CHAPTER 2

Although a substantial body of literature exists on the subjects of education, computerized instruction, computer interface design, educational networking, and the emerging field of virtual reality, very little information is available on the topic of virtual reality as a setting for post-secondary instruction. In order to provide a conceptual framework within which to understand the development and use of virtual colleges and classrooms, this literature review will draw upon a variety of traditional and non-traditional, print and electronic sources.

This review begins with a brief examination of the background literature relative to educational networking and computer assisted teaching/learning. Next, literature concerning the development and use of virtual classrooms is reviewed. Much of the information in this and the concluding segments of the literature review are drawn from unpublished papers, internal documents, research studies, and other electronic resources. The review concludes with an overview of the dynamics of existing text based virtual realities in which gender balance, character development, communication practices, and social organization will be explored. The bulk of literature relative to the dynamics of MUSE/MOO based virtual reality environments exists almost exclusively as electronic text files within the Internet array of document libraries. Scholarly papers and graduate studies constitute a significant portion of the available work with a few outstanding contributions by researchers in private industry, most notably, Parc-Xerox in Palo Alto, California.

Computer Networks in Education

Nation-wide, institutions of secondary and post-secondary education are actively linking stand-alone classroom microcomputers into local or wide-area computer networks. As long ago as 1988, a survey of the of the 173 largest school districts found that 64% were networking, and 36% of those not presently networked planned to use the technology by 1990 (Reinhold, 1988.) Currently, more than 80 post-secondary programs world wide are offering courses partially or completely using some form of

networked computer mediated communication (Harasim, 1990; Harisim, Hiltz, Teles & Turoff, 1995; Hiltz, 1986, 1994.) Some of the most widely used wide area networks employed by K-12 schools, colleges and universities for the delivery of computer mediated communication include Internet, the FrEdMail Network, the National Geographic Kids' Network and the AT&T Learning Network (Levin, Smith & Waugh, 1994.)

A common characteristic of the guidelines established by the majority of institutions delivering instruction via computer mediated communication is the notion that a "social structure" is important for supporting network interactions. The AT&T Learning Network employs a Learning Circles structure (Riel, 1993), while other institutions employ Teleapprenticeships (Levin, Waugh, Brown & Clift, 1994), Reflective Dialogues (Spitzer, 1994) and Telecollaborative Projects (Harris, 1995) to cite only a few. Levin accurately summarizes this finding:

> "One important common point to all these different ways of carrying out network activity is that a structure is important, and the nature of the structure is determined in part by the nature of the network and in part by the goals and constraints on the participants. Interaction on electronic networks is different in some ways from more conventional interaction, and thus requires modified and in some cases totally new social structures to support it." (Levin, 1995).

Another important factor identified by institutions using computer networks for the delivery of instruction is the need for developing a well established process for the planning, delivery and wrap-up of networked instructional projects. Harris, for example, identifies eight steps in organizing such a project:

> "choose the curricular goal(s), choose the activity's structure, explore examples of other online projects, determine the details of your project, invite telecollaborators, form the telecollaborative group, communicate, and create closure." (Harris, 1995).

Failure to develop and follow such a process often results in unsuccessful projects or the perception by the instructor that his/her work was not valued by academic peers. (Chung, 1991).

An additional element in the creation of successful computer networks for the delivery of instruction is the effective use of moderators to initiate and sustain communicative interaction between participants. Typical examples are Learning Circle Coordinators employed to guide the activities of each AT&T Learning Circle group (Reil, 1993) and web weavers, electronic editorial assistants and other mediator roles described by Levin, Smith and Waugh as necessary for developing successful educational networks (Levin, Smith and Waugh, 1994).

As Levin clearly states:

> "In our research, most failures of attempts to build successful network learning environments are due to the lack of appropriate mediation at the appropriate times in the unfolding process of a network learning interaction." (Levin, 1995).

