tell others not to interact with him or her. Eventually, the person either learns to work as part of the team when dividing loot or becomes a social outcast unable to become part of a group. After all, people don't want to group with someone they can't trust.

There is also the social atmosphere of a guild. A guild is a group of individuals that work together and want to spend time together. The most successful guilds often have strict recruiting practices requiring people to apply and interview before they are invited to join. Most applications and interviews aren't as rigorous as applying for a job, but they are expected to be taken seriously. Once a person is invited to join, he or she is often given a trial period to see if he or she fits in with other members of the guild. Guilds usually have some level of hierarchy with requirements for players to be promoted to a higher level. For example, a person who demonstrates leadership skills and the ability to work well with other players may be promoted to an officer position, while someone with the ability to read other players and a salesman attitude may be made a recruiter for a guild.

There are players who take learning the game to the next level. Excel© spreadsheets (Fig. 4.3) have been designed for the 10 different classes in the game for players to input their characters statistics to obtain information on how much adding a point or more to a certain skill category (e.g., intelligence, spell hit, spell damage, etc.) will increase their damage per second. These players know how to calculate a variety of statistics about their classes to get the most out of their characters. For example, they know which pieces of armor will benefit them over others and exactly how that specific pieces of armor will change their abilities. They plot charts using any number of record-keeping programs to be able to compare their characters to others in order to see their progress compared to the other players. Raid and guild leaders will use this information to put together their team for raids or battlegrounds much like a coach picking players for a sports team. Players also learn how to do research outside the game, reading strategies for certain bosses, watching videos, and spending time on sites that help them determine the gear their characters need to improve their skills.

Players learn how to think strategically and analytically, solve problems, plan and execute tasks as an individual and as part of a team, make decisions, and adapt to a rapidly changing environment. The amount a player can learn from a game like World of Warcraft© depends on the individual and how much he or she wants to put into the experience. If players can learn all these skills from a game designed for entertainment, how much can students learn from one designed for education? The short answer is that a student will get out of it what he or she put into it, much like players of WoW.

Using 3D VLES in Distance Education

How does all of this apply to distance education? 3D Virtual Learning Environments can and have been used as a meeting place for distance education courses. This is probably the simplest way to use a 3D VLE, but it is not the only way it can be used. Virtual worlds can be designed for anything instructors need. A class in Shakespearean literature could be held in a traditional Elizabethan theatre where students act out the plays, bringing a richer experience than simply just reading plays. Many schools and businesses use premade environments, meaning there are some buildings and objects already created (e.g., Second Life©) to reduce the staff's initial development workload.

Second Life© has been used for a number of educational purposes: as classrooms and laboratories, and environments to practice/test various skills. Social scientists including anthropologists, sociologists, and psychologists use Second Life© as a laboratory for studying people. They find the interaction of avatars an intriguing subject (Foster, 2005). Researchers have found that many of the connections and tensions that develop among avatars speak volumes about the behavior of people and organizations in real life. Specific research has been done on issues regarding marriage, gender identity, social status, and religion. A professor at Elon College says she "can get her student to understand in five minutes what I would normally have to lecture for about five hours" by using Second Life© (Foster, 2005, p. A36).

Business professors use Second Life© as a virtual economy to study the effects of economic decisions on the real world. Users can create, buy, and sell a variety of goods in this 3D VLE for "Linden dollars," which can be exchanged for real money (Foster, 2005). So, students can study economics, advertising, real estate, entrepreneurship, and many other business interests and skills.

Architecture students use this virtual world to create buildings, public places, or experiment in urban design. Computer science students can also use this world to study game design and familiarize themselves with the different tools used to create objects in this virtual world. Medical students at the University of Kansas use a Second Life© medical clinic to practice patient encounter strategies (Childress & Braswell, 2006). The possibilities of using virtual worlds to teach are only limited by the instructor's imagination.

In one particular case, a distance education course that originally used the LMS Blackboard© for the delivery of its content decided to utilize Second Life© as a method of creating a stronger sense of community among the students and improving communication between the instructor and students (Childress & Braswell, 2006). The instructor wanted to engage students online in an environment that allowed them to become more involved with both the instructor and other students. Chat rooms have been used before to also try to foster this sense of community, but they offer no visual component like a 3D VLE. Students and instructors can watch how other members interact with each other and objects found in the environment which enhances the experience. In this particular case, the instructor designed a three-story building with living quarters, offices, a lounge, a library, a deck with video equipment for watching movies, and a rooftop lounge for larger groups to get together. Initially, this building was only used for virtual office hours, orientation to Second Life© and socializing, but according to class comment cards also worked to create a better sense of community and communication in the class. In the next step of this course, the instructors planned to integrate more instructional tools, class activities, and cooperative learning experience into the environment (Childress & Braswell, 2006).

3D VLES and MMEGs fit well with personal learning environments. A building in Second Life© can allow students to leave messages for teachers and other students and have resources available such as documents, links to Web sites, and videos. It can also serve as a meeting place for live discussion instead of threaded text in the forums or a place for students to work on a project together. MMEGs and virtual worlds can even allow students from different sections of the same class to work, discuss, and study together as they choose in order to maximize their learning experience.

Creating a Learning Culture

Researchers are interested in more than just the learning that comes directly from the 3D VLE and MMEG experience; they are interested in the culture that develops around them. Gee (2005) describes how people in these MMORPGs (e.g., World of Warcraft©, *EverQuest*©, *Lineage*©, and *Guild Wars*©) are creating new ways to build and share knowledge. They are developing new forms of learning communities both online and in real life. It is possible for educators to use these games as models for classrooms and workplaces of the future (Gee, 2005). One example is the groups people form within these environments. Guilds are groups of people who play and help each other. They take responsibility for one another by helping each other improve, work together as a team, and even punishing one another for unacceptable conduct. Think how this could be applied to education. Would students who learned to work together and trust one another help students who are falling behind keep up for the good of the group? Would there be less discipline problems because they do not want to let their team down? These concepts are yet to be explored. Researchers want to know how these communities of learning are formed around these environments. Studies have shown that video games, whether single-player or MMOG, have robust game-playing communities associated with them (Shaffer et al., 2005). Schools sequester students in many ways from one another and from the outside world, while games and 3D VLES bring people together both competitively and cooperatively. Schools encourage students to work primarily alone using school-sanctioned materials, while avid gamers participate in forums, seek out new information, read and write Frequently Asked Questions (FAQs), and learn to become critical consumers of the information available. Shaffer et al. (2005, p. 106) stated

> Classroom work rarely has an impact outside the classroom; its only real audience is the teacher. Game players, in contrast, develop reputations in online communities, cultivate audiences by contributing to discussion forums, and occasionally even take up careers as professional gamers, traders of commodities, or game-designers.

Imagine if these types of communities could be formed around different aspects of education.

Future Research Needed on 3D VLEs

Research needs to continue on these communities and experts must explore how to develop them in education. By adopting these potentially new strategies, we are changing education for current students as well as opening up new possibilities for learning. Childress and Braswell (2006) list many areas of research that need to be conducted related in MMOGs including addiction, sense of community, longevity of groups, apprenticeship, role assignment, collaboration and virtual teaching, learning style and game selection, and game-based motivation. Shaffer et al. (2005) pointed out that we need to understand how commercial games create compelling virtual worlds and how inhabiting one of those worlds develops situated knowledge.

Research also needs to continue on different strategies for distance education. What are the benefits of other VLEs like LMS? Which should be used, LMS or PLE, to connect the students to the information they are trying to learn? Should they be used as the main tool for distance education or be combined with other tools like MMEGs and 3D VLES? How does distance education need to be adapted to account for the variety of different technologies available on the market, but keep it affordable for both students and schools? Research in distance education is still in its early years in many ways, but it is developing rapidly as more programs and courses switch to the ever-growing popularity of distance education.

Current Issues 3D VLEs Face in Education

What are the current roadblocks to using games in education, distance or otherwise? Many administrators are from a non-video-game-playing generation that does not understand the appeal or benefit of using these types of tools in education (Squire, 2003). The first step in overcoming this roadblock is explaining to administrators and spokespeople for schools the range of learning opportunities that games and 3D VLES present for students (Shaffer et al., 2005). Video games are already being used by corporations, governmental and political groups to convey ideas and to teach facts and world views. Shaffer et al. (2005, p. 110) explains "Schools and school systems must soon follow suit or risk being swept aside." Other issues inhibiting the use of virtual worlds and MMEGs include not having access to needed technology, cost, and lack of developed programs or games for instructors to use.

Should 3D VLES and MMEGs be used in school or outside of school? We argue for both. They offer a vast realm of possibilities. Both formats can be used to replace labs that are deemed dangerous or hard to recreate in the classroom. They can function as the classrooms. MMEGs can be assigned for homework or as an after-school tutoring session for students who need extra help. MMEGs can be used as a way for all students to study for tests. One of the differences between virtual worlds and MMEGs is interaction with other students, but it doesn't always have to be an environment for synchronous communication. Students can visit resources, videos, and other links relevant to class information that they might normally find on a course Web page. These tools can be used as additional tools for more traditional online courses, virtual office hours for students and professors to "meet", a place for students to interact as they like, a place for an individual to find more information, or to run a simulation for something students do not understand in class. Using Second Life©, students can study with other individuals for a class project. These tools are already popular with many people outside of education. Instructors could take advantage of this by making Second Life© or other virtual environments a continuation of students' extracurricular lives instead of limiting it specifically to either in-school or after-school use.

Video games are expensive to make, which becomes an issue for education. Students prefer the same level of detail put into educational games as those for entertainment, even though this is not necessary for students to learn from them. Many government agencies (e.g., U.S. Army and NASA) and private corporations that use simulations for training personnel have already found a solution to this problem (Gee, 2005; Shaffer et al., 2005). They have created a flight simulator or military personnel trainer designed for their needs and modified the simulation to create a marketed entertainment version. There is no reason this can't be done with educational 3D VLE and MMEG, or any educational game, to maintain lower costs. Look at Second Life©, for example. Universities and businesses are given free space to use for a semester, while the public buys land for $5 to $195 per month depending on the parcel size they want (Linden Research, Inc., 2008). If these 3D VLES or MMEGs work as well at making learning exciting the way researchers expect, there is no reason that students exposed to these environments both inside and outside of school will not want to spend time immersed in them outside of school. Think of distance education students who meet and work together in a 3D VLE as part of a class. They become friends, but may live hundreds of miles apart or learn that they are taking more of the same courses together that do not use this type of technology and may want to meet to work on homework or study for a test. Medical school students may want to run more scenarios in a virtual hospital that they use for class to practice bedside manners with patients and family members, but they can practice with real people who are suffering from any number of ailments (real or fictitious) without having to worry about real consequences.

Another option for helping to reduce the cost of educational games is through advertisement. Product placements are becoming common in video games (Abelson, 2005). A clean, no advertisement version should be available for use in schools, but advertisements can be added to the version sold for entertainment. Many blogs and wikis do this in order to offer free sites. Teachers may request a site with no advertisement for school use, whereas advertisements are added to the same sites when used by the general public. Costs for advertising in video games can range from $5,000 to $500,000. Advertisements can be subtle. For example, an Apple© computer may be used to receive the results of lab work as part of the storyline of the game. A murder victim in the "Law & Order: Justice is Served" game was about to sign a contract with fashion designer Lacoste (Abelson, 2005). Ultimately, access to these virtual worlds and MMEGs needs to be as low cost as possible for teachers to use. The best games proven to give students a good learning experience will not be used if they are not affordable for teachers who are working with small budgets. We will continue to expand on this topic later in this book.

Games encourage exploration, individual expression, and playful experimentation with social boundaries (Shaffer et al., 2005). They have the potential to change education as we know it both in distance education and in traditional education. Many people feel that the lines between a traditional classroom and virtual classroom will continue to blur until the difference is hard to distinguish. Virtual worlds can recreate a sense of community that has been lost in many courses moved from traditional classrooms to online instruction, as well as allowing students to experience things they may never be able to experience in real-life situations.

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Chapter 5
Serious Games, Simulations, and Case-Based Reasoning

The affordability of technically robust computers, the extensive availability of wireless online access, and the current high demand for distance education courses all make *now* the time to merge gaming technology with higher education science courses. *Why?* We argue that this format is both pedagogically significant and instructionally effective. Research indicates that today's students are expected to spend as many, if not more, hours engaging in simulated games than they are in formal face-to-face instruction (Foreman, 2003; Neal, 2003; Prensky, 2001; Rejeski, 2002). Based on the sheer success of gaming in general, it stands to reason that students may naturally gravitate toward this media. Abell and Lederman (2007, p. 85) state that "Motivation is an internal state that arouses, directs, and sustains students' behavior. The study of motivation by science education researchers attempts to explain why students strive for particular goals when learning . . ." Brophy (1988, pp. 205–206) defines *motivation to learn* as "a student's tendency to find academic activities meaningful and worthwhile and to try to derive the intended academic benefits from them." It can be argued that students' interest in gaming technology would likely segue into an eagerness to work within this environment. Therefore, this format is expected to provide intrinsic motivation encouraging learning. Extrinsic motivating factors, such as the potential for deeper learning and higher grade rewards combined with the expected intrinsic motivation may ultimately dictate the usefulness of such educational technology in the future.

So what are computer games and why are they so appealing? Overmars (2004a, p. 3) defines a *computer game* as "a software program in which one or more players make decisions through the control of game objects and resources, in pursuit of a goal." Not only do computer games provide specific goals, but good games also have clear rules and appropriate sub-goals (or levels) that once completed lead to the ultimate success of a player, or *winning* the game (Overmars, 2004a). Because the final task within a game is designed to be challenging, it typically builds upon previous learning obtained through the achievement of sub-goals. This design allows players a way to build their knowledge throughout the progression of a game, and to develop new skills within the game environment. Ultimate player success (i.e., "winning") requires the player to demonstrate a specific learning/skill level which allows them to achieve the ultimate goal. The sub-goal->ultimate goal design found in most computer games has several advantages. It allows the player to

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- *Obtain rewards based on achievements:*
  - To succeed in each sub-goal (or level) of a computer game, the player must demonstrate a specific knowledge/skill (i.e., achievement). The achievement varies among games and game types, but examples include attaining a specified score, demonstrating certain skill sets, or obtaining a specified object through the display of gained knowledge. The tools required to achieve such feats, as well as the reward, must be provided within the game at an appropriate level and at the appropriate time in order to engage the player. Unique and varied rewards may be provided at specific levels or sub-levels, based on gained knowledge/skill within the game.
- *Evaluation and repetition:*
  - A player's performance, i.e., success or failure, at each sub-goal allows an evaluation of their knowledge/skill at each level of the game. Since success at a lower level is required for players to move to higher levels, individuals may repeat a specific level multiple times. The immediacy of this evaluation and repetition offered in games is an excellent learning tool. It allows for each individual to spend the amount of time they need on a particular topic while keeping up the challenge of the task. Therefore, before winning most games, the player may have failed multiple times. Such high failure rates can be extremely productive. Because of the high probability of failure, players naturally focus on what they did wrong, what they could have done better, and how to get to the next level. In this way, failure is programmed into games as part of the process that leads to success.
- *Build upon previous knowledge:*
  - Games are typically designed so that skills or knowledge acquired at a lower level must be utilized in order for a player to move forward to a higher level. Therefore, as a player moves closer to the ultimate goal within a game they have built up an arsenal of knowledge and skills that can be utilized. Additionally, experience gained throughout the game should help the player determine how best to approach and obtain the ultimate goal.
- *Control their investment in the game:*
  - Players determine how much time and energy they spend on a particular portion of the game. For example, a player may wish to stop at a specific sub-goal or continue to progress further within the game. This format also creates logical start/stop points within the game, facilitating the player's ability to stop and continue within a specified game for long periods of time.

Therefore, within a computer game the developer creates an environment in which the player is challenged and rewarded, allowed to self-evaluate their performance and obtain results/feedback, as well as able to obtain definitive knowledge leading to ultimate success. Each of these gaming components can be directly applied to the instructional design of distance education higher education science courses. For example, students are expected to gain specific knowledge, demonstrate that knowledge, and develop higher level knowledge that is based on previously acquired knowledge. Through the educational process, student success is evaluated by performance in the form of assigned grades and feedback.

The course content for all higher education courses is determined by specific student learning outcomes provided for the course. Depending upon both institution and course specificity, student learning outcomes may be defined by either the college and/or the individual instructor. Regardless, in higher education courses, the instructor typically determines how and when the student will be presented with the material, and how and when student knowledge will be assessed. Student's failure or success on various assessments throughout the course is considered indicative of student learning. Therefore, not unlike players in video games, students in higher education science courses are asked to demonstrate/apply specified knowledge and ultimately achieve a particular goal based on performance.

Considering that the general principles guiding the development of computer games are well aligned with instructional design theory, it is not surprising that computer game technology has captured the attention of educators. Gaming formats blending both entertainment and learning have been dubbed *Serious Games*. These games have been designed as learning tools, typically focusing on one or several learning outcomes. Because the game goals are limited only by imagination and technology, unique educational opportunities in otherwise limited real-world research experiences can be provided through this format (Rikard, 2004).

Although the development of gaming scenarios by educators may first appear to be a daunting task, evidence is mounting that such a task can be reasonably completed at higher education institutions. Because video games encourage students to explore material in a proactive and exploratory nature, this learner-centered approach fosters the development of self-reliant learners, the type of learner that typically gravitates toward distance education instruction (Taradi, Taradii, Radic, & Pokrajac, 2005). Keeping in mind that Serious Games typically supplement online instruction rather than replace it, we explore how gaming technology may be appropriately applied to support distance education science courses in higher education.

Gee (2003) draws parallels between principles that make video games successful and those required for effective learning including the following: context appropriate information, appropriate challenge level, proper motivating factors, and predictability. Because effective learning should correlate with student success in online courses, success in the educational realm dictates analyzing the acquisition of knowledge. Educators widely refer to different levels of knowledge based on specified categories. We will discuss how each of the four major types of knowledge based on a taxonomy of learning outcomes (Anderson et al., 2001): factual, conceptual, procedural, and metacognitive can be achieved through this format. Summaries of these knowledge categories are listed below (Pintrich, 2002).

- *Factual Knowledge*
  - knowledge of terminology, specific details, and elements
- *Conceptual Knowledge*
  - knowledge of interrelationships among basic elements including classifications and categories, principles and generalizations, theories, models, and structures
- *Procedural Knowledge*
  - knowledge of subject-specific skills, techniques and methods, and criteria for determining when to use appropriate procedures
- *Metacognitive Knowledge*
  - Self-knowledge, strategic knowledge, and knowledge about cognitive tasks including appropriate contextual and conditional knowledge

This knowledge taxonomy includes both lower level knowledge, such as factual and conceptual, as well as higher level knowledge, including procedural and metacognitive knowledge. Gaming formats can be designed to incorporate each of these knowledge levels and offer opportunities to enhance higher level learning processes, such as strategic knowledge (classified as metacognitive), which may be difficult to incorporate into other teaching methods. Pintrich (2002, p. 220) defines *strategic knowledge* as "... knowledge of general strategies for learning, thinking, and problem solving." Multiple interactions, promoting various types of knowledge gains, and cumulating in higher level knowledge gain occur within gaming environments. Variations of learner interactions are controlled both by the game design and student choice, and potentially include learners interacting with computer-based agents, each other, and/or an instructor. The availability and format of such a set-up offers players the ability to repeat tasks, make new choices, and to vary collaboration within the platform. Each of these has the potential to enhance the learning process for the player and emphasize different knowledge categories. Bakas and Tassos (2003) demonstrated how 3D virtual environments can effectively challenge student misconceptions. This study used an outerspace 3D environment to address specific astronomical concepts appropriate for 11–13 year-old students. The goal of this exercise was to determine if the virtual environment helped enable students to "visualize" planetary movement (aiding in their understanding of this concept) as well as their understanding of other identified common misconceptions. Students engaged in this activity while "looking" through a "space ship" window within the environment. Bakas and Tassos (2003) found that after completing the exercise children indicated fewer misconceptions and in many cases replaced those misconceptions with scientifically valid explanations. Although this research example includes learners younger than our target population, the theory is expected to hold true for higher education students as well. The North Carolina State University Serious Educational Games research group has used a variety of case studies as the narrative/back story for video game design (Annetta et al., 2008). Initial results indicate that this format is a promising educational tool.

Dickey (2007) suggests that the narrative design of multiple small questions, or quests, typically found in Massively Multiplayer Online Role-Playing Games

(MMORPG) may provide a model for the effective presentation of specific learning tasks within an interactive learning environment. Dickey (2007) describes a MMORPG as a "persistent, networked, interactive, narrative environment in which players collaborate, strategize, plan, and interact with objects, resources and other players within a multimodal environment." Through the utilization of MMORPGs, students can communicate, interact, and work collaboratively with each other in real time. MMORPGs are designed to encourage, or even require, cooperative learning among individuals for player success, incorporating in player interactions as part of the game design. Therefore, multiplayer interactions and collaborations are an integral part of the game strategy. Therefore, these cooperative three dimensional online environments can easily segue into highly powerful educational virtual learning environments (VLE), which by nature may better prepare individuals for team-centered projects encountered in the workplace (Gee, 2003).

Dickey (2007) identified and categorized the small quest types typically found in MMORPGs and classified them based on knowledge domains required to complete each task. The ways knowledge domains correspond with the knowledge taxonomy previously discussed by Pintrich (2002) are outlined below.

- *Declarative Knowledge Domain:* consists of facts, data, concepts, and principles
  - Aligns with both the Factual and Conceptual Knowledge taxonomy
- *Procedural Knowledge Domain:* requires awareness of how to apply knowledge, principles, and experiences to new situations
  - Aligns with the Procedural Knowledge taxonomy
- *Strategic Knowledge Domain:* awareness of how to apply knowledge, principles, and experiences to new situations
  - Aligns with the Metacognitive Knowledge taxonomy
- *Metacognitive Knowledge:* involves reflection and self-awareness of cognition
  - Aligns with the Metacognitive Knowledge taxonomy

Dickey (2007) suggests that the narrative design of multiple small questions, or quests, typically found in MMORPGs (and Multi-Users Virtual Environments (MUVEs)) may provide a model for the effective presentation of specific learning tasks within an interactive learning environment. Within these environments Dickey (2007) identified and categorized types of specific player-initiated game components called *quests*, and sorted them into specific knowledge domains based on the type of knowledge required to complete each task (summarized below).

- *Declarative Knowledge Domain:*
  - Collection Quests: requires the collection of specific information/objects and/or the performance of a specific task a certain number of times
  - Goodwill Quests: requires teaching and/or assisting a peer (reinforces knowledge)

- *Procedural Knowledge Domain:*
  - Fed Ex Quests: requires player movement from/to particular areas to collect and/or manipulate items, then deliver them
  - Messenger Quests: requires player to pass information from one source to another in order to simulate or learn a process and recount the process
- *Strategic Knowledge:*
  - Bounty Quests: requires player to strategize against and defeat character(s)
  - Escort Quests: requires player to strategize on how to successfully transport a non-player character from place to place
- *Metacognitive Knowledge:*
  - Bounty Quests: requires player to strategize against and defeat character(s)
  - Escort Quests: requires player to strategize on how to successfully transport a non-player character from place to place
  - Goodwill Quests: requires teaching and/or assisting a peer

Through her analysis Dickey (2007) established a framework for identifying specific game elements and how they apply to hierarchal knowledge levels/cognitive skills. This framework has direct applications for the development and assessment of MUVEs. Currently, no widely accepted standards have been identified for analyzing the quality of, and effectiveness of, VLEs. Dickey's analysis (2007) emphasizes the overriding importance of designing the appropriate level of rewards within VLEs. Overmars (2004a) emphasizes how effective games require "flow" of the activities. The "flow" of a game depends upon the appropriate association between the increase in challenge level and the player's ability. Designing the appropriate level of rewards is an important motivator driving the "flow" of the game.

Lee, Hairston, Thames, Lawrence, and Herron (2002) emphasized the importance of appropriately matching skill level/rewards within VLEs for the maximization of both educational value and student satisfaction. In this study both biology and elementary education students were exposed to computer simulations within their respective courses. Students within both disciplines displayed generally positive attitudes toward the incorporation of computer simulations within the course. However, the biology students did not rank the computer simulation as a useful learning tool nearly as high as the elementary education students (40% vs. 85%). Although this specific discrepancy was not scrutinized on during this study, one possible explanation is the mismatch of knowledge/skill level among the participants. Overmars (2004b) highlighted the importance of properly matching the "gaming" expectations to student skill. The specific computer simulation used in this study appeared to have been more challenging for the elementary education students and therefore possibly more engaging and effective. The biology students within this study were in their second course of a two-semester biology series when completing the simulation. The education content of the simulation focused on hypothesis testing and study design, expectedly an easy task for the biology students at this level. It may be speculated that it was the mismatch between knowledge level or challenge and task that resulted in the large variations in the student's rankings for overall usefulness of the computer simulation rather than the presentation of the material which would account for the great variation in ranking between the two groups.

Problem-based learning (PBL) engages the student, assisting in their development of independent thinking. This learning-centered approach requires not only rote memorization but the application of course material requiring critical thinking and independent learning. The foundation of computer game design echoes these basic ideas of PBL, requiring the player to acquire skills to reach the ultimate goal. Case-Based Learning (CBL), or Case-Based Reasoning (CBR), is a type of PBL in which a fictional case is presented to the student in a narrative form. A case tells a story written from the first person perspective. Shulman (1992, p. 21) defined a *case* as a "... a set of events that unfolds over time in a particular place" (p. 21). The more realistic and relevant a case is, the more engaging it is likely to be to the student. Therefore, whenever possible, cases should reflect authentic problems and tasks modeling the real world. These characteristics make CBL the ideal framework from which to develop educational games.

Utilizing this technology, interactive materials and/or characters within the game can be designed to facilitate learning either individually or for multiple players. The idea of interactive discussions is central to most teaching and learning practices, and is foundational for CBL. Working through a gaming scenario allows the student to participate in active learning and depending upon specific game design may encourage collaborative learning.

Serious Educational Games group at North Carolina State University has demonstrated how the CBL design can be incorporated into the video game design (Annetta et al., 2008). It is a challenging process to try to take a case and recreate it into a game. Doing so requires flexibility and creativity on the part of the game designer(s), however initial results indicate that this format is a successful pedagogical tool. Although the efforts of this group are continually expanding in scope, current case-based studies include games created from a video, from an athletics scenario, from a filed trip experience and from training and development cases. A brief description of each design is listed below.

Designing a Game from a Video Case

A Racial Ethical Sensitivity Test (REST) is a video-based case in which work-related ethical issues associated with populations of culturally and linguistically diverse students were explored. Six principles common to all reviewed school-based professional codes were identified and included in the game including the following: professional competence, integrity, professional and scientific responsibility, respect for others' rights and dignity, concern for others' welfare, and social responsibility. Results of the REST had been validated as a reliable measure assessing ethical sensitivity to racial and gender intolerance in school situations according to the professional codes of ethics (Brabeck et al., 2000). Researchers at NCSU recreated the original REST information within a simulated virtual environment gaming platform. Five scenarios were constructed utilizing different educational settings. In each case the goal of the student was to identify acts of intolerance that signify ethically insensitive conduct in U.S. schools while acting as an educator.