Finally, the literature concerning institutional use of computer networks for the delivery of instruction makes frequent reference to the idea of "community building" as a significant success element. (Riel, 1993; Spitzer, 1995; Harris, 1995). Howard Reingold offers this definition of a virtual community:

> "A virtual community as they exist today is a group of people who may or may not meet one another face to face, and who exchange words and ideas through the mediation of computer bulletin boards and networks. In cyberspace, we chat and argue, engage in intellectual intercourse, perform acts of commerce, exchange knowledge, share emotional support, make plans, brainstorm, gossip, feud, fall in love, find friends and lose them, play games and metagames, flirt, create a little high art and a lot of idle talk. We do everything people do when people get together, but we do it with words on computer screens, leaving our bodies behind. Millions of us have already built communities where our identities commingle and interact electronically, independent of local time or location. The way a few of us live now might be the way a larger population will live, decades hence." (Reingold, 1992).

In general, the literature concerning development and use of virtual classrooms frequently makes reference to a high degree of collaborative learning, by which is meant a learning process that emphasizes group or cooperative efforts among faculty and students, active participation and interaction on the part of both students and instructors, and new knowledge that emerges from an active dialog among those who are sharing ideas and information (Bouton and Garth, 1983; Whipple, 1987).

Dr. Billie Hughes, Director of the Maricopa Community College District's virtual environment MariMUSE, in an unpublished "think-piece" speculates:

> "Learning is not about transfer of information. Instead, students need to explore ideas and concepts while they interact with other people. Because the participants in the MUSE environment are not limited to a single "classroom," MUSE students could interact with others in different disciplines, or I could invite other educators from around the country to join students in discussion of particular topics. In other words, students could be given a task to complete that required they explore several simulated environments (each that represents a different perspective) and they could interact with other MUSE users as they explored these ideas. This would be very valuable to a constructivist because students are making sense of complex environments as they work on a task, they are being exposed to multiple perspectives, and developing their own mental models from experience rather than attempting to reproduce the knowledge base of an expert." (Hughes, (1993)

In a paper exploring the future of teaching/learning in virtual environments, Lemke appears to support Hughes's views as he postulates:

> "We can claim, against traditional CAI, that human social interaction is a necessary element of education, but cyberspace will be a virtual place FOR human social interaction. We can claim that people interact with other people in fundamentally different ways, probably necessary for learning, from how they interact with artifacts and natural objects, including today's computers. But we also know that people can learn in additional ways if a base of social learning is provided: by observing, by listening, by reading, by video viewing, by manipulating objects, by experimenting, by writing, by drawing, by

> calculating, etc., etc. And in cyberspace all of these, and more, will be available." (Lemke, 1993)

This view is further supported by Turoff who, in a recent paper, writes:

> "Learning can be perceived as a particular type of cooperative work. Studies of the use of computer-mediated communication facilities that form components of a Virtual Classroom[TM] environment have tended to support the point of view that for mature, motivated learners, this mode of learning can be more interactive and more effective than the traditional (physical) classroom." (Turoff, 1995).

And while there appears to be almost universal agreement about the potential learning opportunities provided by virtual classrooms, a variety of unresolved issues remain.

With reguard to managing the actual software involved in operating a virtual classroom, Turoff feels that "We cannot expect most educators to master the hodgepodge of protocols and software."

While Rogers notes that: "Much of this frustration (experienced by teachers attempting to use telecommunications) is due to the learning curve imposed by the current state of technology in the classroom. There are still a myriad of technical obstacles to overcome in preparing to use computers, modems, and phone lines in the classroom." (Rogers, 1990).