Designing a Case for Athletics

This study, originally designed in Adobe Flash^{TM} with minor animation and audio clips, was recreated within the 3D virtual environment WolfDen. The case revolves around an athletic director, Dr. Morgan, who has decided to address the issue of Cardiopulmonary Resuscitation (CPR) and first aid training for his coaches and staff. After concerns raised in the NCAA about the growing number of student athletes who have either collapsed or died during practices, Dr. Morgan hires Tonya Spelling (the game player in this case) to coordinate his training initiative (Fig. 5.1). The player is expected to consider a number of issues including time constraints, negative attitudes, and mandatory versus voluntary training in order to analyze and design an appropriate training plan for the department.

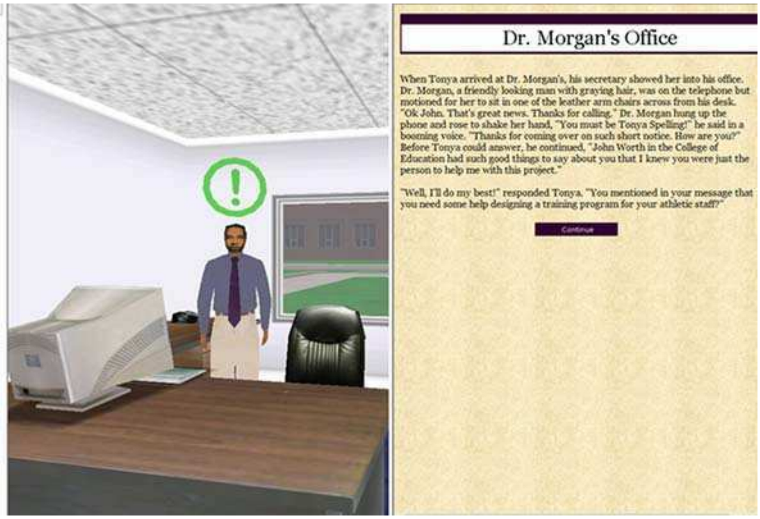

Fig. 5.1 Dr. Morgan provides information about the assignment and important background information

Designing a Case for Training and Development

A training case study was developed which was aimed at creating a consulting firm, Garden Supplies Incorporated (Fig. 5.2), within the 3D virtual environment Wolfden. With students playing the role of the consultants, they were provided with two primary business goals: (1) to increase sales by 25% through a solution-oriented

Fig. 5.2 Entering GSI

approach and (2) to improve customer satisfaction by 30%. In order to achieve the two primary business goals, they have to interview the best sales people and their managers, as a way of understanding how they became so successful. Using that information, the consulting firm would then train other sales people to optimize their performance.

Designing a Case from a Field Trip

The "Bug Farm" is a virtual fieldtrip that simulates the student experience of visiting a farm and creating an insect collection. Developed within the 3D format of *ActiveWorlds*©, this virtual experience acted as an online supplemental lab activity for a distance education entomology course taught at North Carolina State University. Students were directed to navigate various regions of the farm "capturing" various insects for their personal collection based on habitat preferences. Within the environment an interactive flashing icon represented the location of each individual insect species (Fig. 5.3). Clicking on these icons activated a split screen view linking to a specified resource file located on an online Web site maintained by the entomology professor. Specific information provided varied slightly among species but always included a photo(s) of the insect (sometimes at various stages), habitat/life cycle information, and taxonomic information. Prior to entering the farm, students were provided with a list of species to identify, a table to insert

Fig. 5.3 Interactive flashing icons indicating insect locations within the virtual farm

photographs of insects as they were collected, and supplemental information on how to navigate within the farm.

Although current literature supports the effective use of gaming technologies in instruction, few specifically describe how student learning is occurring during these experiences. Kiili (2007) proposed a model of student learning in Problem-Based Gaming (PBG) (Fig. 5.4).

This model is descriptive map of how learning occurs in PBGs. Note that player “reflection” dictates the progression of the player’s action within the game and is based on previous knowledge and prior experiences related to the game outcomes. Although reflection is often considered an individual activity, in Kiili’s model (2007) it may be either individual or may occur among multiplayer communications.

Simulations are closely related to, but unique from gaming platforms in that they are designed to virtually recreate a real-life experience for a student. Simulations, however, may utilize effective gaming components within their design. The U.S. military is one of the pioneers of simulation-based training. The free game *America’s Army*© was funded by the Department of Defense. Because simulations offer a “no risk” approach for individuals to practice and demonstrate responses representative of authentic experiences, they are particularly powerful tools for the engagement and assessment of procedural and metacognitive learning processes.

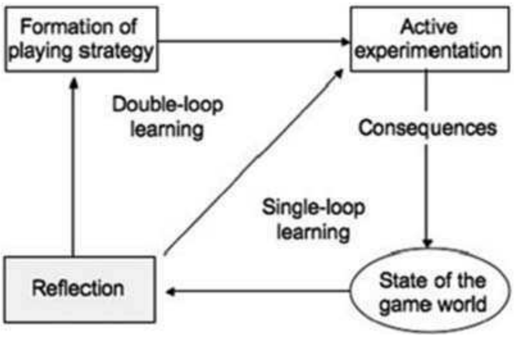

Fig. 5.4 Problem-Based Gaming model describes the learning process with games (reproduced by Kiili, 2007)

Simulations of laboratory procedures and experimental activities have been heralded as a possible solution to the online lab dilemma. The creation of computer simulations may offer a viable option for modeling in class activities virtually. Although valid objections to this type of instruction exist, future educational research should illuminate the pros and cons of such technology for student learning. Current arguments supporting computer simulations are based on the premise that they allow students the opportunity for lab-based experiences that may otherwise be impractical. Time, money, and equipment limitations are all constraints affecting seated traditional labs within higher education. As pointed out by Ma and Nickerson (2006) “Even hands-on laboratories are often mediated by computer, so that there is rarely a pure hands-on experience for students. Therefore, we may really be talking about relative degrees of hands-on, simulation, and remoteness.” (p. 14) Therefore, the role of simulations applies to both traditional and online science lab courses. However, online science labs by nature have additional challenges and limitations to their traditional counterparts including student availability and lack of access to the lab and technical lab equipment. Computer simulations may at least partially resolve these issues by providing students with virtual experiences, controlled by the student and modeled to recreate the traditional lab experience. An additional advantage to simulations is that they can be repeated allowing for risk-free learning. Hofstein and Lunetta (2004) highlighted this advantage by stating “When inquiry empowering technologies are properly used by teachers and students to gather and analyze data, students have more time to observe, to reflect, and to construct conceptual knowledge that underlies the laboratory experiences.” (p. 41) Additional learning benefits of computer simulations have been demonstrated. For example, individuals utilizing computer simulations demonstrated procedural knowledge gains and recalled information relevant to game progression, graphic images, and spoken text more accurately than when the same information was provided as printed text (Belanich, Wisher, & Orvis, 2004). When considering the use and benefits of computer simulations, it is important to clarify that simulations providing students with virtual experiences may, or may not, be followed up by actual laboratory. In other words, simulations may be used in conjunction to real-world experiences either as preparatory, enhancement, and/or reinforcement exercises.

Some higher education institutes have invested extensive time and money into the development of remote labs which utilize off-site maneuverability of on-site technology. One step closer to reality than a computer simulation, these specialized remote labs allow students to collect actual data while performing the experiment at a distance. Therefore, the creation and utilization of remote laboratories are determined, and restrained by, current laboratory and controlling technology. Although current technology limits the application of remote labs, other issues such as considerable time and money constraints to develop such labs may have the most impact on the future utilization of such an instructional method. A literature review on remote laboratories indicated that these problems as well as four major issues including reusability, interoperability, collaborativeness, and convergence with Learning Management Systems would require major commitments to overcome (Gravier, Fayolle, Bayard, Ates & Lardon, 2008).

Today's college students, dubbed the *Net Generation*, have grown up immersed within video gaming technology (Jones, 2002; Fromme, 2003). These individuals are nonplussed by the increased hardware and graphic capabilities of today's PCs and the use of such technologies. These students have come to expect the incorporation of current technology for educational purposes and they have effectively turned their PCs into very robust game-playing machines, particularly for the use of online multiplayer gaming. The success of these MMORPG, such as *EverQuest©, Lineage©*, and *World of WarCraft©*, which are played online by millions of individuals, is astounding and arguably speaks to the promise of harnessing such a format for educational purposes. If the same principles of instructional design are applied to the development of educational virtual environments, these formats may become a powerful pedagogical tool within distance education.

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Chapter 6
The Role of Synchronous Interactions Within Higher Education Distance Education Courses

Access to the Internet is increasing; not only in terms of who has it, but also in terms of what devices can navigate it. For example, today's mobile phones (a mainstay for college students) are used not only as a phone, but also as an externally available Web navigator. This trend, driven by the increasing demand to keep in touch and stay informed (aka being connected), is resulting in more possibilities for communication and information retrieval. Increased access is augmented by new developments in wireless technology and accessibility. Not only has this technology become increasingly available, but students are also expanding their use of this technology at an astounding rate.

The Internet, which at one time was primarily used by students as a search engine for information, has fractionalized into a social network web for this demographic. Therefore, the use of the Internet for these students has shifted from information gathering to information sharing through collaborative exchanges known as Web 2.0. A recent study indicated that 96% of students with online access were participating in social-networking technologies and more than half of these students were using them to discuss education-related topics (http://www.eschoolnews.com August 14, 2007). These numbers are not surprising in light of the overall exponential use of online social networks, such as *Facebook* and *MySpace*. These networks quickly developed into social communities as members meet, exchange ideas, and develop relationships online. This format encourages communication among members, either synchronously or asynchronously, and data sharing in a variety of contexts and formats including texting, photography, and videography. In fact, the utilization and exchange of material posted online have been so effective that individual safety and content control have been an issue raising concern at all education levels. Social network developers and campus Information Technologies (IT) are continually addressing these issues as they pertain to the use of online social networks.

While social networks were originally developed primarily for entertainment purposes, additional uses were envisioned and realized which were based on content specificity. *LinkedIn.com,* one such commercial site, emphasizes information sharing of work-related contextual materials/personnel. Commercial ventures have also focused on member and information control, addressing some issues associated

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with open data availability by creating secure social networks with directed member access. *Affinity Circles©* is an online social network consisting of a managing infrastructure that embeds private and banded social networks within its context. According to the Affinity Circles© Web site[1] (http://www.affinitycircles.com), "Affinity Circles© began in 2002 as a way for Stanford University students to stay in touch with their friends and colleagues. What quickly developed was the Web's first private and completely secure online social network". Affinity Circles members receive network-managed information, dubbed *member opportunities*, through specified categories. Categories include job opportunities, events, travel, groups, discounts/deals, donations, continuing education, and volunteers. Specified member information is used to personalize networking and each member belongs to a specific group of internal social networks within the database which is referred to as their *inCircle©*. Social networking and data sharing within this platform occurs in a multidirectional pattern. Three avenues of communication occur within an individual's inCircle© including the following: member <-> member, association <-> member, and employer <-> member (see Fig. 6.1).

Many Universities are now utilizing social networks in order to provide students with a specified online space that can be used to obtain both social and educational experiences. Some schools have purchased commercial social network rights, while other universities have developed their own social networking communities. Campus-based social networking sites offer a safe, convenient space for students to build ties with community members and experiment with developing a "public self." The University of Pennsylvania, for instance, offers incoming freshmen membership to "Pennster," its social-networking site, so that they can get to know

Fig. 6.1 Affinity Circles© inCircle© diagram

[1] Affinity Circles Web site – http://www.affinitycircles.com

their classmates before arriving on campus. These connections are the foundation to future peer opportunities in both school and work.

The popularity and success of the online social networks caught the eye of educators who realized that social networking might be a key way for schools to increase student access to, participation in, and success in distance education courses. In particular, the general appeal of this format, particularly with populations that are historically underrepresentation in science (women and minorities) was intriguing to educators. Historically female have been underrepresented in science. Despite current enrollment increases at colleges/universities, women and minorities are still poorly represented in the various fields of science (National Science Foundation, 2004). Even within university departments that enroll more women than men, the retention for women within these departments is low compared to white, male students. Additionally, women earn graduate degrees within science fields at a lower rate than males (Sible, Wilhelm, & Lederman, 2006). Because of this disparity, the female population is one of interest for science educators. Popular social networks such as *Doppelganger*©, *Gaia*©, and *Stardoll*© are specifically designed to target the preteen and teen female population. Stardoll© alone currently boasts over 7 million users and continues to grow, indicating the appeal of this format for females. The popularity and success of these female-targeted online social networks indicated the general interest in this type of online interactions may be universal and appealing to all students, even underrepresented groups such as females and minorities. Clearly social networking might be a key way for schools to increase student access to, participation in, and success in distance education courses. So in response various online professional communities have been developed for both training and educational purposes that utilize this design (http://www.eschoolnews.com June 13, 2007).

Elluminate© and Adobe Connect™ are two examples of online software systems that offer synchronous interactions. Participants using this software can "meet" virtually in real-time. These interactions are not limited to simple communications. Participants in these meetings have a variety of tools available including chat windows and VoIP. Instructional techniques available to moderators include, but are not limited to, the following uses: the white board for interactive sharing of information and drawing, shared viewing of prepared presentation materials, group selection among separate participants, polling among participants, and screen-sharing abilities. These are powerful tools that enable participants of these networks to engage in a variety of meaningful ways.

Although these social networks and online software systems are capable of providing meaningful exchanges utilizing online synchronous communication, they are two dimensional in the sense that they lack the spatial component found in online 3D virtual environments. These environments have long been utilized by the "gaming" community. Highly popular Massively Multiplayer Online Games (MMOG) that emphasize synchronous communication and collaboration include *EverQuest*©, *Lineage*©, and *World of WarCraft*© as mentioned in detail in Chapter 4. Like social networking platforms, these formats have expanded into 3D social networks used for purposes other than entertainment. Specific characteristics of these Virtual Learning

Environments (VLEs) that have made them appealing for both educational and training purposes include the following: the ability to maintain real-time communication among groups of individuals and the ability to create variable experiences within the environment by manipulating the types of interactions that occur. These characteristics, as well as the lure of creating innovative learner-centered activities, captured the attention of educators seeking a potentially powerful educational tool to support distance education instruction within the realm of higher education.

VLEs allow individuals, represented as self-selected avatars, to enter into specifically developed online environments. These environments are customizable and dynamic, offering new perspectives and opportunities for the exploration of online pedagogy. Once within the environment, students can work individually or in groups while communicating through the utilization of both text and Voice over IP technologies. In addition to student–student interactions, VLEs allow students to interact with built-in computer components designed within the virtual world. The VLE model provides the following three unique and sought-after characteristics potentially advantageous in online instruction.

1. *Time*: VLEs allow for real-time interactions and therefore provides opportunities for students to act, interact, and react with each other and their environment.
2. *Space*: VLEs offer a maneuverable environment in which individuals can interact with fellow students in a spatial, all be it a virtual, realm.
3. *Identity*: Students enter and maneuver within VLEs as movable digital beings. As avatars, students can move, express (wave, dance, etc.), and interact both spatially and socially with other students. Students can change their avatar and/or alter its actions based on the environment and/or their emotion.

Time, space, and identity as we define them are components typically lacking in asynchronous online instruction which dominate the student experience in some distance education formats. If the sheer popularity of these environments, as demonstrated by the large number of participants in popular 3D social networks such as *SecondLife©*, *ActiveWorlds©*, and *There©*, is an indicator of student enthusiasm for the use of this technology, then it appears that this generation is anxiously awaiting the utilization of this platform within higher education distance education programs.

One of the great advantages of all online networking systems is that they allow for synchronous interactions. *Synchronous* is defined as occurring or existing at the same time. Often synchronous interactions are associated only with traditional instruction and are assumed to be missing in distance education. However, today's technologies allow for real-time interactions, overcoming what was once perceived as a large barrier in previous online distance instruction.

While first generation higher education distance education courses were largely centered around computer-aided asynchronous instruction, current instructional design models typically include synchronous instruction in an effort to replicate the "in class" experience (Moore & Kearsley, 2005). Baggaley (2008) notes that "Distance education practices around the world use a wide range of audio-visual technologies to overcome the lack of direct contact between teachers and students"

(p. 39). The idea of "distributed learning" is based on the assumption that all students, on or off campus, should have the same treatment and experiences. Oblinger, Barone, and Hawkins (2001) argue that delivery methods for both cohorts should be equalized. We ask, *can* synchronous instruction help erode these differences and act as a great equalizer for distance education? In order to answer that question, we have to answer the following question, "Can online synchronous interactions provide the same experiences found in a traditional classroom?" Our response is "yes" assuming synchronous learning tools are designed and used properly. Although a variety of technologies currently available allow for real-time synchronous communication online, each varies in the degree of interaction occurring.

Within the social network's interactions described above, individuals can present information in a variety of ways: text-based, photographic, and through videos. Social networks, based on the VLE model, are more expansive in that they also allow for the representation of an individual through avatars, allow for vocalization via VoIP technology, create environmental emersion by the students, as well as allow for more expansive types of interaction within the environment than those offered in more traditional social networks.

In order to better identify and evaluate the student experiences in each type of social network, we address the varying levels of personalization amongst the different types of synchronous interactions occurring online. For example, we classify text chat (which is probably the most widely used type of synchronous interaction) as demonstrating a low level of personalization. This is not to say that texting can't be personalized or show expression. Students can utilize image icons for self-representation which may be used for increased individuality while participating in online text chats. Additionally, we recognize that individuals often express feelings or emotions through text, by typing ☹, ☺, LOL (which is used for "laugh out loud"), etc. In contrast, VoIP offers similar benefits to text chatting, however we consider this a more personal type of interaction because additional information, such as tone, inflection, and voice recognition, is available using this method of communication. It can be argued that the most personal types of online interactions are available with the use of VLEs which allow individuals to appear as mobile avatars, capable of maneuvering the environment within a designed virtual space, and interacting directly with the environment or other individuals. We believe this type of interaction creates a sense of immersion that is not found within most social networking platforms or other synchronous platforms. Within VLEs, students have conscious control over their actions, interactions, and decisions within the environment affording them a unique sense of presence identity, and personalized individuality (Annetta, 2007).

Traditional instruction, as it is typically found in higher education, occurs on campus at a specific time and place. Most often instruction occurs in a lecture format which includes the presentation of material by an instructor to the students as a group. The idea that learning occurs only within these confounds is becoming obsolete. In an effort to vary teaching techniques, expand learning, and increase availability of course materials, higher education faculty have often developed online tutorials and video-clips which are provided asynchronously. Whether intended as class supplements, or as major components of distance education courses, these asynchronous materials are not received by the students in the same manner as synchronous interactions. However, if professionally prepared, this asynchronous material provides a similar experience to what a student would experience if presented with the same material in a traditional classroom setting. We argue that a variety of complex interactions occur within the classroom that contribute to the learning experience. We propose that online synchronous instruction may potentially provide more similar interactions and experiences to the traditional classroom settings which are lacking from asynchronous online interactions. Therefore, the synchronous presentation of online instructional material may potentially act as an "equalizer" in distance education by more closely replicating the traditional classroom experiences for the student.

We'll start this argument by identifying the different types of interpersonal interactions that occur in a traditional classroom, and then address how each of these can be modeled through synchronous online interaction. The **instructor -> group** interaction model is best represented by a typical classroom lecture. In fact, a majority of higher educational courses are taught almost solely within this mode of interaction. **Instructor -> student** interactions occur as an instructor engages a student either through inquiry or instructional direction. This interaction in reverse, **student -> instructor**, occurs when a student asks a question, seeks clarification, or provides feedback. **Student->Group** interactions occur as a student addresses or directs information to the group. An example of this type of interaction within a classroom would be a student presentation.

Student -> student interactions also occur within classroom. Whether for social or academic reasons, students do communicate within class and this communication represents a part of the whole classroom experience to the students. In fact, many combinations of social interactions would occur in a conventional classroom. Figure 6.2 below outlines these interactions.

Each of these synchronous interactions can be modeled online. Possibly the easiest to replicate, and the most used in traditional instruction, is the **instructor-> group** interaction. Variable technology allows instructors to lecture online to groups of students in real time and some of these technologies, such as *Elluminate Live!*© or *Adobe Connection*™ provide for each of the other additional interactions to occur as well. For example, an instructor lecturing in Elluminate Live!© can receive questions from students (**student->instructor**) and address those questions (**instructor->student**). These instructor-mediated interactions provide distance education students with much needed feedback and support. Gao (2004) noted that timely instructor feedback provided motivation for active learning by students in distance education courses. Moore (2002) concluded that both instructor-led interactions as well as timely feedback were positively related to student satisfaction within distance education courses. Instructors may also utilize technology to assign groups in which students work together on tasks (**student->student**). Additional spontaneous peer interactions may occur through the adopted use of this technology. LaPointe and Gunawardena (2004) demonstrated the positive relationship between

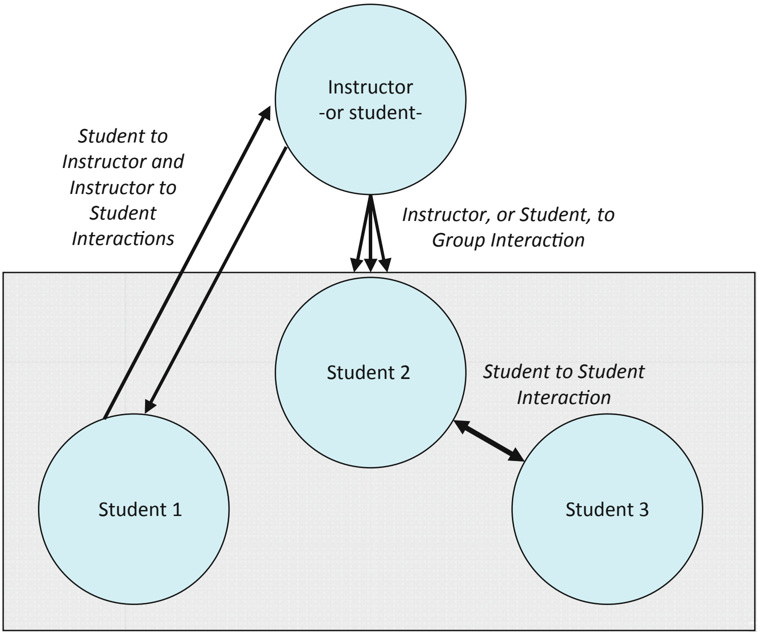

Fig. 6.2 Model of classroom interactions

peer interactions and learning outcomes in distance education courses. These environments also allow students to present material utilizing both VoIP and white board technologies (**student->group**). Each of these interactions also occurs with ease through the utilization of VLEs. While online synchronous instruction may require more planning to facilitate such interactions (New Practioner's Forum – Teaching in a distance education program volume 65, May 15, 2008), each type of interaction can now be achieved online.

We note that *interaction* does not directly equate into *presence*, in fact we acknowledge that they are very different ideas. While an interaction requires student involvement, it does not dictate how the student feels about that interaction or what their perception is of a specified interaction. So why do we care about interaction? Chang and Smith (2008, p. 412) stated it eloquently "... lack of interaction makes learning boring and difficult". It can be that simple. Humans need interaction and interaction is one indicator of learning.

Interaction is the first step in a student's sense of presence. A sense of presence involves a sense of belonging to the group and implies that vested interest occurs on the part of the individual. We do however propose that synchronous instructions provide for an increase in the quantity and quality of interactions. Logically, the more interactions that occur within the synchronous environment, the more likely a student is to feel a sense of self-presence within the course. Zhoa, Lei, Yan, Laie, & Tan

(2005) demonstrate that personal interaction plays a large role in learning via distance education. Rovai (2002) demonstrated that students self-identify within online courses correlated with a students' sense of social presence or belonging. Annetta and Holmes (2006) identified student personalization in the form of avatar selection as an important component of student self-identity and presence, both of which are strongly correlated with student satisfaction and enhanced student engagement and performance within virtual learning environments (Tu & McIsaac, 2002; Richardson & Swan, 2003). This plays an important role in online education because synchronous interaction and a student's sense of presence (i.e., belonging, individuality, etc.) have been identified as the two most important indicators related to learning in distance education courses (Annetta & Shymansky, 2006). If used appropriately, the online synchronous delivery of course materials may enhance learning by emphasizing the social and educational rewards associated with the variability of online interactions.

In addition to providing a variety of interactions for the students, VLEs provide engaging formats for active learning. Gee (2008, p. 23) states that "Good learning requires participation-however vicarious-in some social group that helps learners understand and make sense of their experience in certain ways. It helps them understand the nature and the purpose of the goals, interpretations, practices, explanations, debriefing, and feedback that are integral to learning". Through the VLE format, students have the potential to support constructivist, problem-based learning. Collaboration allows students to develop, test, and resolve educational theories. Collaboration plays a major role in implementing constructivist learning within distance education courses. Annetta et al. (2006) demonstrated how the collaboration and interactivity within multiplayer educational gaming applications (MEGAs) can support the constructivist paradigm. Specifically this platform, if designed properly, can link experiential learning and information representation. The MEGA environment achieves this through the creation of a sense of presence, the presentation of teambuilding activities, and the application of problem-based learning theory. Problem-based learning engages the student and makes learning more fun. Additionally, it helps students develop independent thinking and apply course material while practicing critical thinking and independent learning.

Online multiplayer games are designed to encourage, or even require, cooperative learning among individuals for player success. The popular MMOG EverQuest©, like other similar games, has built-in player interactions as part of the game design. Therefore, multiplayer interactions and collaboration are an integral part of the game strategy. Gee (2003) argues that the collaborative nature of massive multiplayer games may better prepare individuals for team-centered projects encountered in the workplace. Therefore, by following a *learner-centered design* (LCD) rooted in constructivist theory (Soloway, Guzdial, & Hay 1994), VLEs can utilize these educational principles by acting as a social network as well as offering game-like learning experiences. Gee (2003) draws parallels between principles that make video games successful and those required for effective learning. The principles apply to VLE design and are as follows: (1) Context appropriate information provided; (2) Appropriate challenge level; and (3) Motivating factors and predictability.

Dickey (2007) suggests that the narrative design of multiple small questions, or quests, typically found within these games may provide a model for the effective presentation of specific learning tasks within an interactive learning environment. Not only does current research support the educational benefits of such an environment, it also suggests that this is a format that students are familiar with and predicts that many students will spend more hours engaged with simulated games than would with traditional lecture material (Foreman, 2003; Neal, 2003; Prensky, 2001; Rejeski, 2002). It is not surprising then that educators have identified this technology as a promising pedagogical delivery system for the presentation of learning materials.

Simulations are computer-based models used to immolate real events. Simulations may utilize VLE technologies to accomplish this goal. The U.S. military uses simulations for training purposes and has funded the free mainstream virtual game, *America's Army*© as a recruiting tool, as mentioned in Chapter 5. Simulations within VLEs allow for the development of unique environments that model situations that may be too costly or dangerous to develop in real life. These detailed environments can be used to highlight use of specific equipment training as well as allow the risk-free processing of information by students/employees. Within these VLEs, individuals have conscious control over their actions, choosing to interact with specific components within the environment and/or other students. These decisions can contribute to an individual's sense of presence within the environment (Annetta, 2007). These environments therefore may allow students the ability to learn procedures, techniques, and consequences while allowing for repetition and knowledge acquisition. Knowledge levels can be set within the environment allowing for stepwise learning. For example, a science student may be directed to learn a procedure on how to take samples. By successfully completing such a challenge within the environment, the student could then be directed to the next challenge, for example the running of the acquired sample utilizing the simulation of specialized laboratory equipment. This type of learner-centered approach could enhance students understanding of, and preparation for, complex procedures. Additionally, these environments may act as a replacement for, or prelude to, an actual scientific research experience depending upon the appropriate learning objectives designed within the course. This technology may allow students to complete scientific research that may be otherwise unavailable to them and would play a role in providing realistic, valuable online experiences for distance education learners.

Trindade (2005) demonstrated a positive correlation between conceptual comprehension and 3D modeling through computer animations in college-level physics and chemistry courses. *Virtual Water*, a 3D virtual environment, was designed to immerse students into the microscopic structure of water allowing for the student-driven exploration and evaluation of concepts related to water phases and transitions. Specifically, 3D perceptions and student interactivity were identified as the most important factors related to learning. In addition to learning gains, students demonstrated increased motivation for studying and increased interest in the theory behind the scientific principles modeled when using this VLE (Trindade, 2005). Cooper, Donnelly, and Ferreira (2002) reported that students could remotely complete real-life laboratory experiments via the Web. These experiments, although costly and time-consuming, may not be a viable option for most schools, however they demonstrate the possible direction of future distance education instruction in the field of science.

The fact that VLE provides effective real-time synchronous communication that allows for the inclusion of multiple individuals strongly enhances effective pedagogy of this platform for distance education. Current literature cited demonstrates how and why these components make VLEs a promising online synchronous teaching platform within higher education. Students' perceptions of educational online experiences are analogous to their satisfaction with other media presentations, such as movies. Comparatively, the asynchronous format found in many current online educational courses is equivalent to watching the 1970s version of *Superman* with its lackluster special effects. Contrast this movie-going experience with the viewing of the 2007 version of *Superman Returns* with thrilling, cutting edge special effects. In this scenario, VLEs are the online educational equivalent to the current *Superman Returns* movie-going experience. It is no wonder then that student's experiences with most online course content, which is typically asynchronous in nature, leaves them feeling disengaged and/or unimpressed. The proper development and use of VLEs within higher education has the potential to change that.

Once regarded by some as a trend, distance education is now considered a mission for many higher education institutions. Howell, Williams, and Lindsay (2003) painted a picture of the future for distance education in the following statement: "Student enrollments are growing to surpass the capacity of traditional infrastructures, learner profiles are changing, and students are shopping for education that meets their needs" (p. 13). We propose that the simple adoption of synchronous instruction within distance education courses has the potential to aid learning in a variety of ways. By allowing students a sense of presence and the establishment of a collective unity within the course, synchronous interactions facilitate learning. Studies have indicated that both student isolation and student distress are associated with both lack of technical support and lack of clear direction and communication with the instruction (Hara & Kling, 2001). The inclusion of increased synchronous interactions within distance education courses may provide clarity and help alleviate some of these issues (Hara & King 2001). By allowing for these synchronous interactions within the context of accountability, by both the instructor and students, student immersion, engagement, and learning may be increased. Other benefits may include a heightened sense of belonging by the student to the learning community as a whole, encouraged collaboration within the course, and possible increased time on task and better time management by the student. If these benefits come to fruition, as we will demonstrate in this book, they may help counterbalance some factors, such as poor time management and feelings of isolation, that have been identified as obstacles by distance education students which are often associated with high student attrition rates within distance education courses (O'Connor, Sceiford, Wang, & Foucard-Szocki, 2003). Additionally, student utilization of this format may facilitate peer support and may contribute to an increased overall satisfaction with the presentation of distance education material.

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Chapter 7
Presence, Identity, Self-Representation, and Perspective Taking Within Virtual Online Courses

Effective synchronous instruction over the Internet has been the quest of researchers and practitioners for some time. As technology advances and students become increasingly more technologically savvy, Virtual Learning Environments are becoming a viable vehicle for distance instruction. Synchronous learning environments provide rich opportunity for building learning communities and Virtual Learning Environments allow students a sense of presence within their class.

Annetta and Holmes (2006) discussed some original findings on avatar choice and how it correlated with identity. This chapter will revisit those findings and report on how the technology has changed and allowed us more flexibility in discovering the potential value of avatars in online learning. Many studies have suggested positive outcomes with avatar use in video games and multi-user online environments. Avatars potentially build and sustain group commitment through expression of feelings such as salutations using a person's name and/or referring to the group as "we" (Rourke, Anderson, Garrison, & Archer, 1999). Richardson and Swan (2003) suggested that avatars provide individual students a sense of being. In addition, students with high overall perceptions of social presence scored high in terms of perceived learning and perceived satisfaction with the instructor. Annetta and Holmes (2006) conducted an explanatory case study about the use of avatars in a synchronous online science education course where we investigated presence and building community. Two cohorts of students were analyzed to ascertain individual emotions of presence in a virtual learning environment. Data were collected through class observations, written server side bots (a record of avatar changes and conversations), and interviews at the conclusion of the course. Case I was given the choice of 100 different avatars ranging from human to abstract objects such as a motorcycle, helicopter, or animal. Case II was given two choices, a male or female depicted as a tourist. Data from both cohorts showed students preferred to have a variety of avatars, especially the functionally different avatars presented. Responses from Case II expressed a lack of individuality and subsequently presence. The technology of Collaborative Virtual Environment (CVE) aims to transform today's computer networks into navigable and populated 3D spaces that support collaborative work and social play. CVEs are virtual worlds shared by participants across a computer network. Our work falls under the umbrella of CVEs. Benford, Greenhalgh, Rodden, and Pycock

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(2001) suggested that avatars convey identity, presence, location, and activities to others. They are able to use these avatars to interact with contents of the world and to communicate with one another using different media including audio, video, graphical gestures, and texts.

As Gunawardena and Zittle (1997) reported, social presence is a strong predictor of satisfaction with computer-mediated communication. For students to feel an online course is a worthwhile experience, they need to feel as if they were part of the big picture, the community. Moreover, students need to see and hear others, even if the other students are avatars and that they are different from others in the class (Annetta & Holmes, 2006). This visualization creates a positive cognitive dissonance where the student struggles with reality and virtual reality. A struggle such as this seems to open cognitive channels (discussed more in depth in Chapter 9) that online learning has not yet seen. Eventually the mind decides the virtual world is the real world, even if it is not completely convinced, and one's sense of presence is heightened.

Presence and Personality

Fundamentally, presence is a product of two factors: (1) "arrival," or the sense of being in the virtual environment, and (2) "departure," or the sense of not being in a virtual environment. "Arrival," or involvement in a virtual environment, is thought to occur when one focuses energy and attention on a coherent set of stimuli or meaningfully related activities and events, presented in the virtual world. This would suggest that increasing the focus of one's attention on events portrayed in a virtual environment enhances involvement, thereby increasing presence (Kinm & Biocca, 1997).

Immersion, whether physiological or psychological in nature, is intended to instill a sense of belief that one has left the real world and is now "present" in the virtual environment. This notion of "presence" has been considered central to virtual environments since its conception (Minsky, 1980). Barfield and Hendrix (1995) contrasted virtual presence to real world presence and defined virtual presence as the extent to which participants believe they are somewhere different than their actual physical location while experiencing a computer-generated simulation. Is that not what we are hoping for online? If you answered no to that question you may re-think your answer at the end of this chapter.

Garrison and Anderson (2003) defined social presence as "the ability of participants in a community of inquiry to project themselves socially and emotionally, as real people through the medium of communication being used." In the context of online learning, social presence has been associated with enhanced online social interaction (Tu & McIsaac, 2002). Interestingly enough, workforce development needs (i.e., 21st Century Skills) requires avenues for communication and teamwork. The ability to work collaboratively is at the heart of social presence theory. The premise of "social presence" is that if other people (i.e., representative avatars in our case) reside in a virtual learning environment, then there is more evidence that the virtual environment really exists (e.g., cognitive dissonance). Correspondingly, if other persons in a virtual environment essentially acknowledge one's presence in that environment, then it offers further affirmation that one actually "exists" in that environment (Sadowski & Stanney, 2002). This early work suggested that intimacy and immediacy also enhance social presence.

Social presence is also seen to influence not only online activities generally designated as group projects, but also those usually designated as individual projects (Richardson & Swan, 2003). Building upon our work in 3D virtual learning environments, Shawn Holmes and I (2006) studied the link between personality and presence in 3D online worlds. Seventeen undergraduates in their senior year participated in the study as part of a senior seminar class in science education. The class, held in the *Wolfden* (the name I gave to the VLE), was designed as an open communication forum with scaffolded discussion threads facilitated by the instructor. Before the first class, each student took a Jung-Myers-Briggs (JMB) personality test.[1] Each student was asked to respond to their individual JMB test as confirmation of the results. Surprisingly, each of the 17 students confirmed that their JMB results were not in line with their self-perceived personality. The students were given a choice of 100 avatars from which to choose during the course of the semester. The students could change avatars at any time so long as they noted the name of the avatar in which they chose to represent them in the *Wolfden*.

During the final class, the students were asked to share the avatar(s) they chose during the semester and why they chose it. These responses were recorded and compared to the JMB test from the first class. Results of the study were enlightening. Following a double-blind review process to insure inter-rate reliability, it was concluded that there is not a very strong relationship between results from the JMB personality test and the avatars chosen. Based on student responses, results from our studies were confirmed in that avatar choice depended more on how a student felt in a particular class or how they felt emotionally on a particular day rather than their overall personality or at least as it was suggested by the JMB result. It is also important to note that there was not a strong relationship between individual results on the JMB and what students predicted their personality would be prior to taking the test. Most students disagreed with the results of the JMB, which might explain why there was not a relationship between personality and avatar choice in a 3D VLE.

Three-dimensional worlds allow participants to become immersed in the environment and its contents, individuality in respect to the other students in a class, and a belonging to a community of learners. To insure participants are psychologically experiencing what the target experience was meant to be, social psychologists must produce an affective experimental illusion to affect their participants' capacities in attention, motivation, and imagination. Hoyt, Blascovich, and Swinth (2003) replicated the classic social facilitation/inhibition effects where individuals' performance on a task is affected by the presence of others using computer-controlled agents and human-controlled avatars. Results suggested participants mastered one of two tasks

[1] http://www.humanmetrics.com/cgi-win/JTypes2.asp

and subsequently performed the mastered or non-mastered task either alone or in the presence of a virtual human audience whom they were led to believe were either computer-controlled agents or human-controlled avatars. Those performing in the presence of avatars demonstrated classic social inhibition performance impairment effects relative to those performing alone or in the presence of computer-controlled agents. The results gave the social psychologists greater confidence that a VLE can be implemented successfully for collaboration, training, and education because the interactions seem to be governed by similar social dynamics such as face-to-face (FtF) interactions. The results of Hoyt, Blascovich, and Swinth (2003) and our studies confirm that 3D VLEs are as close as humans have gotten to replicating traditional face-to-face instruction (from a psychological perspective) at a distance.

One could argue that Videoconferencing or new classroom management software such as *Elluminate*® provides a platform for real synchronous face-to-face instruction. However, 3D VLEs provide a cognitive framework for replicating a traditional classroom in that students are always "on screen" (i.e., visible to the instructor and their peers) and cannot readily take a passive role in learning. From our work we see the introverted student who is generally not participatory in face-to-face classrooms seems to come out of his or her shells in these environments.

In light of the findings in a study by Jones (2002), for most college students the Internet has enhanced their education. It has changed the way they interact with friends, classmates, professors, and information. Considering Katz's (2005) report on the implications of networking in higher education, which claims an increase in virtuality, mobility, and community in the universities, interactions on the Web will become an expression of virtual portals and avatars. Chepya (2005) distinguishes "presence learning" from "distance learning" to explain his online pedagogical technique. Presence learning is a connection between the instructor and student that is tangible as the student is engaged in the online class. As the instructor overcomes invisibility and becomes a participant in the lectures and discussions, a shared memory of incidents and events are formed. Such elements as companionability and presence, once thought unattainable on the Internet can be achieved successfully through a fusion of technology and pedagogical technique thus building a virtual community. Thought must be given to the aesthetics of online pedagogy and a shift from each and every trick used in front of a physical class to presenting it "in front of" an online class (Chepya, 2005).

From preschool through college, students interact in a social environment in which a teacher is present directing them toward a common goal. Online education courses need to juxtapose making students feel as if they are part of the whole and that they are individuals. This is not unlike a well-designed face-to-face class. Students with a sense of presence will have a greater degree of satisfaction with the course. As our work suggests, individuality in an online course can be achieved by giving students many avatar choices. The data suggest students chose avatars based on either the avatar function in the class assignment (i.e., flying jumping, gestures, etc.), or more commonly by how the avatar affected the students as individuals. Avatar choices can reflect the student's gender, ethnicity, and personality or the desire to change as their mood changes. Knowing how a student feels by observing avatar choices helps the instructor incorporate factors that are correlated to building a sense of community in the course.

Social presence is also seen to influence not only online activities generally designated as group projects, but also those usually designated as individual projects (Richardson & Swan, 2003). In addition, students with high overall perceptions of social presence scored high in terms of perceived learning and perceived satisfaction with the instructor (Richardson & Swan, 2003).

This idea relates to the process of perspective taking. Dewey's methodology from the early 1930s is employed by Selman (1977) in his five-step perspective taking approach: 1. Defining the problem; 2. Considering the feelings of others involved; 3. Brainstorming alternative ways to solve the dilemma; 4. Choosing a course of action; and 5. Evaluating the probable outcome. Finally, culturally relevant pedagogy (Ladson-Billings, 1995), analogous to culturally responsive teaching (Gay, 2002; Villegas & Lucas, 2002), is related to student experience – all students achieve academic success, maintain or develop cultural awareness, and are prepared for active participation in a democratic society. Conceptually, perspective taking includes empathy to the degree that one must take into account the perspective of the other, at least what the other is experiencing, to project possible consequences of one's actions. Of course, one can take the perspective of the other without being empathetic to the consequences of one's actions.

Stimulating Perspective Taking Through Cognitive Conflict

Perspective taking provides the opportunity to consider the viewpoints of others and induce cognitive conflict. This type of growth and recognition of self does not happen in isolation. It occurs through the cognitive development of social interactions and/or moral experiences challenging conflict between thought and behavior, resulting in more sophisticated, consistent, and comprehensive perspective taking behavior (Hall & Bishop, 2001; Selman, 1977). Through social games and social and moral dilemmas, Selman and Byrne (1974) identified four developmental levels of social perspective taking. The levels are age-related in a form similar to Piaget's cognitive operations. They are logically related structures that individuals display when understanding another's point of view: level 0 – no differentiation of points of view; level 1 – unable to maintain own perspective and put oneself in the place of another, nor able to judge own actions from another's point of view, yet understands subjectivity; level 2 – able to reflect on own behavior from another's point of view, recognizes others can place themselves in his/her shoes, however reflections do not occur simultaneously; level 3 – able to reflect on each point of view simultaneously, consider a situation from another perspective, and put his/herself in another's shoes before deciding how to act.

Perspective taking levels are basic structures of social reasoning and are used in content areas such as interpersonal relations, moral reasoning, social problem solving, and communication skills. Imagine a situation where you are teaching ethical sensitivity and racial tolerance. You can have white students take on an avatar that is black and ask them to participate in a world where they are not treated as part of the group. The student in this case gets the real sense of what someone from another race feels when not included. This is another example of how avatars in 3D worlds can provide unique situations above and beyond what we can replicate in the real world. This is in alignment with the five-step sequence outlined in the practice-oriented Icelandic Project by Adalbjarnardottir (Selman, 2003) which lead discourse about social conflicts. This approach is designed along the lines of a three-step approach first suggested by John Dewey in the early 1930s. Both approaches were employed by Selman (2003) as a pedagogical practice for social conflicts. In brief, social conflicts are approached by the following: defining the problem, considering the feelings of others involved, brainstorming alternative ways to solve the dilemma, choosing a course of action, and evaluating the probable outcome. This implies that intervention research should aim to stimulate perspective taking through content areas of social reasoning (Selman, 1977).

Professionals are generally seen by society as having a specialized body of knowledge. They base their practice on that body of knowledge that is beyond the reach of lay people (Furlong, Barton, Miles, Whiting, & Whitty, 2001). The development of knowledge-based skills may take long periods and sections of time that may occur within higher education institutions. Related to knowledge-based skills is the notion of autonomy because professionals use their judgment in uncertain situations rather than routine situations. These judgments are made on behalf of their clients, patients, or students, as seen by the professional. Exercising this judgment requires values, which it can be argued are no obvious forms of training (Furlong, Barton, Miles, Whiting, & Whitty, 2001). Rule and Bebeau (2005) state young professionals start their careers not fully understanding the exact nature of the "roles and responsibilities of the professional" (p. 55). However, Bebeau has been successful using professional codes of ethics and cause/effect awareness to measure and develop ethical sensitivity in dental professionals.

This takes effort and may increase the unwanted thought, whereas perspective taking allows the teacher to lower the level of stereotypic accessibility by remaining present in the interaction. Galinsky and Moskowitz (2000) suggest alternative strategies such as active consideration of others' viewpoints, framings, hypotheses, and perspective taking can be used to decrease stereotypic thoughts.

Considering others' viewpoints is simply what is known as empathy. The degree of Empathy is the amount of perspective taken. The more an environment can stimulate empathy for other students and/or animated characters or agents in the virtual space, the greater perspective a student will have in that environment.

A Stanford University study about interactive characters suggests substantial opportunities for them to enhance online experiences. This is because computer-generated actions of avatars can replace human-controlled avatars and provide activities that are scalable and replicable. The major findings of this study suggest that human–media interactions are fundamentally social and that character interfaces bring social intelligence to online interactions. Further, the benefits of character interfaces are as follows:

1. Characters make explicit the social responses that are inevitable
2. Interactive characters are perceived as real social actors
3. Interactivity increases the perceived realism and effectiveness of characters
4. Interactive characters increase trust in information sources
5. Characters have personalities that can represent brands
6. Characters can communicate social roles
7. Characters can effectively express and regulate emotions
8. Characters can effectively display important social manners
9. Characters can make interfaces easier to use
10. Characters are well liked

Many studies address social relationships in online education. Mama (2001) compared students' attitudes regarding a site-based and a Web-based class (with three face-to-face meetings). It was found that the students in the Web-based class felt it was more personal than traditional, face-to-face courses. Swan (2001) reported that students perceived online discussions as more equitable and more democratic than traditional classroom discussions, and that there was a positive relationship between levels of interaction among students and student satisfaction in the course.

Richardson and Swan (2003) indicated that social presence was positively correlated with students' perceived learning. Students learned course material, and found that efficacy is clearly an indicator of learning. Many other studies claim to have found a positive correlation between social presence and student's perceptions of their learning (Christophel, 1990; Richardson and Swan, 2003). There is also evidence supporting the level of students' perceptions of social presence in their courses and higher results on learning measures (Picciano, 2002). Schutte (1997) found that students in the online course perceived a greater amount of peer contact than traditional, face-to-face students and also earned significantly higher grades than their traditional student counterparts. Rodriguez, Plax, and Kearney (1996) reported that teacher immediacy behaviors influenced students' affective learning, and ultimately influenced students' cognitive learning.

Building communities of practice or professional learning communities is becoming popular once again in educational research. Before exploring the possible connection between social presence and community, it is helpful to understand what is meant by community. Researchers do not always provide a definition of community or an explanation of the link between social presence, community, and learning (Jones, 1995; Gunawardena, 1995; Rourke et al., 1999; Reid, 1995; Swan, 2002; Tu & McIsaac, 2002). Brueggemann (2002) describes community as shared experiences in which both individual and group needs are met, and holds that community can be linked to a place and time but can also transcend them. Rovai (2002) sees community as a group of individual members of formal and informal organizations, interacting and connecting with each other. With this understanding of community, the link between social presence and community can be further explored. Wise, Chang, Duffy, and del Valle (2004) state that the concepts of social presence and community both transmit the sense of relating and caring among participants.

Gunawardena (1995) asserts that "The development of social presence and a sense of online community becomes key to promoting collaborative learning and knowledge building" (p. 164). She believes that collaborative learning is possible only if participants have social presence, a sense of community, and a common goal. Rovai (2002) evaluated online and traditional classes of 14 professors, finding that certain online classes had significantly higher ratings from students on feelings of community in the classroom. He asserts that the method of teaching, not the environment for delivering the course, is what influences feelings of community. This is an important reference because although this book focuses on 3D virtual learning environments, we are not promoting technology over good teaching. Technology is simply the tool that provides the instructor with the ability to be the most effective one can be.

Wegerif (1998) found that students who felt more like insiders in the learning community were more likely to achieve success. Learning takes place in a social environment, and cognitive understanding and personal construction of knowledge depend on relations with others (Fung, 2004; Richardson & Swan, 2003; Vygotsky, 1978). Creating a safe environment for a learning community in class allows students to take risks and collaborate in an authentic manner (Bonk & Cunningham, 1998). Wegerif (1998) contends that it is essential for students to feel that they are members of a community in order to collaborate and learn, and that computer-mediated communication can provide support for the development of feelings of community.

Synchronicity can be valuable for virtual communities provided that members actually take advantage of the synchronous technology design by interacting (Blanchard, 2004). Chepya (2005) suggests the instructor must "be there" and create a "there" that is palpable to everyone. When Internet communication works, the medium becomes a place, as a physical classroom is a place. The learning environment is shared rather than didactic in nature. This notion of being there can meld into what is known as immersion. *Immersion*, as we are defining it, is embedding students inside lifelike problem-solving situations where characters are investigating simulated scenarios, situations, and collaborations that are not possible in a classroom setting (Dede, 2005).

According to Dewey (1916), the difference between play and what is regarded as serious employment should not be a difference between the presence and absence of imagination, but a difference in the materials with which imagination is occupied. A well-defined and constructed virtual environment should elicit this idea. Adding depth and breadth to the general aggression model, Eastin (2006) presented three experiments that test the relationships among user and opponent gender representation, opponent type, presence, and aggressive thoughts from violent video game play. It is important to note that the environments we discuss in this book are not necessarily video games but to make them immersive, the components of good video games could be employed. Eastin suggested that females experience greater presence and more aggressive thoughts from game play when a gender match between self and game character exists. Further, when playing against a human opponent (rather than a computer), aggressive thoughts increase. Finally, playing as a male against a female opponent consistently and significantly decreases aggressive thoughts. This is where a fine line between play, immersion, and presence takes hold. If these environments are constructed in a similar manner in which we have used them, then we need to be sure males and females play equally participatory roles. If not, then the environment becomes deindividualized.

Deindividuation is a state in which people lose their individuality because “group members do not feel they stand out as individuals” and individuals act if they are “submerged in the group” (Festinger, Pepitone, & Newcomb, 1952). The ability to work collaboratively is at the heart of social presence theory. *Social presence* has been defined as the ability of participants in a community of inquiry to project themselves socially and emotionally as real people through the medium of communication being used. Social presence is a strong predictor of course satisfaction regardless of the medium or how content is delivered. Intimacy, immediacy, and identity enhance social presence. Although we’ve touched on all of these in this chapter, *intimacy* and *immediacy* are two terms that add to immersion and social presence and thus need further explanation. *Intimacy* can be defined as the perceived shared control of the environment either with the instructor, classmates, or the computer and *immediacy* is the amount of communication (whether it be verbal or non-verbal) present. When using teleconferencing as a form of distance learning, people may change their behavior. If they cannot be seen, they may use the verbal channel as a substitute for the non-verbal. Thus, they might say “I agree” instead of nodding. It seems, then, that non-verbal cues may not be as crucial as first supposed. Instead it seems that the major difference between the media may lie in the “social presence” that they provide.

Non-verbal cues such as gestures are a central feature of communication and cognition. When students engage in conversations in the presence of material objects, or in our case virtual objects, these objects provide a phenomenal ground against which students can enact metaphorical gestures that embody (give a body to) entities that are conceptual and abstract. In such instances, gestures are often subsequently replaced by an increasing reliance upon the verbal mode of communication. During transitional states of understanding, gestures depict new understandings, although students’ linguistic competencies have not yet developed to express the understanding in a verbal modality. The gestural and verbal modalities therefore express different types of understanding. These results find support in several studies on gestures during “hands-on” science classes. When students are asked to make sense about phenomena that they did not know prior to instruction, the gestural expressions appear to precede the evolution of new verbal modes of expression (Roth, 1999, 2001).

Roth and Lawless (2002) give examples of different types of gestures. These gestures are easy to comprehend in traditional classrooms but the transfer to online learning has been difficult, even in videoconferencing. The examples are as follows:

Beats – Void of propositional content, but provide a regular, temporal structure to communication and may facilitate the (lexical) search for words.

Deictic – When a speaker points to actual objects that are either present, non-present, or metaphorical in nature.

Iconic – When they bear perceptual relation with concrete entities or events. For example, relations between objects in space, modes of action, or paths of movement.

Metaphoric – Similar to iconic, but the images produced relate to abstractions. In such gestures, abstract content is given form in the imagery of objects, space, movement, and so forth.

Gestures are enacted against a perceptual ground, from which, as part of the function of gestures, certain features become salient. Consequently, because they are salient, they do not need to be talked about. This frees up resources in the production of speech that, in some theories, taxes the short-term memory required for word search and assembly of sentences (Anderson, Boyle, & Yost, 1985). The perceptually available entities and gestures therefore scaffold the development of scientific language because they take on representative functions, while the verbal modality is able to devote itself almost entirely to the construction of new theoretical sentences. Though they differ in many respects, both major theories on gesture–speech relations presume that speech and gesture are generated by an underlying semantic model (Hadar & Butterworth, 1997; McNeill, 1985). These situated learning environments advance the learner within a socio-cultural structure. They allow the learner to transfer tasks from virtual environment to same experiences in the real world.

Virtual Community

A virtual community can be defined as an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms. Porter's (2004) typology of virtual communities includes two first-level categories: Member-initiated (those where the community was established by, and remains managed by, members) and Organization-sponsored (communities that are sponsored by either commercial or non-commercial (e.g., government, non-profit)).

At the second level of the typology, virtual communities are categorized based on the type of relationship fostered among members of the community. Member-initiated communities foster either social or professional relationships among members, while organization-sponsored communities foster relationships both among members (e.g., customers, employees) and between individual members and the sponsoring organization.

The Porter typology draws upon Markus's (2002) typology where virtual communities are categorized based on their social, professional, and commercial orientation. In social communities, personal relationships of a non-professional nature are fostered. Often, these communities evolve around leisure activities, hobbies, or other non-professional interests. In professional communities, member relations are formed around shared professional interests. These communities include expert-based knowledge networks and student-based learning communities. However, the concept of the organization-sponsored community extends beyond Markus's notion of commercial communities by recognizing that communities could also be sponsored by non-profit organizations and government agencies.