With reguard to the complexities of using virtual classroom technology, Turoff appears to be in agreement with Rogers as he concludes:

> "There is a great deal of work still to be accomplished to make this distributed system appear to be completely transparent to both the educators and the students. Currently there is no comprehensive authoring system and no integration between the authoring tools that do exist and the browser type capabilities. In addition, a clearly missing piece is the ability of the educators to develop their courseware on their personal computers and to turn their machines into personal servers to control and regulate the communications environment with their students." (Turoff, 1995)

An underlying theme found in many of the articles reviewed for this study concerned itself with the expectations brought to the use of virtual classrooms by teachers familiar with computers but very new to the concepts of telecommunications and virtual instruction. Rogers addresses the expectations/frustrations experienced by some faculty by stateing:

> "A more damaging source of frustration, however, has to do with the ways teachers think about how telecomputing technology ought to work, and what they expect from it. Most computer using teachers expect instant results as they implement technology: plug the computer in, boot the word processor, and begin writing. Plug the printer in and begin printing. Plug the modem in and dial an information service. They expect to announce their presence on a network, request a "computer pal" and instantly have their students involved in meaningful exchanges. When, two weeks later, they have not received even one reply, they are understandably disappointed in the "promise" of this technology." (Rogers, 1990)

Instructional methodology in a virtual classroom presents a variety of unique and demanding challenges. Unlike conventional classrooms in which voice, facial expressions and gestures, for example, can be used to communicate meaning, text based virtual classrooms require a very different set of skills.

In a conference paper presented in 1995, Hiltz suggests that:

> "The instructor should use written language in a skillful way (including the use of humor and metaphor), orchestrate active participation by the students, and stimulate collaborative assignments that involve both social and task-oriented activities." (Hiltz, 1995)

In order to facilitate effective learning in a vistual classroom, Hiltz further recommends that instructors not try to deliver long lectures in written format, that they respond in a timely fashion to students questions. She indicates that for most faculty this takes about 30 minutes to one hour a day, depending on the number of students and the level of their activity.

Hiltz states that in her experience teaching in a virtual classroom:

> "The conscientious instructor becomes a "perpetual professor"; teaching is continuous, like parenthood, rather than being confined to a few specific hours during the week." (Hiltz, 1995)

Finally, Hiltz concludes that:

> "Probably the greatest determinant of the extent to which students feel that the online mode of delivery is better or worse than traditional modes is the amount and quality of interaction between the instructor and the students, and/or among the students. This is not always easy, but if you can cajole or coerce the students into this collaborative approach to learning, they will share ideas with each other in a way that is seldom or never seen in a traditional classroom. Herein lies both the key and the challenge for being an effective teacher in the Virtual Classroom environment." (Hiltz, 1995)

And while there is general agreement that virtual classrooms are of great potential value, the literature often refers to the lack of training opportunities available to faculty who wish to explore this new technology. As Turoff notes:

> "The difficulty of this objective (using virtual classrooms) is not in its technical feasibility but in the education of educators in how to design, prepare, and utilize such non linear forms of material. It is in the technology of creating materials and aiding educators and students to create and utilize non linear materials that the true pragmatic challenge lies." (Turoff, 1995)

Virtual Community

The concept of virtual community, or in this case, virtual learning community, is central to the final portion of this literature review. As previously mentioned in this study, early in the development of the Internet system, users at remote sites found a need to communicate with one another in real time. Although these early conversations were largely technical in nature and focused on the set-up and integration of Internet, in time they developed into a complex array of communications channels,

each dedicated to a highly specific topic of conversation. Formalized and refined, they became Internet Relay Chat (IRC), a network of hundreds of conversational channels with each channel capable of supporting hundreds of simultaneous users. Arising from the daily interactions of persons using these resources grew a sense of connectedness and familiarity, a sense of virtual community.

Using the IRC concept of real-time, text based communication, in the late 1980's Richard Bartle and Roy Trubshaw of the University of Essex began development of a new and novel form of Internet usage, the creation of text-based, real-time, multi-user virtual reality.

In reviewing the literature relative to text based virtual reality, the author makes no attempt to differentiate between applications which are "social" versus "educational" uses of MUSE technology. Rather, the information is presented in the form of several common themes which serve to organize the material across all current uses of MUSE based VR. Among these themes are age, gender, character presentation, communication techniques, and social organization.