Unlike the description of synchronicity, interactivity is viewed as a continuum (Rafaeli & Sudweeks). Indeed, a highly interactive environment can enhance a member's perception of social presence, co-presence, and sense of place (Blanchard, 2004). It also can facilitate the construction of social reality for members (Rafaeli & Sudweeks, 1997). The platform, therefore, focuses only on the technical design for interaction. This is an advantage of 3D virtual environment. All of the attributes of synchronicity are seemingly symbiotic with interactivity. Interactive responses are important in promoting socially meaningful interaction and serve to measure, build, and sustain relationships. This includes a willingness to continue to interact, indicate interpersonal support, and encourage and accept others (i.e., taking one's perspective).

Educational technology has progressed through a number of stages, focusing, in turn, on the content to be learned, the format of instructional messages, and interaction between computers and students. The field is now concerned with the study of learning in complete, complex, and interactive learning environments. These environments allow both the simulation of experiences that students might have in the real world and also the creation of compelling experiences that cannot normally be experienced directly. These environments are also frequently inhabited by more than one person, making learning within them a social activity where learning is distributed among both people and artifacts (Winn, 2002).

According to the University of Manchester's Mark Clark, "The nature of documents is increasingly trending to compound documents that incorporate image, data, text, and voice annotation. E-mail is likely to shrink as a way of sharing documents, giving way to the increased use of collaborative working environments for document development analysis, editing, and even drafting. Videoconferencing, particularly that on the high end associated with technologies such as access grids, is showing exponential growth. Increasingly, virtual communities will be built upon networks as the glue to provide social cohesiveness." Managing the deployment and then integration of converged technologies into a cohesive, converged service environment – and ultimately into the kind of rich collaborative environment as Clark describes – will likely demand considerable attention in the future (Katz, 2005). This is not an easy task but a task we are meeting directly through 3D virtual learning environments. Further research is necessary but this book continues to provide evidence that these environments can be a successful medium of the present and the future.

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Chapter 8
Situated Learning and Engagement in Distance Education

The importance of scientific literacy is a theme in today's educational community. However, this literacy depends upon the student's ability to collect data, manipulate experiments, analyze results, and apply knowledge. Logistically, limitations exist in student's abilities to do so in a typical classroom setting. True experimental opportunities are limited due to both logistic and financial restraints. Factors such as the length of time research requires, safety issues, and lack of scientific equipment are examples of some of the obstacles limiting such research experiences. Given these constraints, educators try to provide students with valuable science learning experiences however all too often the results are elementary quasi-experimental cookbook labs at best. We argue that student's engagement and learning with such activities are often lackluster and the completion of such activities do little to help the student gain scientific literacy since the student's engagement is often limited in such cases.

Virtual environments may offer an alternative way of engaging the student by exposing them to a variety of situations and experiences which would otherwise not be possible. Students' enthusiasm for this format indicates that the utilization of virtual environments may have act as a student motivator. Hickey (2003) demonstrated the undeniable link between motivation and engagement when he stated "... motivational practices are ultimately about getting and keeping students engaged in learning" (p. 411).

Motivation has been a major focus area in educational research. There are two types of motivation: intrinsic and extrinsic. Intrinsic motivation is internally driven and extrinsic motivation is driven by either a desire to achieve rewards or from a desire to avoid punishments. Of the two, intrinsic motivation has shown to be the stronger motivator. Brewster and Fager (2000, pp. 4–5) summarize educational benefits associated with intrinsic motivation below.

Intrinsically motivated students:

- Earn higher grades and achievement test scores, on average, than extrinsically motivated students (Dev, 1997; Skinner & Belmont, 1991)
- Are better personally adjusted to school (Skinner & Belmont, 1991)
- Employ "strategies that demand more effort and that enable them to process information more deeply" (Lumsden, 1994, p. 2)

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- Are more likely to feel confident about their ability to learn new material (Dev, 1997)
- Use "more logical information-gathering and decision-making strategies" than do extrinsically motivated students (Lumsden, 1994, p. 2)
- Are more likely to engage in "tasks that are moderately challenging, whereas extrinsically oriented students gravitate toward tasks that are low in degree of difficulty" (Lumsden, 1994, p. 2)
- Are more likely to persist with and complete assigned tasks (Dev, 1997)
- Retain information and concepts longer, and are less likely to need remedial courses and review (Dev, 1997)
- Are more likely to be lifelong learners, continuing to educate themselves outside the formal school setting long after external motivators such as grades and diplomas are removed (Kohn, 1993)

There are a variety of perspectives in which to view motivation however as Hickey (2003) indicated ". . . motivational practices are ultimately about getting and keeping students engaged in learning" (p. 411). Therefore, from an educator's perspective, one of the surest ways to increase engagement is to increase motivation. Students who are intrinsically motivated naturally become more engaged in a task in the same way that individuals can lose oneself in a good book (Csikszentmihalyi, 1990). Individuals who feel immersed in a novel may read for hours uninterrupted, potentially feeling as though they have entered into the world created by the author. Players of computer and video games also experience this type of immersion within their environment and are willing to spend large amounts of time within the game environment. Therefore, students may be intrinsically motivated to learn through this method and may be more willing to spend additional time on task. Dede, Clarke, Ketelhut, Nelson, and Bowman (2005) found that students engaged in instructional multiuser virtual environments (MUVs) had improved attendance, decreased disruptive behavior, and reported enjoying science. This study demonstrates a positive effect between the use of this format and increased engagement.

Brewster and Fager (2000, p. 7) presented a list of suggestions on how educators can design more engaging in-class activities expected to increase time on task (listed below). Increased time on task is expected to result in increased learning.

1. Insure course materials relate to students' lives and highlight ways learning can be applied in real-life situations
2. Allow students to have some degree of control over learning
3. Assign challenging but achievable tasks for all students, including at-risk, remedial, and learning disabled students
4. Arouse students' curiosity about the topic being studied
5. Design projects that allow students to share new knowledge with others

Below we identify why we believe the virtual environment can be used to achieve each of these suggestions and therefore provide increased engagement. Logically, if an increase in engagement occurs, students will spend more time on task and learn more.

1. *Insure course materials relate to students' lives and highlight ways learning can be applied in real-life situations*. Virtual environments can simulate real-life experiences or they may be based completely in fantasy. Regardless of the setting, the virtual environment allows for students to be exposed to situations that may better model the complexities of real-world experiences better than traditional instructional methods. Gee (2003) argues that the collaborative nature of massive multiplayer games and the complexities of interactions occurring within these environments may better prepare individuals for team-centered projects encountered in the workplace.

2. *Allow students to have some degree of control over learning*. Increased student control has been associated with increased learning. Within virtual environment students control their movements, actions, interactions, and even how they are represented. Annetta and Holmes (2006) demonstrated that by providing students the control of selecting their own avatar student's sense of self-identity and presence increased. Through such a selection, students are offered control immediately upon entering the virtual environment. Dickey (2005a) highlighted the prominent theme of choice, and therefore student control, throughout the game format of virtual environments. He stated "Players continually make choices as to who to be, where to move, what to do, and how to allocate resources. These choices-hooks-both personalize the experience and affect gameplay." (p. 68) Ryan, Rigby, and Przybylski (2006) argue that the control allowed within this environment allows for the players to engender feelings of autonomy, competence, and relatedness.

In addition to the autonomy available for students while interacting within these environments, technology is currently available which allows students the ability to change and/or create their own environment – the ultimate in student control! Virtual multiplayer formats such as *Second Life*© and *Active Worlds*© allow for players to create objects and potentially design their own game scenarios. Such activities would allow the students claim ownership over the environment and their learning.

3. *Assign challenging but achievable tasks for all students, including at-risk, remedial, and learning disabled students*. The scaffolding found within the gaming format of virtual experiences provides a cognitive framework from which achieving the final goal depends upon a student building or advancing his or her skills. These virtual experiences are designed with a set of constraints and affordances built into them so that students progress within the environment as learning occurs. Therefore these environments are designed so that players have to demonstrate mastery of basic level abilities before they advance to higher level skills. Because of the individuality of this format, students can engage in learning at their own pace. Additionally, players that have difficulty at one level can repeatedly focus on this skill for a prolonged period. In this way learning occurs through a system of checks and balances, where a set mastery level has to be achieved for the player to be exposed to more advanced skills. Because of this organizational design, we argue that the virtual learning format supports the ability for students to work at the correct academic level, one that is challenging but also achievable. Therefore, if designed properly, students can systematically increase their knowledge by moving stepwise through the knowledge domains built within the game.

Dede et al. (2005) argues that student's exposure to, and desire to use, technology is reshaping the learning styles of students – emphasizing the role of immediate satisfaction. Virtual environments have the potential to offer quicker rewards and this immediate feedback may be the key to holding students attentions that may otherwise be lost using traditional methods. The use of this format has been shown to increase on time task engagement, and decrease off task behaviors, in special populations such as students with attention-deficit hyperactive disorder. Therefore we argue that virtual environments may be an effective pedagogical tool for students that are unmotivated by standard instructional approaches.

4. *Arouse students' curiosity about the topic being studied.* The format of educational games lends itself to the problem-based learning format. It is not surprising then that the virtual environment design is closely aligned with problem-based learning theory. In case- based learning, a story unfolds. Typically, the story is based on an authentic problem or task but cases may also be developed using fictitious scenarios. Regardless of the scaffolding surrounding the case, the prime goal is to peak the students' interest in a topic, challenge them to gather information/evidence within the process, and force decision-making about the case. This method of instruction naturally arouses students' curiosity and has the potential to allow for exceptional learning gains. Ahlfeldt, Mehta, and Sellnow (2005) support this argument by demonstrating that problem-based activities involve greater student engagement than traditional methods.

5. *Design projects that allow students to share new knowledge with others.* Collaboration is an underlying theme of virtual environments. This format is designed to not only allow, but also oftentimes require, shared experiences in order to achieve the goal presented. Therefore virtual environments are exceptional learning tools for shared experiences and collaborative work. Although students engage each other through collaborative learning within these multiplayer environments, they are not limited to these shared experiences. Players may also interact with objects embedded in the game. Such objects may include other non-player characters, resources within the game, or links to other materials. Additionally, a blended method of interaction is possible. Specifically players may work individually achieving set instructional goals and then work collaboratively to create a project. A summary of multiplayer educational virtual environments utilized, and their associated learning goals and objectives, is presented in Table 8.1 (reproduced from Dieterle and Clarke, p. 2).

Situated Learning

Situated learning theory is based upon the principle that individual learning is unequivocally dependent upon the context of learning or the setting and/or social construct (Brown, Colins, & Duguid, 1989; Lave & Wenger, 1991). Because virtual environments are created, they may reflect a particular predetermined setting, either fictitious or modeled in reality. In fact, the ability to change the setting and/or social

Table 8.1 Summary of educational MUVEs, learning goals, functionality, and corresponding (reproduced from Dieterle and Clarke, p. 2)

MUVE	Developer	Learning goals and objectives	Functionality	Web site
AppEdTech	Appalachian State University	Distance education courses and services for graduate students	AppEdTech is a graphical MUVE designed to support graduate students working over distance. Student control avatars that interact with other students, instructors, and artifacts, such as course resources.	http://www.lesn.appstate.edu/aet/aet.htm
AquaMOOSE 3D	Georgia Institute of Technology	Visualization of and experimentation on parametric equations	AquaMOOSE 3D is a graphical MUVE designed for the construction and investigation of parametric equations.	http://www.cc.gatech.edu/elc/aquamoose
MOOSE Crossing	Georgia Institute of Technology	Computer programming and collaboration	MOOSE Crossing is a text-based MUVE designed for kids aged 9–13. Through the interface, users create virtual objects, spaces, and characters while interacting with one another through text.	http://www.cc.gatech.edu/elc/moosecrossing
Quest Atlantis (QA)	Indiana University	Promotion of social and moral development	QA is a graphical MUVE designed for children aged 9–12 to complete activities with social and academic merit in both formal and informal learning settings.	http://atlantis.crlt.indiana.edu

Table 8.1 (continued)

MUVE	Developer	Learning goals and objectives	Functionality	Web site
Revolution	Massachusetts Institute of Technology	History	Revolution is a multiplayer role-playing game where students experience history and the American Revolution by participating in a virtual community set in Williamsburg, VA on the eve of the American Revolution.	http://educationarcade.org/revolution
River City	Harvard University	Scientific inquiry and 21st Century Skills	River City is designed for use in middle school science classrooms. As visitors to River City, students travel back in time, bringing their 21st Century Skills and technology to address 19th century problems.	http://muve.gse.harvard.edu/rivercityproject
Tapped IN	SRI	Online teacher professional development	TI bundles synchronous and asynchronous discussion tools, a notes section, an interactive whiteboard, and file-sharing space. After logging into the virtual space, users are teleported to the TI Reception Area and greeted by Helpdesk staff.	http://tappedin.org

Table 8.1 (continued)

MUVE	Developer	Learning goals and objectives	Functionality	Web site
Whyville	Numedeon, Inc	Scientific literacy and socially responsible behavior	Whyville is a graphical MUVE designed for children between middle childhood and adolescence. Whyville users, called citizens, from all over the world access Whyville through a Web-based interface to (a) communicate with old friends and familiar faces through synchronous chat and the *Whyville-Times* (Whyville's official newspaper with article written by citizens), (b) learn math, science, and history through interactive activities, and (c) build online identities. As citizens participate in a variety of activities, they earn clams (the official monetary unit of Whyville), which they can use to enhance their avatars and throw parties.	http://www.whyville.net

context is a great strength of this format. Students may be presented with experiences that would otherwise not be available. Therefore the utilization of this format may allow students to have increased experiences which may help guide their development from novice to expert. Dede, Nelson, Ketelhut, Clarke, and Bowman (2004) emphasized the unique learning benefits of situation learning virtual experiences when they stated "In contrast to courses, students learn the knowledge and skills expected of them in their future research careers through modeling, mentoring, and legitimate peripheral participation." (pg. 161)

Because educational MVUs may be used collaboratively and revolve around embedded tasks, they may be better models for real-world experience. The modeling of real-world experiences is the basis of epistemic games. The context of these MVUs is based on apprenticeships with a focus on job training. Therefore the use of these virtual environments may allow students' exposure to increased experiences at a lower risk and lower cost than would be required for traditional internships. Currently, these opportunities are limited, but as more professional and higher educational institutes move toward this format its future potential may be realized. Nilles (2007) argued this point when he stated "… the potential for this new life-situation-based learning is just beginning to be developed. There is still little focus on developing a curriculum oriented toward off-campus, experiential learning for other than the professional schools" (p. 2).

The field of science in particular is one area where this format may help provide apprenticeship research opportunities that may otherwise not be available. For example, Bainbridge (2007) proposed that "It would be quite feasible to have advanced students replicate classic experiments inside SL (Second Life), adding to our confidence in older results while giving young people valuable skills" (p. 473).

One argument against the use of such simulations is that they don't provide the students with the same experiences they would normally be exposed to. We would argue that because these environments are not necessarily based in reality, it is possible that they may be more powerful learning tools. For example, students could virtually experiment on humans, rather than animal models, within this environment. Studies which may be otherwise unethical to conduct may be completed within this virtual environment in attempt to make learning more engaging to the student. Ethics may become part of the learning process when utilizing such a format.

Student Learning

Examples of student learning can be directed and expanded upon based on the level of participation within these environments. Throughout this process students may experience both achievements and failures and must adjust and respond accordingly. This format forces students to acknowledge changing variables and allows for strategic thinking. The complexities of these interactions model the actual pressures found in real-life working conditions. Therefore students in a situated learning experience gain knowledge that expands beyond just the core course content. For example, students in a situated learning experience may be responsible for publishing a weekly newspaper as in the epistemic game science.net. Not only are these students learning about journalism, but they are also experiencing how the pressures of time constraints might help improve time management skills.

In addition to identifying specific individual constraints, a player may broaden their overall understanding of how various interconnections work within those constraints. What the gamer learns and what is transferred is not isolated to any one skill set in particular, but the overall situational awareness of the context itself is important. This idea of overall experiential learning gains is referred to an *embodied empathy for complex systems* by Gee (2003). Therefore it can be argued that learning that occurs in a video game may better transfer to similar problems outside the game than traditional methods. Prensky (2001) argues that the real-life relevance of learning via this method is associated with overall specific strategic learning gains including the following: *Cause and effect*, *Long-term winning versus short-term gains, Order from seeming chaos, Second-order consequences, Complex system behaviors, Counter-intuitive results, Using obstacles as motivation, and The value of persistence.* Prensky (2001) further states that "For *whenever* one plays a game, and *whatever* game one plays, learning happens constantly, whether the players want it to, and are aware of it, or not. And the players are learning 'about life,' which is one of the great positive consequences of all game playing. This learning takes place, continuously, and simultaneously in every game, every time one plays" (p. 1).

Augmented reality blends the gaming format with handheld devices, such as cell phones and PDAs, and the real-world environment. Increased technological advances in these devices now allow for immediate computing interconnectivity almost regardless of location. Dieterle, Dede, and Schrier (2007) spoke of this phenomenon when they stated "Ubiquitous computing" provides contextually specific, dynamic, and temporally aware media and tools that participate seamlessly and almost unnoticed as integral parts of our daily activities. "As powerful computational devices such as WHDs (wireless handheld devices) pervade our physical surroundings, users can obtain ever-present connectivity and access to capture, process, send, and receive information through multiple devices anytime and anywhere" (p. 38).

In augmented reality, these handheld devices are the technical media used to transfer the gaming data. Throughout this process students physically move to various locations using the Global Positioning Systems (GPS) found in their handheld devices, or through cell phones or cell towers. Typically players are provided with additional information at each location. Players then must analyze the cumulative data in order to draw a conclusion. Dieterle et al. (2007) indicated that the use of augmented reality may be a useful pedagogical tool in higher education since its use can redefine the role of the learner from a passive recipient of information to an active participant in the learning process.

Two such games have been funded by the National Science Foundation, *Environmental Detectives* and *Quest Atlantis. Environmental Detectives*, designed for college and high school students, is an outdoor game that requires the students to gather information pertaining to a fictional toxic spill (Klopfer, Squire, & Jenkins, 2002). Throughout this simulation students are moving to a variety of locations collecting new data at each location. Examples of data collected would be information from interviews and the gathering of data using environmental simulations. *Quest Atlantis*, designed for participants aged 9–12, provides the students with a variety of quests or tasks solving environmental problems designed to build student research skills.

This idea of critical reflection is an essential part of the learning process, allowing the player to think back on events from the virtual and project them in meaningful ways onto the physical world. Those projections do not rely just on things that the players know, but also take ways of knowing and ways of being, dispositional stances, and project them onto non-conflicting frames of meaning. In essence, the transfers that occur between virtual and physical worlds are what we will outline below as "conceptual blends." Francis (2006) indicates that both critical reflection and instructor guidance are important factors effecting student learning within virtual environments.

Disposition describes a set of attitudes toward the world generated through a set of practices that can be seen to be interconnected in a general way. Second, and perhaps more important, disposition is distinct from what Ryle (1949) called the *episodic*. This means that disposition goes beyond descriptions of events or practices – rather it represents the underlying mechanisms that engender those events or practices. What transfers in MMOG learning are not just information or skills, but dispositions and the ability to translate those dispositions from inside the game to outside the game through an act of imagination. That moment of transfer is a point of convergence when experiences in virtual worlds are shared among or between players and produce a trigger that allows the player's imagination to transcend the boundary of the game. When these encounters produce moments of emergent collective action, they also create the possibility of incredibly strong bonds among the participants. As a result, dispositions are constitutive of the social context in which the game world develops.

Metaphorical thinking differs from analogy in that analogies depend upon similarities, while minimizing differences. Because simulations or simulation-based games focus on creating similar experiences, learning by analogy occurs. The learning goal of simulation-based games is to introduce student to a specific skill set and provide an avenue for the transfer of these skills and knowledge from the virtual to the physical.

Learning by metaphor, however, may occur in radically different spaces. The MMOG environment may involve metaphoric learning in the since that the virtual and the physical worlds offer different experiences but may offer up a single point of experiential convergence (a trigger). This convergence invites, and may require, reflection of experiences and the ability to translate these experiences into meaningful learning. Virtual worlds may be designed to allow players' imagination to help provide otherwise available experiences.

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Chapter 9
Learning, Psycho-Cognition, and Flow

Learning

Learning is the goal of any educational endeavor. For educational games to be instructional it needs to have all of the aforementioned components in addition to the following concepts. Vygotsky (1934) contended that, unlike animals – who react only to the environment, humans have the capacity to alter the environment for their own purposes. It is this adaptive capacity that distinguishes humans from lower forms of life . . . The animal can only be trained. It can only acquire new habits. It can through exercises and combinations perfect its intellect, but is not capable of mental development through instruction in the real sense of the word. This has never been truer than with today's learners. The net generation or *digital natives*, as they've been called, have the seemingly innate ability to exhaust visual–spatial abilities and cognitive load. They thrive in environments that challenge them, making them adapt to challenges and predict avenues to circumvent challenges. While many studies have been conducted on cognitive models in both textual and visual stimuli, many of these studies might have assessed students not yet ready for video games in the classroom. In a study with grade 5 students, Annetta et al. (2009) suggested positive gain scores for students from pre-game to post-game testing.

Video games have rich visual structures. Visualization is a powerful cognitive strategy and researchers have long recognized visualization as an essential problem-solving strategy (Rieber, 1995; Treagust, Chittleborough, & Mamialo, 2002).While both static and dynamic (animated) graphics demand visually attentional resources, animations have increased cognitive demands over static graphics (Lowe, 2003; Seufert, 2003). There may be issue as to whether cognitive processing can keep up with the rate of presentation (Bodemer, Ploetzner, Bruchmüller, & Hacker, 2005) but we would contend that we have not even scratched the surface of cognitive load with younger learners. This audience is the masters of multitasking. They listen to music, IM, play games, and watch television simultaneously without much trouble. In fact, they prefer environments such as this.

The core information-processing model used by Mayer (2001), Sweller, van Merrienboer, & Paas (1998), and others holds that new information is first received by the sensory system prior to processing by short-term memory (Fig. 9.1). In short-term memory, a number of factors help determine which chunks of information

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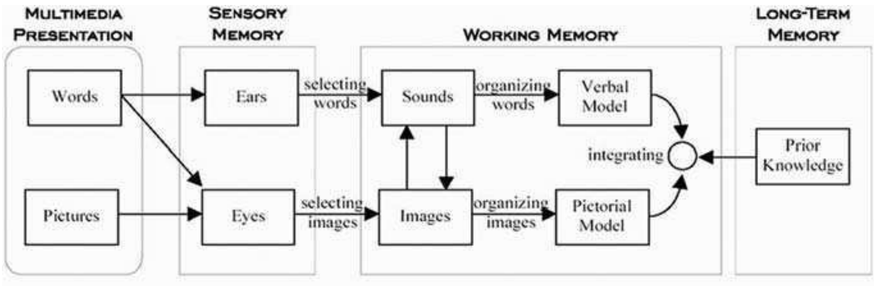

Fig. 9.1 Mayer model of multimedia memory load (1997)

are integrated into long-term memory via schemas. This sequential process means that new information must first be received by a sensory system prior to entry into short-term working memory and possible inclusion in long-term memory. However, material must be meaningful to the learner and must activate prior knowledge.

Self-regulated learning in a virtual environment is most closely based on the stage independent part of Piaget's theory that can be summarized as epistemic conflict and self-reflection (Forman & Pufall, 1988; Taradi, Taradi, Radic, & Pokrajac, 2005). Learning cannot occur unless an individual is in a mental state of disequilibrium. *Learning* can be defined as the construction of new knowledge resulting from the resolution to a conflict. Piaget theorized that knowledge is always transitory. Assimilation is the process of understanding the world through existing schemes, whereas accommodation is the process of building new schemes (based on refinements and blending of existing schemes) (Phillips, 1981; Piaget, 1952). When we tap a learner's existing knowledge base (schema) in games, players take something and make it fit to their prior knowledge and experience allowing players assimilate the embedding content. Games also need to be organized so that information is efficiently recalled.

To do this we've used problem-based, experiential learning to aid the transfer of experiences in the game world to those outside through allowing students to construct their own knowledge through constructing their own game. While there are numerous benefits to problem-based learning, the literature indicates that implementation can be challenging. Technology creates "new opportunities for curriculum and instruction by bringing in real-world problems into the classroom for students to explore and solve" (Bransford, Brown, & Cocking, 2000, p. 195). Problem scenarios must also be complex. Students should recognize that a problem does not provide them with needed information. If students are not challenged by the problem, they may assume there is a single, obvious solution and be reluctant to invest effort into the problem. Students must not get frustrated or feel like a problem is too difficult to be solved. They must also feel like the problem can be solved in the time allotted within the game environment (Cook, in Annetta, 2007). Educational games can bring about a lifelike experience to problem-based learning that cannot be replicated in the traditional classroom or even on field trips (Annetta, Cook, & Schultz, 2007). If playing games influence learning in terms of constructing a connection between virtual life and real life and encouraging critical thinking (Lim, Nonis, & Hedberg, 2006; Mitchell & Savill-Smith, 2004; Turvey, 2006), then building games should influence more long-term memory channels.

When students are active in the learning process, then learning is stealthy. That is students don't realize they are learning embedded content. Active learning assumes that meaningful learning occurs when learners engage in the active cognitive processing which includes attention to incoming words and images, mentally organizing them into coherent verbal and visual representations, and mentally integrating them with prior knowledge (Mayer, 1997). If students are the designers, then they provide the framework for when words and images emerge and the learning scaffolds by which they inherently understand the material to reach a game's climax.

In a classroom setting, the teacher is responsible for creating scaffold-structuring interactions and developing instruction in small steps based on tasks the learner is already capable of performing independently. The instructor is also charged with providing support until the learner can move through all tasks independently. When students create games, the instructor becomes the facilitator and in essence models good practice by scaffolding the design process by which student will then incorporate learning scaffolds in the virtual environment.

Scaffolds develop learners' Zones of Proximal Development. Vygotsky adopted the notion of the Zone of Proximal Development that he defined as the difference between a child's actual and potential levels of development (i.e., what a child can do alone and with the assistance of an expert/computer agent). According to Vygotsky (1978), play creates a broad Zone of Proximal Development, both in cognitive and socio-emotional development. In make-believe play children perform above their own cognitive abilities – logical thinking, memory, and attention. Students construct games with play in mind. They want to create an environment that is fun and fantastic. Using creative processes is the essence of make-believe play. Students are playing as they create. Vygotsky would content that instruction cannot be identified as development, but properly organized instruction will result in the child's intellectual development, will bring into being an entire series of such developmental processes, which were not at all possible without instruction. Accordingly, the teaching methodology that aligns with the Zone of Proximal Development "integrates several approaches to form a comprehensive agenda for research of the genesis, development, function, and structure of the human psyche."

Situated Learning

In 1968, David Ausebel said, "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly." Learning that is grounded, or situated, in the learner's life experiences promotes meaningful assimilation of concepts and content. *Situated learning* has been defined as the belief that knowledge is "contextually situated and is fundamentally influenced by the activity, context, and culture in which it is used (McLellan, 1985, p.6)." Regardless of the outcome of these experiences, one can learn from them. The old adage, "I've learned from my own mistakes," can be thought of as a situated learning event (Merriam & Cafarella, 1991).

McLellan identified eight elements in situated learning environments: stories, reflection, cognitive apprenticeship, collaboration, coaching, multiple practice, articulation of learning skills, and technology. A well-constructed virtual learning environment can promote these elements of situated learning.

The developer can build missions rich in narratives. Stories have been used to engage people in mostly entertaining ways (i.e., books, movies, video games) but rich narratives can be a critical part of learning. The notions of engagement, identity, and presence in this book are often derived from narrative-based learning events. Having the learner actively participate in the story is an immersive way of providing a life experience even if the life experience is virtual. Ryan (2001) applied narrative theory by considering immersion an active condition controlled at least partially by the reader/player. Applied to learning contexts, this theory suggests that despite being immersed, learners may remain in control of a simulated scenario.

Reflection is an often overlooked but vital element in situated learning (McLellan, 1985). Online learning experiences don't give the learner a chance to reflect on their experiences. This could be that most online experiences do not lend themselves to reflection. Allowing a learning community to synchronously interact in a rich story experience provides a base for inquiry teaching. It is a common experience in which the teacher can build upon while allowing the learner to reflect on his/her experience.

Cognitive apprenticeship is a concept that is closely tied to a learner's motivation and sense of *Flow* in their situated learning experience. Being immersed in these game-like environments means that learners have a heightened sense of presence through individual identity, are engaged in the content, and thus are intrinsically motivated to succeed in the challenge of the game's goal. If presence, identity, and engagement are met, then the learner may enter a state of *Flow*. *Flow* is an underlying goal of all good curricular design. Educators may not have called it *Flow*, but if we take a piece from the learning science and game research then we can see how *Flow* should be a goal of all good education.

Three-dimensional learning environments clearly motivate users in ways that conventional instruction, including online non-routine challenge problems, does not (Yee, 2006). People find themselves immersed in these worlds because they find them intrinsically satisfying. Motivation is a set of reasons why one repeatedly engages in a particular behavior. Intrinsic motivation encompasses such areas of challenge, curiosity, control, and purpose; when people are motivated intrinsically, they become more engaged in the task.

Collaboration is also an important element in situated learning. Chapter 6 of this book digs deep into collaboration but we will revisit it for a short time here as well. When learners work together as trams, they learn from each other and learn to build a community of practice that allows them to share an educational experience.

Coaching or feedback is a central part of situated learning. Whether it is peer feedback, instructor feedback, machine feedback, or some other form of scaffolding, coaching provides a framework for which a student can be challenged with a safety net. Students receive feedback and guidance as they perform tasks related to the learning objectives. This guidance fades as the student needs less scaffolding to correctly perform the tasks (March, 2003; McLellan, 1985).

Multiple practice is yet another element in situated learning as well. As McLellan (1985) states, "Skills are honed through practice, where the student moves toward flying solo, with the support of a teacher and coach (p. 11)." Good games often have multiple levels. This idea can be accomplished through loading new 3D maps or increasing difficulty within one map. Connecting levels in a game provides a platform for increasing complexity of concepts and content in an educational game. This is where classic educational psychology has been surreptitiously used in the game design process. Finally, technology is also an important factor in situated learning. What we have presented in this book is all about technology-driven learning. In 3D virtual learning environments, students interact with different parts of the environment, ask questions of characters, listen to interviews with different characters, and work to solve a problem.

We have begun to investigate McLellan's elements by developing ongoing research in Learner-Centered Design (LCD). LCD recognizes that learners have unique needs – such as a lack of background knowledge and a lack of motivation that need to be addressed in the design of educational software tools. When developing educational technology experiences, learners' needs arise both from the software and from the activities. To address learners' unique needs, LCD practitioners often incorporate additional coaching or scaffolds into the educational software. We will discuss scaffolding more in depth later in this chapter. In software development, scaffolds often appear as part of the user interface, providing support and guidance throughout the activity.

LCD is guided by three issues that must be addressed:

- Tasks: What tasks need to be undertaken in the software?
- Tools: What tools are provided to cope with those tasks?
- Interfaces: What is the interface to those tools?

The insight offered by the user-centered design movement (Norman & Draper, 1985) was that the user needed to be at the center of those issues.

In putting learners at the center of the design, however, the special needs of learners must be addressed:

- Understanding is the Goal: Learners will not know accounting principles or practices when a spreadsheet is presented to them. HOW will they learn to use that spreadsheet?
- Motivation is the Basis: One cannot count on the motivation of learners: both students and professionals have a strong tendency to procrastinate, to fritter away

time, when confronted with a task for which they are unprepared. Why can't software play a role in supporting the learner's wavering motivation?
- Diversity is the Norm: Classrooms and professions are composed of individuals from a diverse set of backgrounds, with a diverse set of interests, skills, and abilities. How can an application be "one size fits all"?
- Growth is the Challenge: A spreadsheet is by and large the same on day 1 as it is on day 100. But an individual can be very different, e.g., that person may have learned quite a bit (Soloway, E., Guzdial M., & Hay, K.E., 1994).

Model-based thinking and analogical reasoning are two other concepts we have used as a theoretical framework for our work. Model-based thinking provides a platform for students to create cases, be creative and innovative, and to interpret and construct dynamic models of real-world processes. It further allows students to learn to negotiate. Negotiation is the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative sets of norms.

Analogical reasoning is widely accepted to be important in learning and understanding. Novel problems can be solved by reference to previously understood situations (Kurtz, Miao & Gentner, 2001). In its simplest form, analogical learning results from noticing a similarity between a well-understood "base" domain and a less well-understood "target" (or "test") domain. Mapping aspects of the target domain to the base domain and adapting a solution from the base domain can facilitate solving problems in the target domain. In LCD environments (Kolodner, Owensby, & Guzdial, 2003), the process of transferring knowledge is not trivial. It has been variously shown that even when appropriate bases are stored in memory, retrieval often fails (Perfetto, Bransford, & Franks, 1983; Ross, 1989; Weisberg, DiCamillo, & Phillips, 1978, all cited in Kurtz et al., 2001).

These concepts support constructivist theory through experiential learning and active engagement. Educational learning environment must be good for role-playing, simulation, or adventure that lack violence. They must involve strategic planning and problem solving and enable concepts that will be developed and remembered by the learner. As the gaming population becomes online learners, it becomes increasingly more important to design educational experiences that align with their wants and needs. Experienced gamers show positive characteristics such as self-monitoring, pattern recognition, principled decision-making, qualitative thinking, and superior long- and short-term memory. Games boost egos, increase motivation, enhance self-worth, and increase spatial ability (Deubel, 2006), all elements we have discussed as critical to developing 3D spaces for distance learning. Gamers use the same strategy to learn: both trial and error and utilizing friends as sources of information about games. The insufficient use of documentation to reach information is worth considering as well.

Finally, we ground all of our design in problem-based, experiential learning to aid the transfer of experiences in the virtual world to experiences in the real world through allowing students to construct their own knowledge through constructing their own activity in the virtual space. While there are numerous benefits to problem-based learning, the literature indicates that implementation can be challenging. Technology creates “new opportunities for curriculum and instruction by bringing in real-world problems into the classroom for students to explore and solve” (Bransford et al., 2000, p. 195). Problem scenarios must also be complex. Students should recognize that a problem does not provide them with needed information. If students are not challenged by the problem, they may assume there is a single, obvious solution and be reluctant to invest effort into the problem. Students must not get frustrated or feel like a problem is too difficult to be solved. They must also feel like the problem can be solved in the time allotted within the game environment (Cook, in Annetta, 2007). 3D virtual learning environments can bring about a lifelike experience to problem-based learning that cannot be replicated in the traditional classroom or even on field trips (Annetta, Cook, & Schultz, 2007). If interacting in these environments influence learning in terms of constructing a connection between virtual life and real life and encouraging critical thinking (Lim et al., 2006; Mitchell & Savill-Smith, 2004; Turvey, 2006), then building these environments should influence more long-term memory channels.

Psycho-Cognition

Connecting levels or teleports between activities in a virtual environment provides a platform for increasing complexity of concepts and content. If we can grasp the concept that activities developed in a virtual learning environment are like games, then we can begin to understand how classic educational psychology can guide the design process. In 1951, Piaget observed that certain kinds of games precede others and studied their relationship with the cognitive, affective, and social evolution of children. He classified games in three main groups: games of exercise, symbolic, and with rules. The first category includes the games performed by babies and young children, during their first 2 years of life. These are games where both the senses and movement are involved. In this stage it is common that children associate one object with a different one (for example, a piece of wood might become a “gun”). When children are about 7 years old, they get involved in a new form of play that involves rules, like soccer or racing. Piaget named this third category “games with rules” and it develops while the child goes under the socialization process. These three main groups of play behaviors emerge, according to Piaget, as the child develops, but the three classes will remain intact during adulthood.

Piaget (1962) suggested the main organizing element in game play consists of explicit rules that guide children’s group behavior. Game play is very organized in comparison to socio-dramatic play. Games usually involve two or more sides, competition, and agreed-upon criteria for determining a winner. Children use games flexibly to meet social and intellectual needs. In single player games, the “other side” in the competitive duo is the machine-through interaction with non-player characters. This allows for learning to be replicable and the learning objects to be met by a variety of learners who possess a variety of skills and competencies. The rules need to be explicit so that learning can increase and become more complex as the player proceeds through the game environment. The actions of the player are usually repetitive and serve to explore the environment and its objects.

There is a balancing act when designing complex educational games. This is not unlike designing a complex science activity. It involves juggling multiple objectives, choosing what to prioritize and when, what to defer, and what conceptual levels to tap. This is arguably the most difficult part of educational game design. The designer wants to be sure that the player always progresses but must also be certain the player is rewarded based on his/her qualities and in-game decisions. If the player reaches the pinnacle of a flow state, then the player reaches *pleasurable frustration*.

Students prosper when the subject matter challenges them to the extent of their abilities. Making lessons too difficult causes frustration, while making lessons too easy causes the player to become disengaged and bored. Cognitive psychologists call this the *regime of competence* principal. As opposed to other forms of entertainment, video games uniquely rely on the regime of competence. Movies and TV shows do not start out with simple dialogue or narratives and build in complexity like video games. Books don't pause mid-chapter to check vocabulary skills. Even *Pong* got more challenging as time passed (Johnson, 2005). When an educational game progresses, the abilities of the player should improve and, hence, the game's challenges should become more difficult. Keeping a game in flow is difficult because it depends on the player. To keep the player in flow, there needs to be a big reward in playing on a more difficult level or the player will regress from flow and eventually become disengaged. Another option is to let players skip certain challenges and do alternative ones that are better suited to his/her abilities. This is where artificial intelligence within game engines could be the structured interactivity through increasing complexity of content and game play.

In educational settings, visualizations are an important consequence of an increased emphasis on inquiry learning that often exploit the human ability to identify patterns in images and video (Edelson, Gordin, & Pea, 1997). To assist in the construction of science knowledge, scientfic models and visualizations can help individuals make sense of abstract concepts (Treagust et al., 2002). As Srinivasan and Crooks (2005) note, multimedia instruction in the sciences has typically fallen short of its instructional promise. For this reason (and others), there has been considerable interest in the learning sciences research community as to the cognitive basis of multi-representational learning (e.g., Mayer & Moreno, 2003; Paas, Renkl, & Sweller, 2003a; Ploetzner & Lowe, 2004). One broad line of research that attempts to address these issues is based on cognitive load theory (e.g., Paas, Tuovinen, Tabbers, & Van Gerven, 2003b; Sweller et al., 1998) and a related theory of multimedia learning (e.g., Mayer & Moreno, 2003; Moreno, 2002). Both of these theories are based on a model of cognitive architecture that includes a discrete, limited-capacity working memory component (Baddeley, 1999; Newell & Simon, 1972). While this model is based on core, historical models of cognitive architecture, more current related work based on connectionist models and using neuropsychological techniques continue to support this basic model of a limited-capacity working memory component (e.g., Bunge, Klingberg, Jacobsen, & Gabrieli, 2000; Just & Varma, 2002). Theoretical work on the structure and function of working memory has posited unique processing mechanisms for both visual and auditory information (Baddeley, 1999; Paivio, 1986). These theories become important to the current study because video games juxtapose graphics and audio that stimulate the player. Video gamesmanship represents conscious, deliberate mental and physical activity and promotes active learning by shifting players into the participants' role. Each strategic movement generates a visible response. Moreover, the immediacy of reciprocal responses reduces the sense of distance between the player's efforts and successes. External stimuli are controlled to focus and define exploration and problem solving. Challenges are matched to players' developmental levels to create a psychological sense of *Flow* (Bowman, 1982).

Researchers have reported powerful combinations of animated graphics and audio as an useful instructional design strategy (e.g., Mayer & Moreno, 2003; Rieber, Tzeng, & Tribble, 2004). The educational advantage of this sensory combination is often linked to a reduction of the working memory demands being imposed on the user (Paas et al., 2003b; Sweller et al., 1998). But while much of the research on the use of animations has reported favorable responses by learners, results of studies that have looked specifically at the advantages of using animations in the promotion of conceptual understandings are mixed (e.g., Hegarty, 2004; Hutcheson, Dillon, Herdman, & Wood, 1997). While a static image is likely to be reinspected numerous times (Carpenter & Shah, 1998; Hegarty, 1992), the image elements of interest in a video game are likely to change shape, location, etc., or disappear altogether as the user plays. There may be issue as to whether cognitive processing can keep up with the rate of presentation (Bodemer et al., 2005; Lowe, 1999). This is a central concern in virtual learning environment design and use.

Constance Steinkuhler's work in MMORPGs has supported the notions of activity theory (e.g., Engestrom, & Miettinen, 1999), d/Discourse theory (Gee, 1999), distributed cognition (e.g., Hutchins, 1995), ecological psychology (e.g., Gibson, 1979/1986), ethnomethodology (e.g., Garfinkel, 1967), mediated action (e.g., Wertsch, 1998), situated learning (e.g., Lave, 1988; Lave & Wenger, 1991), socio-cultural theory (e.g., Vygotsky, 1978), and situativity theory (e.g., Greeno & Moore, 1993). Within virtual learning environment, cognition is "a complex social phenomenon ... distributed – stretched over, not divided among – mind, body, activity and culturally organized settings (which include other actors)" (Lave, 1988, p. 1). Steinkuhler would contend that emphasis should be put on the interactional structures of such social and material systems, not structures in the individual mind per se.

Changes in knowing become changes in being: Through participation in a given Discourse community (Gee, 1999), an individual does more than merely acquire and reorganize symbolic knowledge about the world, the learner is ontologically transformed by it. Learning, from this perspective, is progress along *trajectories of participation* (Greeno, 1997). How individuals interact with their material and social contexts, and how these interactions change over time, replace accounts of individual knowledge construction mentally occurring. It is the gradual transformation of an individual from *legitimate peripheral participant* (Lave & Wenger, 1991) to central member of a community through apprenticeship and increased participation in values community practices. Steinkuhler would further state that at the aggregate level of the community, this learning process takes the form of an emergent reorganization of the patterns of member participation coupled with a growth of shared knowledge through changing practices and artifacts, while at the individual level, however, it is ontological in nature, "a process of coming to be, of forging identities in activity in the world" (Lave, 1988).

This aligns with the idea of conceptual blending – the dynamic integration processes which build up new " 'blended' mental spaces" and that develop as emergent structures for the construction of meaning. Conceptual blending provides not only an explanation for how we learn but, more important, for how we innovate. Accordingly, we look at the process of metaphor and reflection as a key ingredient in conceptual blending and suggest that virtual worlds and MMOGs provide one of the key tools for integrating imaginative thinking into new systems of education and learning (Turner & Fauconier, 1998).

Flow

If a student player feels like he is an individual in the virtual environment, then he has a true identity and feels like he is present in the virtual world. We use the definition of *presence* defined by Witmer and Singer (1998) as the psychological perception of *being in* or *existing in* the game environment in which one is immersed. In a study of high school genetics students, participants showed much higher engagement (time on task, concentration, etc.) during game play than a similar class doing a traditional genetics laboratory experiment (Annetta, Minogue, Holmes, & Cheng, in press). These results suggested engagements were due to students feeling present and having identity.

As previously mentioned, when players are present, engaged, and motivated to continue the game's challenge, they reach a state of *Flow*. Students enter a *Flow* state when they become completely immersed in an activity and feel at one with it. Csikszentmihalyi (1990, p. 4) defines *Flow* as "... the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it." Csikszentmihalyi (1990) identified eight characteristics that are recognizable (and required) when a person is in a flow state:

1. Feeling the activity can be successfully completed.
2. The player can concentrate fully on the activity.
3. The activity has clear goals.
4. The activity provides fast feedback.
5. Deep involvement in the activity.
6. A sense of control over the actions necessary to perform the activity.

7. Self-awareness disappears during flow.
8. Altered sense of time.

This is an important guideline to use as a basis for designing scaffolds within a game. Players are so engaged and absorbed by certain activities that they seem to *Flow* along with it in a spontaneous and almost automatic manner.

Flow is a highly energized state of concentration and focus. *Flow* can further be considered a psychological state, based on concrete experiences, which acts as a reward by producing intrinsic motivation and active engagement. *Flow* is achieved by increasing the level of challenge as the individual's skill level increases so there is a dynamic tension between the states of boredom and frustration. Finneran and Zhang (2005) stated that flow represents a state of consciousness and that during flow, conscious people are so absorbed in an activity that they show high performance without being aware of their environment.

"Activities in virtual spaces should be usable and provide clear goals and appropriate feedback to the players in order to facilitate the *Flow* experience" (Kiili, 2005, p. 19). According to Kiili, inappropriate challenges of the game environment and bad usability of the computer games reduce the possibility of *Flow* experience. Feedback within games is a crucial idea that is even more important in educational games. Interestingly, educational game feedback does not need to be only content feedback but also performance feedback. These feedback channels should facilitate stealth learning – a concept discussed in more detail later. Pilke (2004) emphasized the user interface of computer games and stated that user interface should not require more cognitive processing in order to facilitate *Flow* experience properly. The more interaction a player has with the computer, the higher probability for engagement and *Flow* to exist. Art Graesser would contend, however, that feedback is more important than getting progress feedback. Confusion is a better indicator of learning than fun or *Flow*.

Conclusion

We will progress more into the idea of artificial intelligence in the next chapter but it is proper to mention it here as well. As it pertains to learning, artificial intelligence built into these environments has the potential to react to wide spectrum of learning abilities. James Gee (2003) challenged the education community by stating the biggest thing limiting games in education in my view is the lack of good artificial intelligence to generate good and believable conversations and interactions. Verbal and visual information are processed in different cognitive sub-regions: a verbal region and an imagery region.

Play systematically confronts the child with a learning situation that could only be located within the area of close development; that is, it would involve a task located slightly above the acquired skills. This has led to the current arguments on the use of games in preschool establishments or beyond (Vygotsky, 1967). We somehow lose the notion of play as students progress from pre-school through higher education. According to Vygotsky, such developmental factors as memory, skill acquisition, and reasoning ability affect a child's capacity to incorporate new knowledge into existing schemes of thought. Incorrect preconceptions need to be confronted in an appropriate fashion to help students develop a deeper understanding. Metacognitively guided learning or reflection, constructing conceptual representations through thought experiments and graphical representations, argumentation coupled with model-based reasoning, and idealized representations are effective methods that will be incorporated in the learning progression modules (Vygotsky, 1962). Incorporating these ideas into 3D virtual learning environments meets the wants and needs of today and tomorrow's learner and is justified in the realm of psychology and cognitive research.

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Chapter 10
Assessing and Evaluating Virtual World Effectiveness

In November 2007, U.S. Secretary of Education, Margaret Spellings, suggested that U.S. colleges and universities implement a standardized test not unlike the K-12 *No Child Left Behind Act*. Measures need to be made to see which institutions are assessing and evaluating their innovation and courses in general (Tyre, 2007). As educational institutions become more data-driven and accountability is increasingly more important, assessment and evaluation of courses is crucial. As it pertains to online delivery of courses, especially those in 3D virtual worlds, many are shying away from assessment and evaluation primarily because it is not an easy venture. Since integrating 3D worlds in education is an emerging idea, something my former college football coach reiterated time again comes to mind. He said, “Prior Planning Prevents Poor Performance.” As we begin to develop or further develop these environments for education purposes, planning how the courses will be assessed and evaluated prior to going live can prevent potential missing data that could help improve courses and meet the requirements for institutional accountability.

The no significant difference phenomenon of the 1990s in studies comparing online courses to their face-to-face counterparts has driven many to design within group studies that lacked some of the rigor to really show the relative power of online education. One important reason for the incoherent findings in online environments is that methodological flaws in the study designs often do not allow a rejection of the null hypothesis of no difference. In 1999, the “Institute for Higher Education Policy” (Phipps & Merisotis, 1999) pointed out that the majority of all published studies comparing online distance education with classroom instruction had serious methodological flaws and poor study designs. Randolph (2007) re-examined these studies and came to a similar conclusion. Most of the studies were quantitative–descriptive, qualitative–descriptive, or correlative studies in which participants were not randomly selected, extraneous variables or feelings and attitudes of students (reactive effects) not controlled for, or the validity and reliability of the measures not reported. Bernard et al. (2004) found that methodological and experimental differences (including inadequacies and missing information) explained a large amount of the reported variation in the research literature. Dwyer, Millet, & Payne (2006) proposed a comprehensive national system for determining the nature and extent of college learning, focusing on four dimensions of student learning:

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- Workplace readiness and general skills
- Domain-specific knowledge and skills
- Soft skills, such as teamwork, communication, and creativity
- Student engagement with learning

Since this book is grounded in game-based learning and 3D online worlds, it has never been a better time to infuse methodologies commonly used outside of education. This chapter will look at how we employed some of these methodologies and how we used the power of available technologies to harness our data collection processes. If the hallmark of games is their interactivity, their ability to grant players agency within the narrative fiction of the game world and its rules, the theoretical models need to account for players' action in creating the experience (Squire, 2006). Relatively few evaluation studies have been conducted on the use of computers in education and on the learning outcomes of the different modes of educational software (Presby, 2001).

In 1991, Brant, Hooper, and Sugrue examined the effectiveness of computer simulations based upon their placement within a larger sequence of instruction. Their design involved the stratified random sampling of 101 college students from an introductory animal science course. Participants were in one of three treatments: one experimental group of students ($n = 34$) that solved computer simulation problems *before* a classroom lecture on the topic; a second experimental group ($n = 32$) that worked on the simulation problems *after* a lecture; and a control group ($n = 35$) that was not exposed to the simulation, receiving only a lecture on the topic. Using a 17-item post-test that assessed students' ability to apply genetics principles to solve breeding problems as their dependent measure, they found that the effectiveness of a simulation is influenced by its placement in the instructional sequence. That is, the group that experienced the simulation prior to the lecture significantly outscored the untreated control group on the genetics test (effect size = 0.91) as did the group that engaged in the simulations after the lecture, but the magnitude of this difference was smaller (effect size = 0.36) (Brant, Hooper, & Sugrue, 1991). In another study, Carlsen and Andre (1992) introduced students ($n = 83$) to a simulation about electrical circuits that was combined with either a traditional text or a conceptual change/refutation text. The treatments were presentation of the simulation before the text, simultaneous with the text, or no simulation. The main cognitive measure was a post-test consisting of 26 items designed to assess participants' conceptualizations about series circuits. It was found that simulation groups' scores were not significantly different than those of the no simulation group but the authors assert that evidence existed that the mental models of the simulation group participants were more advanced.

Guided by the five-step process first elucidated by Heck, Steigelbauer, Hall, and Loucks (1981) we will (1) *identity innovation components* such as teacher behaviors, student activities, or ways innovation resources and materials are used; (2) *identify additional components and variations* that constitute variations of implementation that range from ideal use to unacceptable use for each component; (3) *refine the innovation components* as part of our research plan outlined above;

(4) *finalize the innovation components* as we construct a component checklist consisting of innovation components and a set of variations within each component that is field-tested with a small group of innovation users; (5) *collect innovation data* as we administer the checklist in written or interview format to our innovation users and analyze data in order to determine prevailing innovation configuration patterns.

Given the likelihood of a mixed early reaction to the general concept of postsecondary education assessments, an incremental approach to implementation may be appropriate for initial consideration. Here are several related issues for consideration:

- Regarding assessment development, the options range from having one organization develop and test the needed assessments to the clearly less desirable option (from the point of view of comparability and efficiency) of having each of the 4,071 institutions develop its own assessments.
- The outcomes associated with successful performance on the different dimensions of student learning could vary. For example, mastery of work-readiness skills could lead to a certificate, while performance on domain areas could be tied to a new valuation of the bachelor's degree.
- Performance indicators could be developed for individuals, institutions, or both.
- The number of students taking the assessment could range from all students in higher education to a sample from each institution.
- The number of times that students take the assessments could range from one to multiple times. Several key questions may guide the expert panel as it considers where on the different continua it wishes to place its marks:
- Should there be individual scores? Would this help future employers and graduate and professional schools know more about the inputs into their systems? How should this consideration be balanced with the cost savings of a sampling approach?
- Should there be institutional scores? Would an institutional score help both prospective students and their families have a more informed sense of what the educational experience will be like? What would an institutional score signal to employers and graduate and professional schools about their graduates?
- What should the rollout plan be for the new postsecondary education system? Should a demonstration program be conducted, while plans for a longer-term nationwide system are developed?
- What are the desired types of analyses – pre-/post-test, individual growth models, value-added analyses? Each of these analyses has important data thresholds that need to be met.

Since much of our work has been supported by the National Science Foundation in the United States, it is only fitting we share the Foundation's Division of Research on Learning's Cycle of Innovation and Learning as a framework from which we have operated (see Fig. 10.1).

These five steps to design, implementation, and evaluate an innovation clearly lead to synthesizing lines of work and study new ideas and questions posed by the

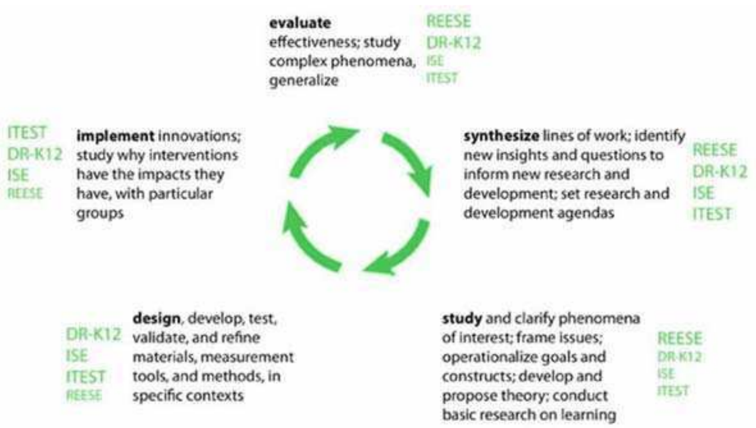

Fig. 10.1 DRL cycle of innovation and learning (Note: Programs whose primary emphases relate to particular components appear in larger type.)

implementation. The model is truly a cycle in that new ideas and research questions facilitate new designs, implementation, and evaluations. As it pertains to our work, we have gone through this cycle numerous times and thus new iterations of our software and courses have evolved tremendously.