Age and Gender

There appears to be a general agreement in the literature that the most extensive use of the MUSE environment is predominantly by young males from mid-teens through mid-twenties (Serpentelli, 1992; Rosenberg, 1992; Curtiss, 1991; Bruckman, 1992). In a survey of users of LamdaMOO, a large and well established MUSE maintained by Parc-Xerox, it was found that of the 55 people who answered the gender-related questions, 73% were male and 27% were female (Serpentelli, 1992). Other researchers contend that the percentage of male users is actually closer to 90% (Curtis (1991), Bruckman (1992)).

The literature offers a variety of explanations for this gender imbalance. Serpentelli (1992) notes that:

> "the programming aspect of computers put women at an early disadvantage, for women are discouraged from participating in math/science related activities in general. The idea that computer programming is a "language", a field in which women are thought to be proficient, seems to be downplayed in favor of emphasizing computers as a "science", a male domain." (Serpentelli, 1992).

and that:

> "the competitive and solitary nature of a programmer's dedication to the computer world exemplified in the hacker culture but true to some extent of many computer-related activities, majors, and careers - is at odds with the reality of many women's experiences in relating to the world in a more connected, cooperation-oriented fashion" (Serpentelli, 1992).

While Turkle (1984) observes that:

> "There are few women hackers. This is a male world. Though hackers would deny that theirs is a macho culture, the preoccupation with winning and of subjecting oneself to increasingly violent tests makes their world peculiarly male in spirit, unfriendly to women " (Turkle, 1984).

Still other authors (Curtis (1992), Rosenberg (1992)) suggest that the amount of unwanted attention received from female players in MUSE environments may be contributing to this gender gap.

The disproportionate number of males in existing MUD/MUSE environments and the characteristics of the "hacker" persona will be important considerations in the development of future virtual classrooms. The literature suggests a need to develop a more realistic gender balance and again points out the underrepresentation of women in science and mathematics.

Character Presentation

The characters participants create to represent themselves in MUSE environments is a topic widely discussed in the literature. For some players, Bruckman (1992) finds that MUSE environments offer an

opportunity to create characters which represent, and to some extent help clarify, unresolved personal dilemmas. She offers the following example:

> "Gayle is overweight and has a large chest. She has different characters for different moods: Renata is gorgeous and sexually desirable. Marla is petite and flat chested. Susie is an emotionless Vulcan. Gayle uses these personalities to help sort out her feelings about her real self." (Bruckman, 1992).

In discussing his methodology for assisting a young girl attempting to resolve a complex personal problem, Erikson says “We offer her a toy situation so that she may reveal and commit herself in its ‘unreality’” (Erikson, 1985). Just as the imaginary world of toys and dolls creates a safe space in which children can explore their feelings, Bruckman contends that "Virtual worlds, whether they are made of blocks of wood or blocks of text, form a rich psychological play space." (Bruckman, 1992).

In her paper *Conversational Structure and Personality Correlates of Electronic Communication*, Serpentelli observes that:

> "My earlier game companions consisted largely of teenage players, and these young people, caught in the awkward adjustment to the adult world, produced game characters who were suave, cool, deadly, and superbly adjusted to their world - samurai, elven magicians, and clever hobbits. For these characters, there were few problems that could not be quickly solved by blowing somebody up with a fireball spell or slashing them to pieces with a shining katana " (Serpentelli, 1992).

and also states that a

> "fantasy-based, fabricated character can be used to express very real aspects of a person's psychological makeup, as well as becoming an exemplar of future goals..." (Serpentelli, 1992).

The ability to create characters through which learning and exploration take place may be a significant factor in the creation of successful virtual classrooms. Such characters provide a safe alternative to participation in more conventional instructional settings and may allow the learner to take risks with his/her virtual persona which would be unacceptable in real life.

Gender Swapping

While most characters retain their real-life gender, the practice of "gender-swapping" has been observed and commented upon by several authors. Bruckman, a female author, takes a positive view of the practice arguing that

> "Most people would acknowledge that gender affects human interactions. Gender swapping on MUDs allows people to experience rather than merely observe this phenomenon" (Bruckman, 1992).