Entitled "Being Fluent with Information Technology," a National Research Council Committee (1999) acknowledged tendencies to focus on skills when approaching technology literacy. The report explained that literacy today requires a complement of knowledge and related abilities to be fluent in information technology (FIT). Much of this report aligns with what we suggested in Chapter 1 of this book on 21st Century Skills. According to the report, FITness is a long-term process of self-expression, reformulation, and synthesis of knowledge in three realms: "Contemporary skills, the ability to use today's computer applications, enable people to apply information technology immediately . . . are an essential component of job readiness . . . [and] provide . . . practical experience on which to build new competence. Foundational concepts, the principles and ideas of computers, networks, and information, underpin the technology . . . explain the how and why of information technology . . . give insight into its limitations and opportunities . . . [and] are the raw material for understanding new information technology as it evolves. Intellectual capabilities, the ability to apply information technology in complex and sustained situations, encapsulate higher-level thinking in the context of information technology ... empowers people to manipulate media to their advantage and to handle unintended and unexpected problems when they arise . . . [and] foster more abstract thinking about information and its manipulation."

The report offers an intellectual framework that can help distinguish between achievements (those of a particular time) and learning outcomes (results over time) when assessing what competencies students need to have. The proposed framework might also help differentiate among research (of teaching and learning theories), evaluation (of learning programs and processes), and assessment (of learning outcomes) as scholars and their audiences seek to show who and what measure up or make the grade. Although the specific skills for each area will change with the technology, the concepts are rooted in the basic information and abilities required to function in technology-enabled environments.

What follows is an example evaluation plan we designed in conjunction with colleagues at Information In Place, Inc. on a National Science Foundation-funded project where we are creating training simulations for prospective science teachers. *STIMULATE (Science Training Immersive Modules for University Learning Around Teacher Education)* seeks to use Serious Game technology to train prospective science teachers in laboratory safety and managing a safe classroom environment. These simulations are immersive and take a first-person perspective not unlike training simulations used by the military and medical fields.

First, each class was randomly assigned into one of the two treatment groups. Pre-tests were given to all participants one week before the intervention began. Once the intervention period began, treatment group #1 played three interactive *STIMULATE* game modules over a period of six weeks. They had access to the game during non-class time. At the same time, treatment group #2 received a written case study scenario that was the same as the ones used in *STIMULATE*, and their interactivity was through classroom analysis and discussion of the case-based reasoning approaches. At the end of each game session and in both treatments, the professor led the class in a whole group discussion of an after action review analysis focusing on decisions made, evidence supporting those decisions, and a discussion of specific domain-specific content addressed in each scenario. These after action reviews were videotaped so that individual classroom interactions could be analyzed in more detail.

One week after the intervention, both groups completed post-tests. One week after the post-test, individual semi-structured interviews were conducted with eight students and four professors to better understand student and classroom specific patterns and implementation issues.

Simulation and Game Design

We find that the model presented by Garris, Ahlers, and Driskell (2002) and (Fig. 10.2) helps us to articulate how the prior work done in the areas of computer-based instruction, inquiry-based science, and learner-centered design amalgamate to inform our work. This model involves the design of computer-based instructional program that incorporates instructional content and certain features games. They suggest that the six key dimensions that characterize games include the following: fantasy, rules/goals, sensory stimuli, challenge, mystery, and control. Next, they assert that the combination of instructional content and game characteristics initiates a *game cycle* that involves user judgments or reactions (such as enjoyment or interest), user behaviors (such as greater persistence or time on task), and system

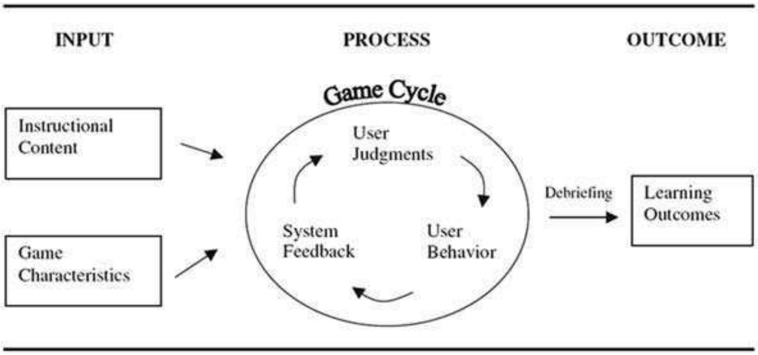

Fig. 10.2 Simulation design from Garris, Ahlers, and Driskell (2002)

feedback. During this cycle, users are actively constructing knowledge from their experiences within the virtual world in which they are immersed. This model also includes a *debriefing* phase that serves to provide a critical link between the game cycle and the achievement of the desired learning outcomes. This debriefing often includes the review and analysis of events that occurred in the game itself (Garris, Ahlers, & Driskell, 2002), what we called the *after action review*.

Dondi & Moretti (2007) nicely categorized learning objectives, required features, game typology, and possible number of players. Table 10.1 briefly illustrates this categorization.

Design-Based Research

Researchers working in these areas are helping to chart the way by identifying best practices in commercial and educational game design that are also consistent with both cognitive and constructivist learning theories. Many of our projects engage in "Design-Based Research" (Squire & Barab, 2004, Brown, 1992; Cobb, Confrey, deSessa, Lehrer, & Schauble, 2003; Design-Based Research Collective, 2003), the results of which are then integrated into the three dimensions of the "contextual model of learning" in free-choice environments as posited by Falk and Dierking (2000). We believe our work is beginning to establish an international dialogue among educators as to how game-based learning can most effectively reflect and inform the personal, physical, and socio-cultural contexts of free-choice learning. Although not fully embraced by the research community, particularly those who advocate for randomized controlled trials in education, we feel that this research paradigm is highly appropriate for this innovation.

We generally engage in two cycles of design, development, enactment, analysis, redesign, and refinement of our intervention in order to generate design knowledge and build theory. Our studies employ a *concurrent triangulation* research design. This mixed-methods strategy utilizes both quantitative and qualitative data in an

Table 10.1 Dondi's learning game categorization

Learning objective(s)	Definition	Required features	Typology	Number of players
Applying concepts and rules	Translate knowledge into new contexts	Presents of a set of rules and instructions, possibility of applying the rules to different contexts, balance between reality and abstraction, chance as a factor, finite scenarios in game, documentation of the scenario, real-time monitoring, time considerations, open-endedness, session based	Sport games, action-adventure games, driving games, drill-and-practice games	Single player vs. the PC
Decision-making (strategy + problem solving)	Knowledge analysis based on problem solving, prediction, drawing conclusions, choice making, reasoned argumentation	Narrative based, chance as a factor, finite scenarios in game, documentation of the scenario, real-time monitoring, time considerations, considering background knowledge	Strategy games, adventure games, role play games, simulations	Single player in connection with other players/opponents

Table 10.1 (continued)

Learning objective(s)	Definition	Required features	Typology	Number of players
Social interaction/value/cultures	Understanding the social environment of others	Chance is not a factor, involves deep negotiation or coalition skills, reflection as a factor, persistent state game, Narrative based, presence, time is not a factor, difficulty determined by the abilities of more then one player, relevant feedback,	Strategy games, role play games, simulations	Multiple players
Ability to learn/self-assessment	Evaluation	Available evaluation tools, engine provides different scenarios each time, relevant documentation, time is not a factor, presence, after-action review, reflections, chance is not a factor, balance between action and reflection	Role play games and simulations	Single player

attempt to confirm, cross validate, or corroborate findings within a single study. We implement the quantitative and qualitative methods and measures during each of the "testing cycles" and with equal weight to obtain different but complementary data regarding our interventions (Creswell, 2003; Creswell, Plano Clark, Gutmann, & Hanson, 2003).

With a focus on linking processes to outcomes in particular settings, this iterative process requires the collection and coordination of a complex array of data sources including video and audiotapes, student work, classroom observations, responses to interviews, and formative test results (Cobb, Confrey, deSessa, Lehrer, & Schauble, 2003).

The multiple sources of qualitative data generally emerge from our studies that are analyzed according to standard procedures for qualitative analysis (e.g., Coffey & Atkinson, 1996; Erickson, 1992; LeCompte, Millroy, & Preissle, 1992), with each data source analyzed slightly differently based on the type of data it yields and the purposes of the data.

Testing the Intervention

Through systematic feasibility and usability studies of successive versions of our interventions, we collect data that are used to inform and guide the creation and refinements of our program prototypes. What follows is a comprehensive description of our data sources, potential measures, and how we use the information generated.

We propose that good design-based research exhibits the following five characteristics: First, the central goals of designing learning environments and developing theories or "prototheories" of learning are intertwined. Second, development and research take place through continuous cycles of design, enactment, analysis, and redesign (Cobb, 2001; Collins, 1992). Third, research on designs must lead to sharable theories that help communicate relevant implications to practitioners and other educational designers (Brophy, 1998). Fourth, research must account for how designs function in authentic settings. It must not only document success or failure, but also focus on interactions that refine our understanding of the learning issues involved. Fifth, the development of such accounts relies on methods that can document and connect processes of enactment to outcomes of interest.

To better understand the importance of integrating design-based research, it is important to clarify the distinction between existing methods for understanding learning and cognition, and those central to design-based research. Collins, Joseph, and Bielaczyc (2004) contrast several different methodologies with design-based research. They posit seven major differences between traditional psychological methods and the design-experiment methodology. Barab, MaKinster, & Scheckler (2004) summarized this notion by stating, "Central to this distinction is that design-based research focuses on understanding the entropy of real-world practice, with context being a core part of the story and not an extraneous variable to be trivialized. Further, design-based research involves flexible design revision, multiple

Table 10.2 Comparison of psychological experimentation vs. design-based research

Category	Psychological experimentation	Design-based research
Location of research	Conducted in a laboratory	Occurs in real-life settings where most learning takes place
Complexity of variables	Involves a single or a few dependent variables	Involves multiple dependent variables including climate variables (e.g., collaboration among learners, available resources), outcome variables (e.g., learning of context and transfer), system variables (e.g., dissemination and sustainability)
Focuses of research	Involves identifying a few variables and holding them constant	Involves characterizing the situation in all its complexity
Unfolding of procedures	Uses fixed procedures	Involves a flexible design revision in which there is a tentative initial set that is revised depending on the success in practice
Amount of social interaction	Isolates the learner to control interaction	Involves complex social interactions with participants sharing ideas, distractions, etc.
Characterizing the findings	Focuses on testing the hypothesis	Involves looking at multiple aspects of the design and developing a profile that characterizes the design in practice
Role of the participants	Participants as subjects	Involves different participants in the design so to bring different expertise into producing and analyzing the design

dependent variables, and capturing social interaction. In addition, participants are not 'subjects' assigned to treatments but instead are treated as co-participants in both the design and even the analysis. Last, given the focus on characterizing situations (as opposed to controlling variables), the focus of design-based research may be on developing a profile or theory that characterizes the design in practice (as opposed to simply testing hypotheses)." Table 10.2 shows Barab's comparison of psychological experimentation versus design-based research.

Finally, we would like to include the characteristics of design-based research proposed by Wang & Hannafin (2005) as another way of illustrating the power of this paradigm (Table 10.3).

Assessment Techniques

In an attempt to depict how the features and components of a project developed by my colleague, Dr. James Minogue, are related to resources, activities, and outcomes, we used a logic model to guide our design (Fig. 10.3). Although most logic

Table 10.3 Wang's design-based research characteristics

Characteristics	Explanations
Pragmatic	Research refines both theory and practice, the value of theory is appraised by the extent to which principles inform and improve practice
Grounded	The design in theory driven and grounded in relevant research, theory and practice, the design is conducted in real-world settings and the design process is embedded in and studied through design-based research
Interactive, iterative, and flexible	Designers are involved in the design processes and work together with participants, processes are iterative cycles of analysis, design, implementation, and redesign, the initial plans is usually insufficiently detailed so that the designers can make deliberate changes when necessary
Integrative	Mixed research methods are used to maximize the credibility of ongoing research, methods vary during the different phases as new needs and issues emerge and the focus of the research evolves, rigor is purposely maintained and discipline applied appropriate to the developmental phase
Contextual	The research process, findings, and changes are well documented, results are connected with the design process and the setting, the content and depth of generated design principles vary, and the guidance for applying generated principles is needed

models include short-, intermediate-, and long-term outcomes, given the focus on development, we felt that the identification of long-term outcomes would be a bit premature.

This example depicts how a project employs design-based research with the inclusion of experts. The logic model is a good way to illustrate the design process to easily organize one's thoughts on the initial design phase. The model can be changed as the iterative design process unfolds.

Usability/Feasibility

In software development, usability and feasibility are two very important concepts by which the design process is informed. It is critical to be sure the software, or in this case the virtual learning environment and simulations, is understood by the end users and that it can be sustained as technology evolves.

We have attacked this issue by collecting data through remote (e.g., simulation back end, videoconference, telecommunications) access and face-to-face cognition interviews. Convenience sampling is generalized and used because it is increasingly difficult to stratify participants from a distance. These participants are asked pointed questions focusing on how the environment is used, how decisions are made in world, and how content is understood as it relates to real-world scenarios.

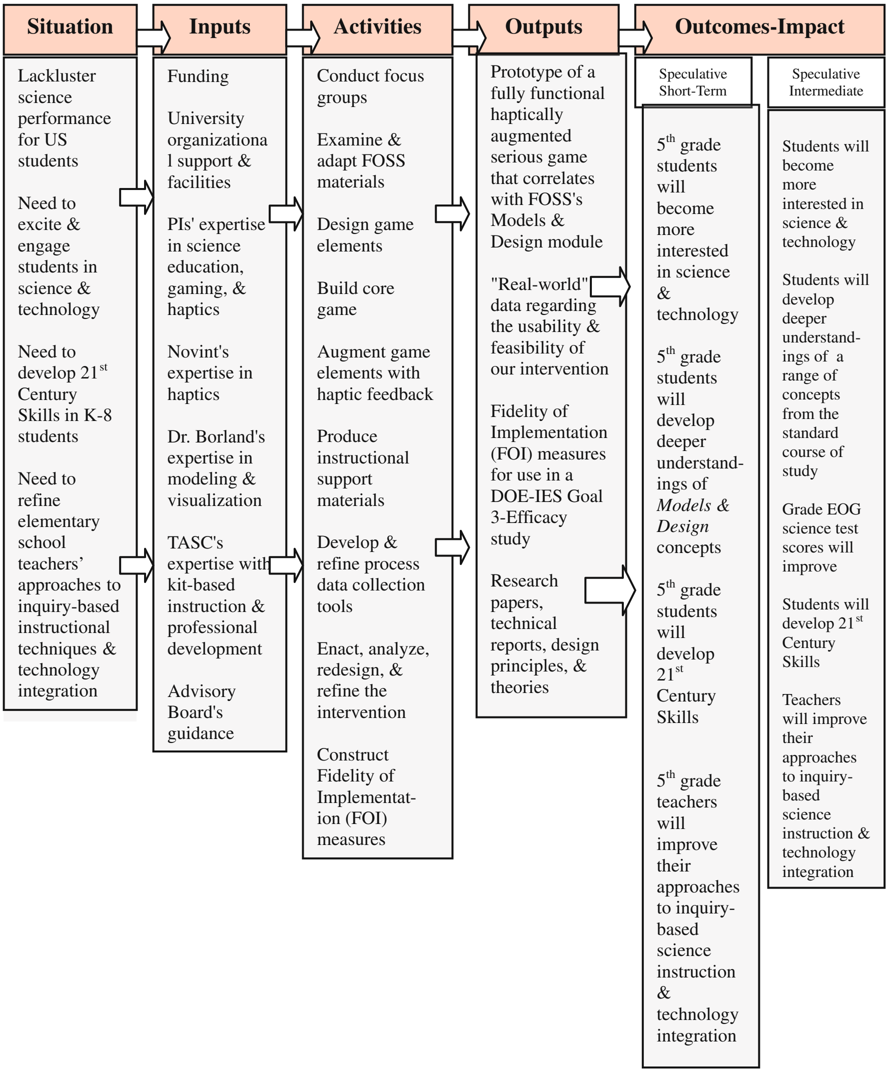

Fig. 10.3 A logic model for the *ASPECT* project

The multiple sources of qualitative data that emerge from this technique are analyzed according to standard procedures for qualitative analysis (e.g., Coffey & Atkinson, 1996; Erickson, 1992; LeCompte, Millroy, & Preissle, 1992), with each data source analyzed slightly differently based on the type of data it yields and the purposes of the data.

The purpose of this phase of the research is to determine the perceived effectiveness of the proposed design of environment or simulation scenarios as well as to use the outcomes to further improve the design of the product. In this first phase of the research, we use methods of qualitative naturalistic inquiry (Lincoln & Guba,

1985) with a focus on learner-centered design (Quintana et al., 2004) and participatory design (Schuler & Namioka, 1993) approaches. The team creates a preliminary design document, which provides written descriptions and storyboards of the key scenarios. We then use methods of rapid prototyping (Tripp & Bichelmeyer, 1990) which enable the team to "test" the ideas with potential users of the environment or simulation in order to obtain early feedback to improve designs as well as to inform the overall effort of what issues arise with regard to designing this type of environment for this type of audience.

To understand the perceived effectiveness of design outcomes, we provide surveys and conduct focus groups. Surveys are used to collect demographic data on participants as well as to respond to 5–10 questions related to the design ideas. Focus group discussions are then held to specifically examine how well the scenarios potentially impact usability and feasibility of the proposed audience.

Usability Data

We are equally interested in gaining insight into the usability of our intervention. Thus, another key component of our research plan involves the collection, analysis, and careful application of *usability data*. Following the design-based research model, we regularly collect and analyze multiple sources of data. These sources include the following: (a) classroom observation protocols; (b) videotapes of testing sessions; (c) student think alouds; (d) student questionnaires; (e) students and teacher interviews; and (f) formative knowledge assessments and attitudinal assessments.

Classroom observations. Adopting ethnographic techniques, we become part of the user community and make careful observations of our intervention in use. These focused observations of our test sessions require the development of classroom observation protocols and coding schemes. One such instrument we tend to use is the *Science Teacher Inquiry Rubric* (STIR) (Beerer & Bodzin, 2003). This instrument allows us to quantify and plot classroom activities along an inquiry continuum. Comparing pre-intervention and post-intervention activities helps us assess whether or not our intervention is actually promoting inquiry as we intend it to.

Videotapes of testing sessions. When usability issues exist, participants often hesitate, struggle, and/or become frustrated. Thus, content analysis and resulting codings of user's speech and actions during the videotaped testing sessions likely yield critical information about a wide range of factors including workflow, navigation, and terminology.

Think alouds. A researcher from the team also works individually with one student during each of the testing sessions. This researcher has the student user engage in concurrent think aloud strategies in an attempt to gain insight into how students process information as they engage in our environments and simulation. Users are asked to verbalize their actions, perceptions, and expectations regarding the application's interface and functionality (Dumas & Redish, 1999; Ericsson & Simon, 1993).

Questionnaires. Although limited somewhat by the relatively low number of students involved, it is still expected that this approach will generate valuable data regarding users' level of comprehension of our program's purpose and functionality, initial expectations of where features are located within a system's interface, and reactions to the visual design of an interface.

As part of the collection of usability data, we also develop and administer open-ended and Likert-scale questionnaires to all student users. Open-ended prompts may include the following: *What do you like best about the instructional program? What do you like least about the instructional program? What aspects of the instructional program would you like the designers to change? How?* Again, through our work with Dr. James Minogue, his instrument, *AIM* – a solo taxonomy, prompts participants to answer questions with regard to knowledge gain and transfer. Written responses to the open-ended items are coded and trends are identified. The quantitative results of the Likert-scale items are analyzed descriptively and both data sources are fed into the analysis, redesign, and refinement cycle.

Interviews. We also engage in retrospective probing (Wickens & Hollands, 2000) of the student users. Semi-structured interviews of a randomly chosen sub-sample of students are conducted immediately after they have completed a task or series of tasks with our intervention. Designed to reveal the users' memories of their experiences, responses highlight major usability concerns or issues that are prominent in the users' minds.

It is expected that this approach will generate valuable data regarding users' level of comprehension of our program's purpose and functionality, initial expectations of where features are located within a system's interface, and reactions to the visual design of an interface. These interviews are often audiotaped, transcribed, coded, and analyzed in an effort to further isolate areas of strength and weakness regarding the usability of our intervention.

Usability data are also garnered from the potential teacher participants. Given that they will be integral to the design, development, testing, and refinement process, it is equally critical to tap into their observations and feelings regarding the usability of each iteration of the interventions. Straight forward and important questions such as *Does the software program crash when students use it? Are the activities planned for a particular lesson do-able within the allotted time?* are asked. Again, the results of such sessions are recorded and its content analyzed to inform subsequent "design and test" efforts.

Feasibility Data

Early on in the project we conduct focus groups with diverse groups of participants from the targeted audience. The focus of these sessions is to document the viability of integrating our environment or simulations in authentic education delivery settings. Here we operationally define *diversity* as potential students with varying age, gender, race, years of online learning experience, and their reported use of technology. Each of these focus groups is videotaped or screen recorded to allow for subsequent analysis.

Additional critical insights into the feasibility of our intervention in our particular setting are gained throughout the development and testing phases. Although much of this data collection is gathered informally, this information constitutes a key piece of the feasibility studies.

In addition to the above described focus group sessions and informal conversations with the participants, feasibility data are collected via survey instruments. Due to the 3D, game-like nature of our environments and simulation, we like to use the *Self-Efficacy in Technology and Science* (SETS) (Ketelhut, 2005). This instrument focuses on efficacy as it pertains to science as inquiry and common informal technology uses such as video games, online chat, etc. Analysis of this survey data is descriptive in nature and we look for relationships between specific items/topics and characteristics of respondents in order to better assess the technical, organizational, and cultural feasibility of our intervention.

Recognizing the importance of administrative support in the ultimate success of educational innovations, we also interview district level officials and school level administrators. Through our content analysis, we posit these sessions will highlight any potential barriers (be they logistical, financial, or philosophical) to the implementation of our program, as well as gauge the level of support for a larger scale implementation in the future.

In short, through these activities, we aim to accurately assess the pedagogical feasibility, management feasibility, economic feasibility, and client acceptability of our computer-based instructional program and this information will help inform the initial design of our intervention.

Server-Side Data Collection

During each testing session, we use *Just-In-Time* (JIT) analysis so that we can record technical problems, immediately generate a prioritized master list of problems, and fix as many as possible on the spot. If problems are not remedied immediately, we use affinity analysis in which each problem is written on a sticky note, notes are placed on a wall or board, notes (problems) are grouped into emergent categories, and assigned a priority and fixed. This process represents a critical component of any development project. We must not lose sight of the fact that we are ultimately attempting to design and build an intervention that is *likely to produce better student outcomes relative to current education practices*.

One of the many assessment ad evaluation components to integrating virtual learning environments in distance learning is their ability to incorporate data tracking, analytics, and bots in what I have called *virtual observations*. Often in educational settings we record classes to ascertain what works and what needs more refinement. However, when teaching from a distance, this technique becomes difficult, especially in asynchronous learning. In our environments, and as part of the design process, we create tracking systems to help us analyze data stored on servers.

Data are collected electronically using a customized tracking system. We include such variables as unique user logins (demographics), time stamps, patterns of use and interaction, chat logs, and in-world decisions (especially in simulations, field trips and labs). When students first log in to the virtual learning environment, they receive a tracking code and each decision they make as they navigate through the environment or simulation is recorded in the tracking system. Most often analyzed is each user's time stamp and chat logs in the multi-user environment. The chat logs tend to serve as an ill-structured *think aloud*. To analyze this data, we conduct several readings of the whole transcripts from the chat logs. Then we use Miles and Huberman (1984) "concurrent flows" of analyses approach to data analysis. This approach has the following phases: (1) data reduction, the transformation of raw data, and decision-making regarding data "chunking" (2) data display, the assembling of information into displays such as matrices, graphs, and charts (3) conclusion drawing, with notation of "regularities, patterns, explanations, possible configurations, causal flows, and propositions." It is important to note that this data is analyzed for specific content, such as focusing on text relating to a particular theme. These processes in the data can only be identified by several readings of the whole transcript and tracing an individual's text in the context of other participants' text.

As it pertains to simulations, in-world decisions and patterns of use become critical variables for which data mining techniques can be used. According to Ian Ayres, an econometrician and law professor at Yale, data mining analytics is a microcosm of a powerful trend that will shape the economy for years to come. He states that these data are the replacement of expertise and intuition by objective, data-based decision making made possible by a virtually inexhaustible supply of inexpensive information. Ayres calls those who use and manipulate these data streams as *Super Crunchers*, which is also the title of his book. Ayres continues by stating that Super-crunchable data can be broadly statistical or profoundly personal.

In a study in which we partnered with Dr. Chris Dede, Harvard University Professor of Learning Technologies, his doctoral student Geordie Dukas, and *SAS©*, we used data mining techniques to gain insight into server-side data potential as an emerging form of education analytics. In one online simulation where Algebraic concepts were being taught, server-side data were used to create a visual display of pattern tracking and in-world decisions made by students engaged in the simulation over the course of a semester.

Figure 10.4 illustrates the simulation map: the level and models of the simulation. The ultimate goal of this simulation was for each student to save the high school by defeating a witch who challenged the students to high level algebra questions.

Figure 10.5 shows the overall student decisions in this world. Note, the darker the shaded area, the more decisions made in this simulation and vice versa. The areas marked in red illustrate male decisions and those marked in blue show female decisions. There are three avenues in which a student could win this game (denoted by the "InRadius OfWitch" in the upper left of the map). Students could climb the walls (shown on the left side of the map) while answering questions of increasing

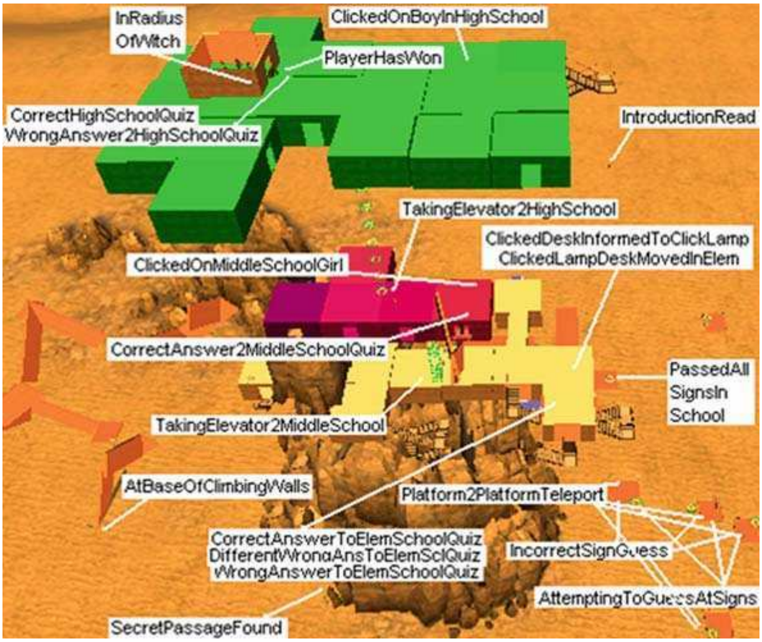

Fig. 10.4 Aerial view of algebra simulation

difficulty as they progress up the walls and through elementary, middle, and finally high school. Secondly, students could answer some high order questions that would give them a secret code that would move them to the top level. The secret code/high order question region is shown in the lower right side of the map. Finally, a student could find the secret passage to the top level. The passage is found in the lower middle of the map. What we see in Fig. 10.5 is that students spent the lion's share of their time attempting to answer the high order questions that unlocked the secret

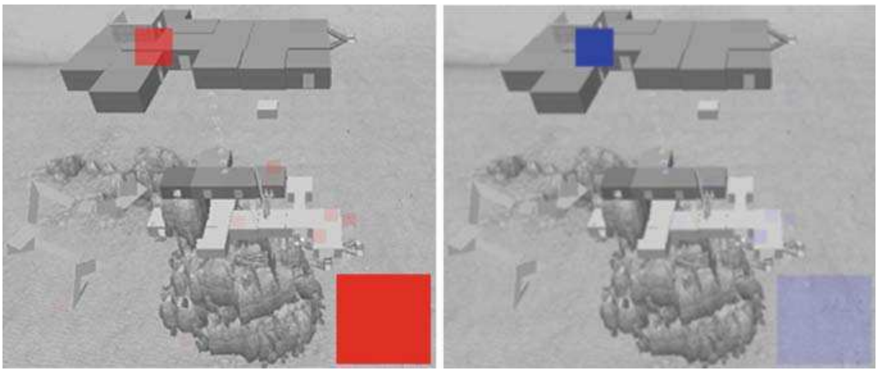

Fig. 10.5 Overall gender decisions in the algebra game

code. Interestingly enough, males spent more time in this area suggesting they had more incorrect guesses than females. Because the blue square in the upper left is darker for females, we can see that females also defeated the witch and won the game more often than males.

If we are to break these decisions down by time, another interesting event occurs. In the first 3:00 min from login, males not only had more guesses in the secret code area, but also there were some decisions being made to find the secret passage (Fig. 10.6). The secret passage is equivalent to what commercial games call *cheats*. It is an easy path to the final level. The developer of this simulation was curious if anyone would look for a cheat rather than answer the questions that were designed to teach the Algebraic concepts. Moreover, the lightly shaded red squares (other than those in the secret passage region) suggest that males not only read the game instructions, but also answered more questions through the game progression than did females. What we don't know is whether or not males just wanted to "play" the game by finding all of the game's triggers or they just could not answer the high order questions in the lower right that unlocked the secret code.

Finally, Fig. 10.7 shows that all females finished the game within 6:00–9:00 min from login. It also suggests that males were either progressing through the game at a normal rate or still trying to guess the code. Some males had finished within this time period but most have not.

These illustrations begin to shed light on the developmental aspects of the simulation and provide critical user data as to how to refine the simulation. Even through regular observational methods, the coding and analysis would create time constraints usually not worth the effort by some researchers. However, using this tracking technique ensures an immediate visual output that provides the needed data for refining the intervention.

From these images, we can work backward to discuss how the data were collected and stored in world. Figure 10.8 shows an example of a True/False type item that is built into the system. Based on the answer given by the student, the responses are numerically coded and sent to the server.

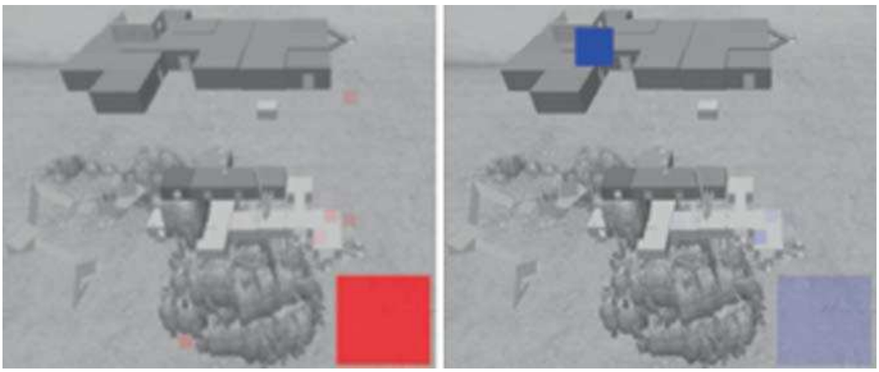

Fig. 10.6 In-world decision in the first 3:00 min

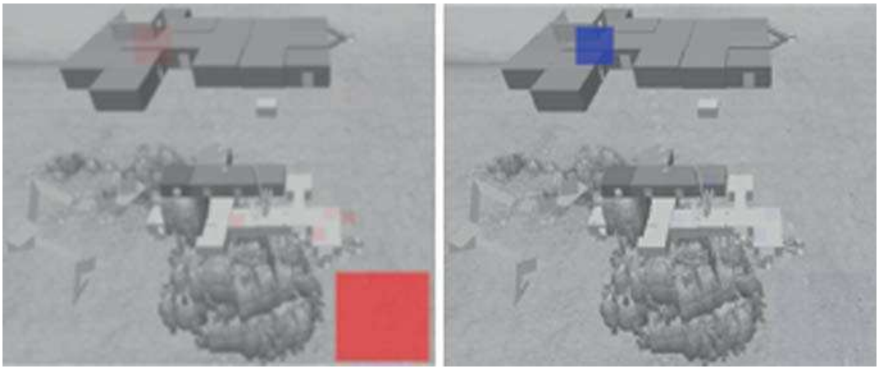

Fig. 10.7 In-game decisions from 6:00 to 9:00 min from login

Fig. 10.8 In-world assessment example

Cognitive Ethnography and Discourse Analysis

For the qualitative readers, Steinkuehler (2006) introduced the concept of cognitive ethnography (Hutchins, 1995): a "thick description" (Geertz, 1973) of the socially and materially distributed cognitive practices that constitute MMOs. She reports that the proper unit of study for work on cognition is not the individual "head" but rather the intact interactional structures of social and material activity. In most ethnographies, the researcher participates overtly, observing what goes on within the virtual world, taking digital video recording and field notes, listening to what is said, asking questions, and generally “collecting whatever data are available to throw light on the issues that are the focus of the research”. “From these data, patterns of routine cognitive/cultural activities can be discerned. Meaning is therefore not individual but rather it is embedded in the history and social practices of the group” (Gee, 1999, p. 105) answers to the remaining research questions, such as what and where learning occurs and what it means for the identity of participants in the gaming culture, which are inaccessible without such groundwork.

In addition to routine observation and field notes, participants/students of varying ages, ethnicities, socio-economic statuses, and levels of expertise/social status within the community are recruited and interviewed repeatedly in unstructured (e.g., informal conversation within the virtual worlds), semi-structured (e.g., telephone/Skype interviews about particular topics of interest), and structured (e.g., repertory grid interviews, Fransella & Bannister, 1977) formats. Finally, chat logs form are also collected in order to capture virtual world actions.

Further, discourse analysis can take the chat logs and answer research questions beyond the scope of cognitive ethnography. Gee (1999, pp. 4–5) defined *discourse analysis* as “the analysis of language as it is used to enact activities, perspectives, and identities.” Understanding which and how particular social and material practices mark membership in the MMO communities and how participation in those practices shape, and are shaped by, participants’ identities within and beyond the game, requires understanding the *situated meanings* individuals construct (not just the information they process), the definitive *role of communities* in that meaning, and the inherently *ideological nature* of both. Coming out of the New Literacy Studies (e.g., Gumperz, 1982; Halliday, 1978; Kress, 1985; Street, 1984), d/Discourse theory (Gee, 1999) provides a way to maintain the Learning Sciences’ focus on intact interactional structures, while, at the same time, foregrounding the role of d/Discourse (language-in-use/“kinds of people”) in such interactions.

Such analyses focus on the configurations of linguistic cues used in spoken or written utterances in order to invite certain interpretive practices. Configurations of such devices signal how the language of the particular utterance is being used to construe reality in terms of the following: (1) *semiotics*, what symbol systems are privileged, how they construe the relevant context (the world), and on what epistemological basis; (2) *the material world*, what objects, places, times, and people are relevant and in what way; (3) *socio-cultural reality*, who is who and what their relationships with one another are, including the implied identity of the speaker/writer and who the audience is construed to be, all in terms of affect, status, solidarity, and (shared or disparate) values and knowledge; (4) *activities*, what specific social activities the speaker and her interlocutors are taken to be engaged in; (5) *politics*, what social goods are at stake and how they are and “ought” to be distributed; and finally (6) *coherence*, what past and future interactions are relevant to the current communication (Gee, 1999). Through microanalysis of how group members’ utterances construe the world in particular ways and not others, we are able to infer the cultural models and concomitant Discourse(s) as play. With such analyses comes explication of the full range of social and material practices with which they are inextricably linked, since the meaning of those practices is done with and through language in-use. Through such discourse-analysis-based ethnographic work, then, we capture the sense human beings make of the social and material world and their (inter)action with it – in other words, we finally get at the phenomenon of cognition itself, in all its unbounded, situated, distributed, social, and ideological messiness.

Heuristics

Heuristics are yet another way to measure variables in virtual worlds. Five heuristics – interactive creativity; selection hierarchy; identity construction; rewards and costs; and artistic forms – form is the structural basis of Web-based communities according to Gallant et al. (2007). The heuristics were developed using a threefold process. First, they examined past research and developed a 10-item list of elements they deemed essential to online communities. Second, they ran a content analysis of written responses from 18 participants. Third, they investigated how the 10 items related to the participants' use of Web-based communities. This analysis produced the five heuristics of Web-based communities. Finally, they tested these five heuristics on three focus groups with participants who are heavy users of two popular Web-based communities: Facebook and MySpace. The five heuristics of facilitating social usability for Web-based communities were verified in the empirical analysis.

Engagement

Engagement is one of the key indicators of learning as we point out many times throughout this book. However, measuring engagement is not an easy task. In 2003, Elaine Chapman summarized successful techniques in assessing online engagement. She explained that a few studies have used summative rating scales to measure student engagement levels. Summarizing her work, she points to studies done outside of the electronic medium but studies that can be applied to online learning. Teacher report scales used by Skinner and Belmont (1993) and Skinner, Wellborn, and Connell (1990) asked teachers to assess their students' willingness to participate in certain school tasks such as effort, attention, and persistence during the initiation and execution of learning activities. They also delved into their emotional reactions to the aforementioned tasks (i.e., interest vs. boredom, happiness vs. sadness, anxiety, and anger, such as "When in class, this student seems happy"). The *Teacher Questionnaire on Student Motivation to Read* developed by Sweet, Guthrie, and Ng (1996) also asked teachers to report on factors relating to student engagement rates. These activities (e.g., enjoys reading about favorite activities), autonomy (e.g., knows how to choose a book he or she would want to read), and individual factors (e.g., is easily distracted while reading) were targeted in their analyses.

Triangulating data sources is a key to ensuring reliability. In online virtual worlds, it is difficult to observe students, especially if the course is delivered asynchronously. A number of established protocols are available for observations when the virtual observations (as previously mentioned) are not available (e.g., Ellett & Chauvin, 1991; Ysseldyke & Christenson, 1993; Greenwood & Delquadri, 1988). The *CISSAR (Code for Instructional Structure and Student Academic Response*: Greenwood & Delquadri, 1988), for example, defines *engagement* in terms of behaviors such as attending (e.g., reading from the blackboard), working (e.g., reading aloud/silently), and resource management (e.g., looking for materials). Clearly these actions are nearly impossible to observe unless the online course closely mimics the seated classroom. What is of critical importance is observer agreement as it pertains to scoring observational protocols. Inter-rater reliability on a near-point scale provides reliability measures that validate scores from two or more different observers of the same actions. Near-point ratings account for observer agreement on a ± 1 regardless of the protocol used. This is why a common protocol is important and that the observers are properly trained on the use of the specified protocol.

You might ask how one observes classroom engagement in 3D virtual worlds? The answer is twofold. First in synchronous meetings, software packages such as *Camtasia* or the open-source equivalent *Camstudio* could be used to video capture the entire class. Just as one might review a videotaped class at a later time to view and score student dynamics, these captured videos can be saved electronically and opened on the computer. In what I have called *Virtual Observations*, the server-side data mentioned earlier can code student dynamics in real time and store the information to be mined at a later time. Thus, you don't need to video capture classes or if the class has an asynchronous component, the researcher can "observe" student engagement by looking at the mined data stored on the server.

Lessons Learned for Future Growth

This project really sheds light on how to better prepare for game and simulation development. Specifically, we learned that gender is an important variable when designing questions and understanding how males and females spend their time in an educational game/simulation. The visual model created at Harvard is a nice substitute to conventional data mining software and techniques and it provides researchers with an idea of how recorded events are effecting in-world decisions. What this model does not tell us is why these decisions were made. Future research on how to better establish an analytic model and how that model influences game and simulation architecture is sorely needed.

As described in the National Research Council report, *Knowing What Students Know* (Pellegrino, Chudowsky & Glaser, 2001), sophisticated educational media now enable the collection of very rich data streams about individual learners. As previously mentioned, each participant's utterances, interactions, and movements in a digital educational setting are automatically time-stamped and archived in a relational database. Analyzing these rich data streams can potentially yield the following:

- Formative, diagnostic information that provides real-time feedback to teachers on which kinds of students are most at risk in a particular learning situation and what types of immediate assistance to use for each (Feng & Heffernan, 2005);
- Summative assessments about what each student has mastered, based on authentic performances, are a richer, more accurate assessment of educational outcomes than are standardized pre/post measures (Hulshof, Wilhelm, Beishuizen, & Van Rijn, 2005);
- Insights about complex patterns and dynamics of student behavior and learning related to individual characteristics such as gender, native language, and prior educational preparation (Ketelhut, Dede, Clarke, Nelson, & Bowman, in press);
- A better understanding of collaborative problem solving and team learning processes (Avouris, Margaritis, & Komis, 2004; Linton, Goodman, Gaimari, Zarrella, & Ross, 2003; Suthers & Hundhausen, 2003); and
- Insights about the microgenetics of learning by examining patterns and relationships between students' behavioral patterns and learning outcomes.

Through the use of real-time intelligent agents (virtual world-based characters programmed to respond to user actions) coupled with data mining (Seydim, 1999), this could eventually provide the basis for real-time analysis identifying comparable paths of students currently in the 3D virtual environments.

Kennerly (2003) proposed a sequence of assessing actions and mining data in game-based environments. The 6-part sequence states

1. Live: Scoop up lots of raw data in the live service.
2. Archive: From here, clean it up and store it for safekeeping in an archive.
3. Statistics: Sift through the data to create statistics, which are more informative than the raw data.
4. Analysis: Then apply the actual mining, which yields knowledge about player performance.
5. Hypothesis: Propose hypotheses about how to tune the game.
6. Test: Test each hypothesis and then introduce the new design into the live service.

The final step closes the loop.

Kennerly further proposes an alternative method to cleaning data taken from the server. Here is a simple method that economizes storage space and reduces mining computation.

This preprocess has five general steps:

1. Take a snapshot of the database.
2. Validate that the data is clean and appropriate for analysis.
3. Integrate the data into a central archive.

4. Reduce the data down to just the fields you need.
5. Transform the reduced data into a form that is easy to analyze for player performance.

Conclusion

In conclusion, assessing virtual environments is a new and critical avenue for future research and evaluation. It is important to constantly assess the effectiveness of our teaching – and this has never been as important as now – and when you create and teach in a new setting. This chapter provides some insight into how you may assess your courses in 3D virtual environments so that the data can inform practice.

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Chapter 11
Tri-Hybrid Learning

Introduction

Traditionally, classes were mainly taught in the classroom, but this book has shown how many classes have moved toward a blended way of learning and the benefits of this style of teaching. Blended learning is a combination of different approaches to learning. Normally, it encompasses both classroom sessions and technology resources (e.g., Web sites, course management systems, or learning management systems). Common examples of blended learning include traditional classroom meetings with an information Web site that contains most of the information found in the syllabus as well as additional resources needed for the class and occasional announcements. For example, at least one statistics class at North Carolina State University used this method. Students met five days a week for face-to-face classes with the instructor, but had access to his Web site where all course information was posted. This included homework assignments, class notes, labs, data for problems, and *SAS© code*. In addition, the professor posted announcements regarding changes to homework or quiz problems. Another example of blended learning is students meeting once a week for class, then reading and discussing articles by using an online forum for homework. Still, other classes offer face-to-face lectures, unlike everything else (e.g., exams, homework assignments, discussions, etc.) that is conducted through a course management system.

Blended learning allows teachers and students to communicate on a number of levels that previously were not available with classroom-only sessions. In many ways, the teacher is now more accessible to the student with the help of forums and e-mail than he or she was before using only scheduled classes and office hours. In addition, blended learning offers the benefits of classroom instruction with the advantages of individualized learning, which helps to reach a broader range of student needs. Today, blended learning is not only common in school settings, but is also popular for workplace training and continuing education.

As technology continues to advance, education must keep up or be left behind. Virtual worlds are becoming more and more a part of everyday life for many people around the world. Gartner, a technology research firm, states that "current trends suggest that 80% of active Internet users and Fortune 500 companies will participate

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in Second Life or some competing virtual world by the end of 2011" (Roush, 2007, p. 8). Virtual worlds are places where people come to socialize, play, conduct business, and even learn. They give the person a sense of face-to-face communication, even when in reality people may be thousands of miles apart. Virtual worlds allow people to experience things they may never be able to experience in real life, from traveling to new locations, to exploring an atom or space, to even something as small as walking that many of us take for granted (Appel, 2007). Virtual worlds can also prepare us for things we may experience in the real world from flying a plane or triaging causalities to learning how to shop in a supermarket (Neale, Brown, Cobb, & Wilson, 1999). One of the great things about virtual worlds is that they are an equalizer in a number of ways that just can't occur in a classroom. People are no longer judged by their appearance or abilities. If we looked at avatars the same way we look at people, we would be shocked by what we saw. For example, gender bending is common in many virtual worlds. In the popular game *World of Warcraft*©, which takes place in a virtual world, one out of every two female characters is actually played by a male (Yee, 2005). The reasons are many, including preference of avatars' looks or playing the damsel in distress to get help from other players, but what this shows is you never know who is truly on the other end of the avatar. In virtual worlds, it is more important to look at what people say and how they act, which can sometimes be misleading, but in many cases the "true" person that sometimes people are scared to be with others face-to-face comes through.

These are some of the reasons why we propose taking blended learning to the next step – tri-hybrid learning. Tri-hybrid learning is a combination of classroom learning (or face-to-face meetings), Web use (i.e., Web site, CMS), and a 3D VLE component (e.g., *Second Life*©, *There*©, Activity Worlds©, or one of many others). Tri-hybrid learning gives faculty and students a new level of freedom. A recent course taught at a southeastern university demonstrates the use of tri-hybrid learning. Students from two schools, one in the Midwest and the other in the southeast, met once a week in *Active Worlds*© for class. The virtual world allowed them to hold discussions and project presentations just like they would have done in a normal classroom. In addition, a Web site with a forum was set up for students to post their reflections of weekly reading assignments for all students in the class to read and respond. The final project encouraged students to work together with fellow classmates at their own institution and a faculty member to create a research design. This project allowed for face-to-face communication and work with both students and local faculty. Some of the benefits of offering the class this way included allowing students from two schools to get to know each other (i.e., networking), improved discussions, and the ability to learn about regional differences in education. Most of the students from the southeastern university had already been in many classes together, which can limit discussions when they feel they already know each other and how they feel on certain topics. Adding a different perspective, especially from a different region of the country, seemed to benefit both groups. Probably one of the most important benefits of having class this way was the ability to hold class no matter where people were. The professor had an extensive travel schedule during the semester with meetings and conferences, but was always able to host class no matter where he was. The same applied to students who were traveling for different reasons throughout the semester.

Tri-hybrid learning gives students and faculty flexibility normally not found in a traditional blended learning class. Class can be held face-to-face or in a virtual world, changing on a daily or weekly basis. This can be changed as needed to address the needs of the individuals (both faculty and students) in the class. For example, a course that traditionally meets on campus has several students who are going to be away at a conference but don't really want to miss the class. They request that the professor host it at the virtual world site so the entire class can attend. Adding the use of 3D VLE doesn't have to be the main focus of a class in many cases. It is just another tool that is used periodically throughout the semester. The 3D VLE could be used once in the semester to help demonstrate a point or hold an investigatory lab. For example, medical students enter Second Life© to participate in The Heart Murmur Sim created by Jeremy Kemp at San Jose State University, CA when they study heart problems (Kamel Boulos, Hetherington, & Wheeler, 2007). 3D VLEs give faculty the ability to take virtual field trips, host labs that cannot be done in a regular laboratory setting, and assign homework that requires students to interact, study, or monitor elements that would be hard for working individuals or full-time students to find the time to do in the real-world.

What 3D VLE's are available for educators to use? There are a number of different platforms available on the market. Each virtual world offers a slightly different experience and only the instructor will be able to decide which virtual world is right for his or her class. Three Web sites that may help in the decision are listed in Appendix. The best way to really understand a virtual world and what it has to offer is to explore it as well as talk to other educators about their experiences.

The platforms that are currently the most popular for use in education are Second Life©, Active Worlds©, and There©. When looking through all of the information and research available on virtual worlds and education, these three platforms pop up again and again. One of the reasons these virtual worlds are so popular in education is that they are ungoverned communities shaped by the users, unlike many of the virtual worlds used for MMOGs, in which users are driven by quests or in-game goals (Appel, 2007; Roush, 2007). The goals created in these worlds are solely those of the player or, in our case, the instructor. We will look at these platforms in more detail to see what each of them have to offer.

Second Life© (Fig. 11.1) is probably the most popular virtual world currently used for non-gaming purposes, including education (Kamel Baulos et al., 2007; Taylor & Duclos, 2007). It has been used for both informal and formal educational purposes over the last few years. Linden Labs, the owner of Second Life©, has made it one of its objectives to encourage educators to use their virtual world for educational purposes (Helmer, 2008). They did this by creating a learning-friendly world in which they felt educational simulations and learning programs could be easily and inexpensively developed. Some of the ways they have encouraged this are by creating an educator list serve, offering a free trial period for educators to teach one class in Second Life©, and having an employee whose main purpose is to work with and help educators (Appel, 2007; Lester, 2006). From there, the educators

Fig. 11.1 NC State brickyard in Second Life

of Second Life© have developed a wiki and guides to help new educators coming into the environment. Educators have also created an annual conference to discuss new innovations and ideas for educational uses of Second Life© (Kamel Boulos et al., 2007).

Some examples of how Second Life© has been used for education include the following:

- A real-time weather map on which avatars can walk – created for NOAA to educate visitors about the weather and climate change (Hackathorn, 2006; Roush, 2007).
- International Space Flight Museum – offers information on the history of space flight through exhibits, tours, and lectures (Cochrane, 2006; Roush, 2007).
- Camp Global Kids – a summer camp that focused on raising participant awareness on global issues (Feldman, 2006).
- Alternative spring break service learning program – Global Outreach Morocco project allowed students with backgrounds in technology, business, and hospitality to study economic development in Morocco through its growth in travel and tourism industry using experiential education as the core component (Bedford et al., 2006; Mason & Moutahir, 2006).
- Nutrition Game – allows visitors to learn about the impact of fast food on health (Kamel Boulous et al., 2007).
- Telescope trainer – teaches student the proper order for adjusting focus knobs on a real telescope (Kemp & Livingstone, 2006).

The list of educational examples in Second Life© goes on. Its bounds are only limited by the subject being studied and the imagination of the instructor. Second Life© has been used to study sociology, psychology, economics, advertising, engineering, medicine, science, and other topics, disciplines, etc.

There are some negative aspects associated with Second Life©. It may take some time for new users to get used to the software. Many people get stuck on Orientation Island, which is poorly implemented (Taylor & Duclos, 2007). Second Life does not allow the user to run 3rd party software (e.g., Web browsers), but video and audio streaming are available within the world (Taylor & Duclos, 2007). Lag times and outages can be an issue, particularly in Second Life© compared to the other two virtual worlds. It has the most demanding system requirement for use, including the need for a high-end graphics card, but it is the only one of the three worlds that supports Mac and Linux operating systems.

On the other hand, there are some positive aspects associated with Second Life©. The world is organized by different islands, which can be either public or private. Membership is now free for anyone, but if the instructor wants to build or have a private island for their class they will have to pay a fee, which depends on the size of land they want to build on or buy. Avatars' looks and clothing styles can be customized, allowing users to individualize themselves in whatever way they choose, including taking on non-human forms (Taylor & Duclos, 2007). Users are capable of having an inventory of items as they explore the world, and there is a currency for buying additional items or services. Users control their avatar through the keyboard. In addition to walking, avatars can fly, use a vehicle, or teleport around the world. Individuals can communicate through gestures, text chat, and in-game chat. They are able to keep track of people they meet with a friends list or join user groups that may be of interest to them. The search dialog allows users to search for people and places.

One of the features of Second Life© that many educators prefer is the ability to easily create objects using basic building blocks called *prims*. These prims can be used to create simple (e.g., a stool) or complex (e.g., a tropical reef) objects in the environment, whereas other platforms like Active Worlds© limit the user to the items found in the objects library. Objects can be created using software outside of Active Worlds© and imported into the world, but often these design tools are not as user-friendly as the design tool embedded in Second Life©. In addition to building object's actions, it can be scripted.

Many tools have been created to be used in conjunction with Second Life© making it, in some cases, a more versatile world. These tools include Babbler, Skype, and Vivox (Taylor & Duclos, 2007). These are all tools designed to enhance communication both inside Second Life© and outside of it. Babble allows for chat sessions to be translated, Skype allows for voice chat, file transfer, and videoconferencing; and Vivox provides integrated voice chat, video, and instant messaging. In-game chat is now a part of Second Life©, removing the need for some of the features of Skype and Vivox, but these tools may still be preferred for more private conversations. In Second Life©, conversations are conducted via distance. As an avatar gets closer or further away from other avatars, it will move in and out of conversations.

Programs like Skype and Vivox allow conversations between users no matter where they are in the world and can be limited to only invited individuals, which may be more beneficial for educational and privacy purposes.