A less optimistic view of character selection and gender swapping is offered by Carlstrom who provides the following example of a character's description:

> *Allysa*
> *You see a tall, luscious young woman with long, wavy deep-auburn hair that gleams golden when it catches the light. She has fair ivory skin, the soft, supple kind that makes you want to reach out and touch its silkiness. Her deep emerald-green eyes are inquisitive, as well as coy and seductive. She is wearing a slinky black cashmere sweater that falls teasingly off her irresistible white shoulders, and a black leather mini that reveals the long, toned legs of a dancer. She glances at you shyly, but in a way that is maddeningly inviting. The delicate fragrance of her sweet perfume reaches you and tantalizes your nose, taunting you, calling for you to step up to Allysa and slip your arm about her slim waist. Basically, if you believe this, you'll believe anything. In real life, Allysa (whose name is actually Rebecca) is a homely nerd like all the other MOOers with ridiculous descriptions like this, or who knows? chances are she's probably a guy out for a netsex cheap thrill. how pathetic.* (Carlstrom, 1992)

Again, the ability to swap gender may have significant benefit on the learning process. For some, the male role may include issues of control, certainty, and confidence which might obstruct the learning process. Assuming female gender may alter these stereotypical roles and allow learning to occur. The same dynamics might also hold true for females who choose to assume male gender. The exploration of the effects of

gender on teaching/learning may play an important part in the development of instructional methodology in the virtual classrooms.

Communication Techniques

Person to person, "face-to-face," communication makes use of various visual, auditory and tactile strategies for transmitting, and confirming the accurate receipt of, information. Voice inflection, stance, gestures, facial expressions, and even silence are all powerful tools for communication which can be used deliberately, reactively or at an unconscious level. The "band-width" of these communicative media is extraordinarily broad. Subtle differences in meaning can be communicated with little difficulty. In MUSE/MUD environments where all communication is presently text based, new methods must be invented for directing the complex communications normally carried by "broad band" voice, auditory and kinesthetic channels through the narrow gateway of text-only communication. This is a topic which has received a good deal of attention in the literature.

Perhaps Carlstrom puts it most succinctly in her statement:

> "In a MUD it is literally true that "reality" is created through language, both by the actions of the players and through the code used by the programmers. Experience in a text-based virtual reality has convinced me that the flavor of "reality" found there is not merely an imperfect reflection of real life potentials, but an independent system whose communicative and social forms arise from the modality itself. The ways in which interaction on a textual interactive system are different from real-life interaction should not be seen as flaws or signs of inferiority, but as indications of a different kind of reality." (Carlstrom, 1992).

In a "real-life" environment the intended receiver of our communication is selected and notified using a variety of well understood socio-cultural strategies. In a virtual environment, where visual cues and spatial/geographical relationships are entirely arbitrary, targeting the intended communication receiver(s) requires more deliberate action.

Several options are available which expand or restrict the scope of the communication. Carlstrom attempts the following explanation for a few of the more commonly used options:

> "Because the MOO is a programmed environment, I can and must delineate the distinct communication forms possible there. The speech modes are `say', `page', and `whisper'. Say is the usual mode, used for talking to anyone in the room. Page is used to speak to someone at a distance (it is private, and can be used in the same room). Whisper is used within a room, and is private." (Carlstrom, 1992)

Text based language must be modified for use in a MUD/MUSE environment to carry some of the communicative content ordinarily transmitted by gestural or auditory means. Some standardized conventions have been devised for this purpose. In his article *Mudding: Social Phenomena in Text-Based Virtual Realities*, Pavel Curtis notes:

> "The course of a MUD conversation is remarkably like and unlike one in the real world. Participants in MUD conversations commonly use the emote command to make gestures, such as nodding to urge someone to continue, waving at player arrivals and departures, raising eyebrows, hugging to apologize or soothe, etc.
>
> As in electronic mail (though much more frequently), players employ standard `smiley-face' glyphs (e.g., **:-)**, **:-(**, and **:-|**) to clarify the `tone' with which they say things. Utterances are also frequently addressed to specific participants, as opposed to the room as a whole (e.g., "Munchkin nods to Frebble. `You tell `em!'")." (Curtis, 1992)