Sloodle is a hybrid between Second Life© and Moodle, a popular learning management system (Kamel Boulous et al., 2007; Kemp & Livingstone, 2006). This "hybrid system uses Moodle open source system and Second Life's connectivity features to mirror Web-based classrooms with in-world learning spaces and interactive objects" (Kemp & Livingstone, 2006, p. 13). Currently, there are two directions they can go with this project: one – LMS can be modified to link or refer to places in the virtual world for students to visit and explore, and two – do just the opposite by creating links in the virtual world to the LMS. In a survey by Kemp and Livingstone (2006), 86% of the educators surveyed felt that integrating LMS and virtual worlds would be useful. The most requested features included linking to virtual world locations from inside the LMS, broadcasting LMS announcements in SL, accessing assignment handouts from virtual worlds and LMS, displaying text information from LMS in virtual world, and logging students' time in the virtual world sent to the LMS. In this case, the virtual world to which they were referring was Second Life©.

One of the weaknesses of LMS is that they are often used as document repositories, whereas a weakness of virtual worlds is that they are very poor document repositories. Hybrids like Sloodle are designed to take the strengths of one application and use it to strengthen another application. Sloodle is still being developed, but there are several tools available for educators to try out and use. With applications like Sloodle under way, education is already starting to move toward tri-hybrid learning. These projects are designed and created by people in the education field wanting an easier way to link everything making teaching and learning easier.

Active Worlds© (Fig. 11.2) is the oldest 3D world in use today (Taylor & Duclos, 2007). Like Second Life©, Active Worlds© also fosters the use of its platform for educational purposes. One major advantage of Active Worlds© is its ease of use for new members.

Some examples of how Active Worlds© has been used for education include the following:

- As a platform to teach education students how to design games for use in their classrooms.
- As a platform for case studies in instructional design and teaching students how to write action plans.
- As format for holding poster presentations in a simulated conference environment.
- For Virtual field trips to train entomology students where to find the insects they will be collecting on a real field trip.

Active Worlds© has a free membership for individuals, but it is very limited as to what the individual can do. If the instructor wants to build or own a world in

Fig. 11.2 Vet World an Active Worlds Edu environment

Active Worlds©, they will have to pay a fee. Active Worlds© limits the amount of avatar customization to just allowing users to choose from several premade forms (Taylor & Duclos, 2007). Active Worlds© is organized by worlds that can be public or private. Unlike Second Life©, Active Worlds© allows the user to run Web browsers within the program and links can be created to open other types of documents from the world. Users cannot have an inventory and there is no type of currency in Active Worlds©. Individuals can communicate through very limited gestures (10 or less), text chat, and in-game voice chat (Taylor & Duclos, 2007). Video and audio files are supported. Building is available, but is not as easy to use as Second Life©. System requirements are minimal. Users are able to navigate (e.g., walk, fly, or teleport) using the keyboard or mouse. There have been issues with users on laptops having trouble being able to fly with default settings, depending on the style of keyboard. Individuals can keep track of friends through a users list. Finally, Active Worlds© offers incentives for school-age students to do well in their classes. Students who demonstrate the most improvement or are in the scholastic excellence categories are given their own worlds that they may retain as long as they continue their academic standings (ActiveWorlds Inc., 2008).

The virtual world, There© (Fig. 11.3) is often mentioned in the literature discussing virtual worlds, but very few examples of how it is used can be found. It is also the only one of the three that does not promote educational purposes on its Web site. Taylor and Duclos (2007) believe that its heyday is over.

There© has a free basic membership account and a premium account with a one-time fee. The premium membership has the benefits of voice chat, listing auctions, owning neighborhoods, and reserving zones for meetings (There_Community, 2007). There© does not have the community of educators established like Second Life© and Active Worlds© do. There© is organized by islands like Second Life©. Avatar customization is available once the user is within the game. Web browser and

Fig. 11.3 Egypt in There

other 3rd party software cannot be run within the world. There© has a currency system and allows users to have an inventory of items (Taylor & Duclos, 2007). Audio files are supported in-game. Building is limited in There©, compared to the other two worlds. Both There© and Active Worlds© have limited amount of lag and interruptions that Talyor and Duclos (2007) reported in their observations of the worlds compared to Second Life©. There© requires a graphics card, but it does not have to be a high-end card as required for Second Life©. All other system requirements are minimal. Users can control their avatars with a keyboard. Avatars can walk, float, or use vehicles to get from location to location. They can also teleport or summon people if they have a premium account. Gestures are limited and text chat is restricted to balloons above the avatars' head instead of a dialog box for individual conversations, but group conversations do have a chat window. Users can create a friends list as well.

There© appears to be the most limited of the three virtual worlds in what the user can do, which may explain why educators have not created a following around it like they have for the other two virtual worlds. It is the cheapest to join with its one-time membership fee, which might work for people with tight budgets.

Another area of 3D VLE's that is becoming common in education is mirror worlds. Mirror worlds are "geographically accurate, utilitarian software models of real human environments and their workings" (Roush, 2007, p. 6). The most commonly known mirror worlds are Google Earth© and Microsoft Virtual Earth©. Google Earth© is far more popular at the moment than any other type of virtual world gaming or non-gaming (Roush, 2007). Mirror worlds allow the user to explore the world as it is today, visiting famous landmarks or even where they live. Currently, most of the world is offered in 2D using satellite photos of varying qualities, but some places (e.g., the Grand Canyon) have been created in 3D, allowing visitors to view in a more natural way. Other places like New York City have had all the buildings rendered in 3D, providing visitors an idea of what it would be like to walk down one of the streets.

Mirror worlds are designed to let users keep track of the real world and not to escape from it (Roush, 2007). Researchers use models like these to help them analyze data. Some of these data sets are available for educators to use, such as earthquake layers that show earthquakes that have occurred over the past several years around the world and their magnitude. Layers like the earthquake information are created by outside sources, but can be imported into mirror worlds for viewing. More general layers such as roads, campsites, hotels, and restaurants are part of the program itself. Anyone can create a layer who has the time and resources available to them.

Roush (2007) hypothesized what it would be like if Google Earth and Second Life© merged into one platform – a metaverse. A metaverse can be a connection between mirror worlds, virtual worlds, and the real world or a platform that is both a mirror world and virtual world that is connected as one to the real world (Roush, 2007; Kamel Boulous & Burden, 2007). This allows users to walk, fly, or swim around Google's simulated environments, explore historical buildings, or walk down the streets of some foreign city. If or when this happens, it will add more benefits to the tri-hybrid way of learning by allowing a user to be able to review water quality data on a mock-up of the local water system, conduct simulations in city planning on a particular town, or take virtual field trips to historical sites that would not be possible for a normal class. But for now this is in the future and just one possibility of what the future of VLE holds. Applications are already being designed to link Google Earth and Second Life©. Daden Labs created DataGlobe in Second Life©, which allows users to access real-time, real-world data feeds (e.g., Google Earth KML feeds and GeoRSS feeds). They created a Web mapping tool that allows users to place markers on a map and name them. Then, DataGlobe generates Google Earth or Google Maps data feed for viewing on the Web (Kamel Boulos & Burden, 2007).

As was mentioned in the discussion of the different virtual worlds, most allow users the chance to have a private or public island/world. The question is which is more beneficial to education? There is no right answer. It depends on the class and what the instructor is willing to endure that may occur during their class. Public or open worlds can have issues with mature content like streakers in Second Life©, or vandalism of property that was created for a class. According to Taylor and Lucos (2007), mature content can be found on all islands of Second Life© and There©, whereas Active Worlds© is a little more PG-rated. Second Life© and There©, with their better avatar customization, also allow users to remove their clothing for acts like streaking, whereas Active Worlds'© limited customization does not. Appel (2007, p. 16) mentions that the appropriateness of Second Life© content can be an issue with some students, "there is range of seedy activity available to users: Gambling, stripping, and virtual prostitution are easy to find if you look for them." Linden labs have created Teen Second Life© for younger users, which is restricted to individuals aged 13–17, but this does not help educators who want to use a cleaner version of Second Life© because all adults except Linden Lab employees are banned from that version (Appel, 2007). In addition to seedy activities that students may encounter in the virtual world, other problems may occur with disruptive players. Class held in publicly accessible areas may be the subject to troublemakers who could negatively impact the students' learning experience or just interfere with classes, for example by paintballing the instructor (Kemp & Livingstone, 2006). Second Life© and Active Worlds© have private islands/worlds available for educators. They are left up to the instructor if they want them to remain private or be open to the public. They can be given limited access to just members of a particular class or group, so that the instructor has control of the class environment just like they would in the real world, making it easier to keep out unwanted guests. Vandalism can be an issue in some cases, but both Active Worlds© and Second Life© have means to prevent it. In both platforms, user restrictions can be set to limit building on private property or building in general. Vandalism can be an issue in either public or private worlds. For example, during a recent summer camp, students were playing a game created in Active Worlds© designed to learn about various habitats found in North Carolina. When the students got to the end of the game, a large building was sitting on top of where a prairie was suppose to be, preventing the students from completing the game. This was a private world to which multiple users had access through different classes. Second Life© also offers the ability to report abuse and harassment to the Second Life© Abuse Team.

Open worlds allow educators to use existing environments and materials that have been created by other users, like the NOAA weather map. So, they may be more appropriate for field trips or labs. If the class is a psychology or sociology class that is going to study the people in the virtual world, then it would be beneficial to have access to the people and it might even be educational to have occasional interruptions to the class. They also normally offer the cheaper alternative for owning land if budget is an issue.

Private worlds allow the educator more control of the environment, ranging from who has access to what they can build. On the other hand, private worlds are normally blank canvases waiting to be created. Educators can buy some prebuilt islands in Second Life© or hire an in-game designer to create objects for their island. Active Worlds© doesn't mention these services, so they may or may not be available to help educators get started. Choosing between an open world or closed world is going to depend on the amount of control the instructor wants, the amount of building the instructor wants to do or inspire students to do, the number of interruptions that may occur, access to other users areas, budget, and the type of students that are in the class. Students may tend to wander, which may be easier to control if they are in a smaller area of a closed world.

One of the main draws for educators in using virtual worlds is the improvements made in interaction to and the expression of students when compared to traditional distance education courses (Appel, 2007). Students in the Global Outreach Morocco Project were able to meet and work from different access points without the need to sit face-to-face in the same room (Bedford et al., 2006). The students felt that what made this type of communication successful was that each person had his or her own identity in the form of an avatar. This made communicating through the VLE appear more personable than e-mail or instant messaging. In addition, conversations in VLEs are naturally more casual in nature than normal face-to-face classroom conversations often are (Robbins, 2006). The use of VLEs has also been shown to facilitate better reflection and sharing of experiences between online learners. This can lead toward building a better community of practice (Kamel Boulos et al., 2007).

VLEs like Second Life© also create opportunities for teacher–student socializing that do not always exist in the real world (Robbins, 2006). Students and educators may attend some of the same events within the virtual world. Second Life© can also cause problems with confidential conversations being overheard. Educators may want to take a lesson from gamers when it comes to communicating in virtual worlds. Many gamers control unwanted eavesdroppers on conversation by using a 3rd party program like Ventrilo© or Teamspeak© for voice chat instead of relying on in-game voice chat or text chat for private conversations. Robbins (2006) feels that students who engage in a community in a VLE quickly realize that learning can occur in more places than just designated classrooms and can occur long after the class time is over.

Another draw is the connection of VLEs to a constructivist way of learning through first-hand experiences (Neale et al., 1999). VLEs like Second Life© allow "each student to individually experience, explore, and develop ideas then combine them into much larger idea" as in the case with the Global Outreach Morocco project (Bedford et al., 2006). Project-based learning environments like the Global Outreach Morocco project allow students to work in teams to solve real-world problems. In this particular case, the team chose to use Second Life as the platform to promote tourism in Morocco (Mason & Moutahir, 2006).

Students will adapt to using a VLE at different rates. Some students will pick up the skills needed to navigate in no time, while others will take longer. Middle school students who were part of a recent week-long summer camp were able to learn how to navigate, place objects, and do simple coding in a matter of a few hours. The students were given no instructions and through their own individual exploration and collaboration with other students in the virtual world, they were able to learn these skills. On the other hand, some college students that participated in a class in Active Worlds©, a "reportedly user-friendly" environment, had trouble learning some of the basic skills of navigation. Some people feel that the difference between these two groups is the amount of experience they have had with computer or video games. Bedford et al. (2006, p. 25) discuss their own experiences with learning the skills needed in Second Life©:

> A student from the Technology College writes, 'I have a very high technical understanding of computer programs and in general, Second Life was fairly easy to learn. It took me about 2–3 hours to figure most things out.' While others, like a student from the hospitality school, found Second Life to have a learning curve that she is struggling to overcome.

Even with the difficulties some of the students have had with learning how to navigate, they still found Second Life© fun, exciting, and easily accessible (Bedford et al., 2006). Carter (2006) recommends holding an orientation to the VLE at the beginning of the semester or year in order to engage the students while their interest levels are still high. Without an orientation to the environment, students can get frustrated, which may lead to disengagement and loss of the opportunity to learn. She designed an orientation area in Second Life© that taught students the skills they needed to complete assignments in Second Life©. Some of the skills they learned included walking, using camera controls, chat, teleport, using money, using items, and building. The orientation was setup like an obstacle course that the students had to complete in small groups. Each obstacle taught new skills and in addition, reinforced skills from previous obstacles (Carter, 2006). This type of orientation could easily be assigned for homework, as part of a lab, or even as the first class. In general, Mason and Moutahir (2006) found students' abilities to adapt to the VLE were more dependent on attitude than technical skills.

Another area to consider is students with mental and physical disabilities. Virtual worlds can give students with disabilities freedom or the opportunity for experiences they may not be able to have in real life. Roush (2007, p. 20) mentions a group of adults with physical disabilities at an adult day-care facility and how they use Second Life to feel "like the rest of the world." It allows them to feel like everyone else by not being treated any differently from any other avatar. Kamel Boulos et al. (2007) mentions how virtual worlds, like Second Life©, can be used to help people with physical disabilities combat social isolation and loneliness. They go on to give an example of a user with cerebral palsy that runs a dance club in Second Life©. VLEs have the potential of connecting all members of a class together instead of leaving some members feeling isolated or left out.

VLEs have been shown to help students with mental disabilities by giving them an avenue for experiential learning to fill educational experience gaps (Neale et al., 1999). The experiences in VLEs cannot replace their real-world counterparts, but they can be used to prepare the students for them. VLEs have been successfully used to teach students with mental disabilities the skills needed for independent living (e.g., grocery shopping, how to make a cup of coffee) (Neale et al., 1999; Standen, Brown, & Cromby, 2001). Special tools were used to help students move around in these virtual environments. As the student became more and more comfortable with the controls, they would progressively take more control of the interaction with the environment. The students demonstrated high levels of engagement during the VLE especially when they were not aided in the exploration of the environment. Students with higher ability ranges were even able to demonstrate evidence of being able to transfer the skills learned in the VLE to real-world applications (Neale et al., 1999; Standen et al., 2001). For students with mental disabilities to have the best educational potential in these VLEs, their interaction needs to be guided either by an educator or with in-game assistance (Standen et al., 2001).

One issue with virtual worlds is students who are visually impaired. Most virtual worlds do not currently work with screen readers. This limits the amount of in-game chat and text they can read in the world possibly making moving around in these environments difficult for these students (Kemp & Livingstone, 2006). Voice chat or in-game chat is becoming more common in virtual worlds eliminating some of these problems.

The use of VLEs in tri-hybrid learning could be a powerful tool for helping students with disabilities feel more a part of the class or give them the experiences they need to learn the same concepts as other members of the class. But consideration should be made to make navigation and participation easily accessible to all members of the class, as in the case of students with visual impairments.

The Tri-Hybrid Model and the Evolving Role of the Instructor

In September 2005, following the coattails of *The No Child Left Behind Act of 2001* and increasing governmental expectations from education, Education Secretary Margaret Spellings appointed her *Commission on the Future of Higher Education*. This committee was charged with identifying and addressing issues impacting the effectiveness of higher education within the United States. Specifically accountability, credibility, and data comparisons among institutes were key factors addressed. The formation of this commission acted as a beacon to the higher education system highlighting the imposing public scrutiny found in this current standards-based era. Amid this environment phrases such as "Student Outcomes," "Instructor Accountability," and "Comparative Data and Transparency" were used with renewed rigor, and the role of accreditation among higher educational institutes was spotlighted. Historically, accreditation was synonymous with quality assurance – an absolute relationship which has recently been questioned. At a time of increased accountability for both higher education instructors and institutes, coupled with concerns over the possible increased role of federal control over higher education, the effectiveness of educational technologies is being closely evaluated.

Although online courses have been highly scrutinized since their development, the current focus on the effectiveness of higher education in general has put the entire realm of distance education instruction under an even higher powered microscope than it is already under. Additionally, there has been a nation-wide call demanding further integration of DE instruction within higher education. The *A TEST OF LEADERSHIP: Charting the Future of U.S. Higher Education* report specifically identified this emphasis by stating, "We want postsecondary institutions to adapt to a world altered by technology, changing demographics and globalization, in which the higher-education landscape includes new providers and new paradigms, from for-profit universities to distance learning." (2006, p. xi). Specifically *how* instructors can address these increasing challenges is the focus of this book. We believe the tri-hybrid model of instruction proposed has the potential to enhance both instructional delivery and student learning. By utilizing the tri-hybrid model of in-person instruction and online instruction mixed with the 3D VLE experience, the instructor is afforded the flexibility to present specific instructional materials and activities within the format which best supports it.

The appropriate use of technology is a keystone factor in the ability of the tri-hybrid model to achieve its expected goal of increased student learning. The "media effect" refers to the impact, or lack thereof, of technology itself on learning. Clark (1983, 1994a) argues that technology is simply a tool used to present knowledge, the form of which is immaterial to learning. He views technology as the mediator of information supporting, but not enhancing the information provided, although Clark does not recognize how the specificity of technology selection may either enhance, or distract from, the learning process. Kozma (1991) supports the opposing view that specific technologies may enhance learning if appropriately designed and effectively utilized by the learner. Nathan and Robinson (2001, p. 12) demonstrate these differences among the views by stating "Clark's view of knowledge commits him to a separation between media and method. However, knowledge is viewed by Kozma as an interaction between the learner and his or her environment, whereas learning is the development of knowledge within the learner. Thus, Kozma is interested in the interaction, rather than the separation, between media (the learner's environment) and method (supports for active learning within the learning environment)."

Throughout this book, various distance education technologies along with their respective advantages and disadvantages have been discussed. With the advent of virtual worlds, students are becoming more immersed within the learning process than ever before, and instructors are thinking about the presentation of course information with a whole new perspective. In March 2008, the New Media Consortium's (NMC) annual *Horizon Report* identified virtual worlds among the six most promising emergent higher education technologies. This technology was ranked behind other "user-created content" such as blogs, social networking sites, and wikis; however, the report emphasized its increasing role in education stating that this technology was "likely to have a large impact on teaching, learning and creative expression" within 3 years. Consider for example how student outcomes related to the structure and function of the human heart would be approached using these technologies. An instructor may provide "traditional" lecture information online, create a wiki in which students create a shared document highlighting this information (user-created content), or students could "enter" into a simulated heart or "design" a heart themselves utilizing virtual environments. As previously discussed, the format of the VLE lends itself to the constructivist approach and problem-based learning, potentially increasing critical thinking skills within the classroom.

Besides the technical "trendiness" afforded by the creation of these parallel universes, the potential to increase learning and critical thinking skills among students has captured the attention of higher education institutes. The NMC (http://www.nmc.org/about), comprised of more than 200 campuses and other educational organizations, created a virtual NMC campus housing 30 simulated "islands" containing virtual libraries, museums, planetariums, classroom space, and a science center (among other features). This VE, created as part of the NMC's Emerging Technologies Initiative, also houses a virtual lab which offers campuses single-acre plots free for one semester which instructors can use to build educational activities utilizing virtual world technology.

The document Transparency by Design: Principles of Good Practice for Higher Education Institutions Serving Adults at a Distance identifies "Interaction and Student Engagement" as one of the principles that "facilitate(s) the continuous improvement of adult higher education programs delivered at a distance by establishing benchmarks of quality. (p. 1)" (excerpt below).

> **Principle 6. Interaction and Student Engagement** The institution ensures that distance education courses are designed to optimize interaction between the faculty and adult students, among students, and between students; and the course content is designed to encourage critical thinking, problem solving, and mastery through student engagement in the learning process.

The tri-hybrid approach lends itself to the development of increased interaction and student engagement by offering a multi-pronged approach to both student-to-student and student-to-instructor interaction. This model also allows for the shifting of modality, offering a combination of synchronous/asynchronous and dependent/independent interactions. Clearly, there has to be a commitment by both the instructor and the institute in order for this model to achieve its full potential. Not all instructors will be interested in, or capable of, creating such learning tools. Various studies have identified both intrinsic and extrinsic factors that motivate instructors to develop and teach online courses. Such intrinsic motivators include such themes as intellectual challenges and the ability to reach more students (Bower, 2001; Maguire, 2005; Bruner, 2007). Extrinsic motivators include a perceived benefit to the instructor and take multiple forms including monetary gains, increased collaboration, and institutional motivators such as recognition of work and scholarly advancement. Maguire (2005) emphasizes this idea by stating, "When faculty outline the support issues that would motivate them to teach online, the support issue most noted is that of administrative recognition and encouragement for online efforts." Perceived barriers by instructors most often include lack of technical support, lack of time or funds to develop and maintain course material, and concerns about course quality (Bower, 2001; Maguire, 2005; Bruner, 2007). Numerous publications have discussed the increased demands on instructors teaching through distance education (Hartman, Dziuban, & Moskal, 2000; Cavanaugh, 2005; Pattillo, 2005; Mandernach, Dailey-Hebert, & Donnelli-Sallee, 2007).

While this tri-hybrid approach clearly affords an opportunity for enhanced instruction, it also admittedly places an additional instructional design burden on content experts, not unlike that required for distance education in general. Arguably this includes the multifunctional role required of the distance education instructor to also act as the developer, designer, and technologist for the course. The content expert should ultimately decide how course content, assignments, and assessments should be presented to best enhance the effectiveness of specific learning objectives. Because of the increased demands placed on the instructor to create such an experience, higher education institutes should be committed to sharing the burden. This includes a commitment to technical training at all levels, from students to professors.

Both Clark (1983, 1994) and Kozma (1991) recognize the importance of proper instructional support for whichever technology is utilized, addressing the relevance of the institutional infrastructure supporting currently available technologies. This infrastructure should not only accommodate current technologies and technical support, but should also additionally focus on identifying and preparing for the delivery of materials in the future. Many higher education institutes currently have such programs in place, although the degree to which training is provided, required, and utilized varies.

For example, North Carolina State University is a research 1 land grant institute which developed *Distance Education and Learning Technology Applications* (DELTA), a division of the Provost's office, in order to provide for the university's commitment to technology for teaching and learning. Established in 2000, DELTA is staffed with DE experts that provide both short-term and long-term guidance to instructors for instructional design and technology support. In addition to group training, individualized training is provided upon request. DELTA offers support for a variety of technologies including course management systems (Moodle, VISTA, etc.), user-created content (blogs, wikis, etc.), and virtual realities (Second Life©, Activity Worlds©, etc.). This type of infrastructure, modeled by NCSU's DELTA, is an example of how instructional support can be provided to support this type of integrative innovative instruction. Besides technical training and support, instructors often have concerns pertaining to allowances for time and monetary compensation for both the research and development of new technologies. Educational scholars have demonstrated that faculty hesitance to employ such teaching strategies often lies in their concern over these lack of incentives for their time and efforts (Hartman et al., 2000; Cavanaugh, 2005; Pattillo, 2005; Mandernach et al., 2007). Various grants offered by NCSU through DELTA are available to help offset the time and monetary costs associated with developing quality DE programs at the University. Therefore, this division engages in a way which supports, contributes, and guides instruction within the institution. The reality however is that some higher educational institutes do not, and will not be able to provide such services.

Ruth (2006) presents five possible avenues proposed to allow higher educational institutes to fully expand and/or profit within the online educational arena (p. 28):

- Investigate Mergers and Integration
- Establish a no-nonsense, globally oriented virtual university
- Limit bricks-and-mortar investment in favor of blended learning
- Support the deliberate proliferation of distance learning adjunct faculty
- Accept that E-learning is costly but crucial

The idea of institutional merger endeavors is theoretically sound; however, concerns such as the division of monies and labor are inevitable. Historically some collaborative efforts among highly regarded institutes such as Oxford, Yale, and Stanford have failed (Matthews, Pickar, & Schneid 2007). In contrast, some current and well-thought-out models have been successful. One such example is the partnership between Eastern Kentucky University (EKU) and the Orlando-based Compass Knowedge Group (CKG) (Matthews et al., 2007). EKU's College of Justice and Safety (CJS) implemented the scholarship requirements for the Master of Science in Loss Prevention and Safety online, while CKG provided the burden of marketing, recruitment, and retention within the program. The clearly defined roles within this partnership, as well as the clearly thought-out goals and implications deemed it a success. Matthews et al. stated that "After 12 months of implementing our online master's degree program, and assessing the merits of our partnership, it is clear that our partnership has resulted in significant benefits for EKU."

Our tri-hybrid design could be utilized by either an individual institution or as a collaborative effort. This model emphasizes the incorporation of a "virtual university" while also supporting the blended learning approach. Certainly to develop or even navigate within such a model, specific technical skills and commitment level are required of the instructor. The specific status of the instructor is less crucial to the success of the model than the identification of the appropriate instructors (i.e., those intrinsically motivated). Many institutions are opting to create full-time "lecturer" positions which provide the individual with more stability than adjunct status, and help alleviate some of the financial burden associated with "tenured research faculty". This is one option. There is no doubt that E-learning will play an important role in the future of higher education. Like all methods of instruction, budgeting is a factor; however, we believe that the monies spent on developing and supporting such technical advances in DE will be not only a wise investment in the educational model of an institute, but to the overall future financial heath institutes of the future as well.

Besides institutional support for tri-hybrid learning, there needs to be additional research done on the VLEs themselves, teaching and learning in a tri-hybrid method. Design work of new tools and research needs to continue to look for the best ways to merge CMS and virtual worlds, thereby making it easier for educators and students to use in a tri-hybrid learning environment. Projects like Sloodle are what we need to pursue to turn to improve these VLEs and CMS and keep up with ever-progressing technology.

Futhermore, research needs to be conducted on the ways students with physical and mental disabilities participate in classes taught in VLEs. As mainstreaming of student with disabilities continues to occur in schools, VLE may prove to be a useful tool for making them more a part of the class. Research should be conducted to find out if VLEs make them feel more like a part of the class and whether it improves the learning environment for these students over a traditional classroom.

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Appendix A
Web Sites for Discovering Virtual Worlds

Virtual Environments. Info	This site offers information on a number of virtual worlds as well as information on education and research currently going on with virtual environments.	http://www.virtualenvironments.info/
RezEd	A community designed to discuss anything related to learning and virtual worlds. They feature inter-related podcasts, brief best practices, digital resources in the library, and featured blog posts and discussions.	http://www.rezed.org/
Second Life in Education	This site mainly focuses on using Second Life in education but it also has some information on other virtual worlds designed for education.	http://sleducation.wikispaces.com/virtualworlds

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