In addition, Rosenberg observes that:

> "Methods have been developed which can overcome some of this problem, but they are limited by the players experience and ability to express himself. Body language is very difficult to enter into the MOO. Players will often enter commands like "Player looks shocked!" or "Player gasps" or "Player laughs" but these lack the meaning that true body language would give. Inflection is a bit easier to instill, by highlighting words in various ways, for example: ALL CAPS, ***asterisks***, and _underscore_." (Rosenberg, (1992)).

Communication issues are particularly crucial to the development of virtual classrooms. Much of teaching as it is now practiced relies on gestures, "body language" and other tactile/kinesthetic mechanisms to communicate meaning. Many of the visual cues which instructors use to judge student reactions to new information do not exist in a text based environment. For example, new ways will need to be created to duplicate the simple practice of raising a hand to ask a question.

The MUSE environment does provide some "built-in" protocols for adding a sense of grammatical immediacy to communications. For example, during an on-line conversation, a student whose character was named Star might type:

; eyes open wide in wonderment!

Other students would see: "Star's eyes open wide in wonderment!" The semi-colon symbol automatically adds the possessive to the character's name. Similarly, using a colon before a statement produces a statement in a more "active" voice. For example, typing:

: looks to the sky for assistance displays on the computer screens of other students as *Star looks to the sky for assistance.*

Because of time delays in data transmission and the occurrence of multiple simultaneous conversations, information arrives in "bursts" which must be remembered and sorted into meaningful threads until the entire communication has been received.

Bruckman notes the "multi-threaded and multi-layered" nature of typical MUD/MUSE conversations while Serpentelli speaks at length about their dynamics observing that:

> "a user may have to keep track of many conversations at once in such a setting, since two different threads might be in progress in the room itself, while s/he might be whispering or paging with yet another person in a private conversation. Thus, though MOO conversation is more coherent in terms of focus, it still often forces

> the user to learn how to divide attention effectively between a few conversations at the same time, a skill not often practiced in real-life conversation." (Serpentelli, 1992).

Managing simultaneous, multiuser conversations will present the virtual instructor with a variety of challenges. Organizing and sequencing "multi-threaded and multi-layered" conversations may provide new opportunities for the exploration of alternative learning styles.

Social Organization

The social organization of MUD/MUSE environments is a dynamic and constantly evolving process. Without exception, all such systems have one or more persons with absolute authority to allocate resources, resolve disputes and generally manage day-to-day operations. Depending upon the theme of the MUD or MUSE, these persons are called Directors, Wizards and sometimes Gods. Again, depending upon the social architecture and theme of the environment, the functions of these individuals can vary significantly although the role of "police officer" and final arbiter of justice is common to all.

In discussing the social dynamics of MUDs/MUSEs, Haakon the ArchWizard of LamdaMOO states:

> "On most MUDs, the wizards' first approach to solving serious behavior problems is, as in the best real-life situations, to attempt a calm dialog with the offender. When this fails, as it usually does in the worst cases of irresponsibility, the customary response is to punish the offender with `toading'. This involves (a) either severely restricting the kinds of actions the player can take or else preventing them from connecting at all, (b) changing the name and description of the player to present an unpleasant appearance (often literally that of a warty toad), and (c) moving the player to some very public place within the virtual reality. This public humiliation is often sufficient to discourage repeat visits by the player, even in a different guise.
>
> On LambdaMOO, the wizards as a group decided on a more low-key approach to the problem; we have, in the handful of cases where such a severe course was dictated, simply `recycled' the offending player,

removing them from the database of the MUD entirely. This is a more permanent solution than toading, but also lacks the public spectacle of toading, a practice none of us were comfortable with." (Curtis, 1992).