Chapter 1

INTRODUCTION

During the last twenty years, computers have altered the ways in which much of the world functions. Business, government, communications, research and education have been fundamentally changed by computer technology. A matrix of silicon now wraps the planet in a web of intricately interconnected global computer networks. Much like the neural networks in our own brains, new data pathways are constantly being created or enhanced. Out on the cutting edge of technology, the future is being created. This study has selected for exploration, a new educational environment born of virtual reality, global networks and the dynamic process of teaching and learning. Moving beyond the conventional and well explored issues of placing computers in the classroom, this study explores the possibility of placing the classroom in the computer.

BACKGROUND

Networks

The history of computing is also the history of efforts to link and share information. During the late 1950's and early 1960's, the first mainframe computers supported banks of workstations located within the immediate vicinity of the computer. These workstations were often in the same room or building as the host computer and were each individually attached to the host computer through miles of copper wire.

As computers grew in complexity, sophistication and cost, the need to share computing resources across wider geographical areas became obvious. Mainframe computer systems with their highly localized access via remote computer terminals were inadequate to meet the informational needs of government, military, academic and private researchers working at remote sites across the country. Advances in wide and local area networks improved access at a regional or organizational level but did not solve the problem of access over continental and inter-continental

distances. Further compounding the issue of information sharing was the absence of a single, commonly agreed upon information exchange method between distant computer systems.

In an attempt to unify this electronic "Tower of Babel" and provide an effective method through which computing centers around the world could link, the National Science Foundation (NSF) funded a program in 1985 to establish and link five national supercomputing centers. Using a standardized method of information exchange (TCP/IP) designed to transport information at what were considered very high rates of speed (approximately fifty-six thousand characters per second), this experimental project would grow to become what we know today as Internet, the world's largest computer network.

Internet expanded rapidly, doubling in size every six months. By 1988, more than 250 academic institutions and research centers were connected along with more than half a dozen international sites in Europe, Canada, Mexico and other parts of the world.

Internet

To accommodate increases in system usage, in 1988 additional data transmission capacity was added to major computing sites on the Internet Data transmission capacity was increased from fifty-six thousand characters per second to one and a half million characters per second. An additional expansion planned for the next decade will provide data transmission capability at forty-five million characters per second to over 500 universities.

In May 1989, then Senator Albert Gore Jr. introduced S.1097, the "National High Performance Computer Technology Act of 1989" which would authorize a federally funded National Research and Education Network (NREN) expenditure of $400 million over 5 years to upgrade the data transmission capacity of Internet to three billion characters per second by as early as 1996.

Since 1986, the number of computer hosts on the Internet has grown by approximately 100% each year. In January 1993, Internet was linking more than 1,300,000 hosts in most major countries. Although growth of the Internet in the United States is slowing down (to 80% in the past year), growth elsewhere in the world is just beginning. The number of hosts increased 200% in the United Kingdom in 1992 (where Internet hosts now number more than 58,000) and increased some 170% in Japan, with nearly 24,000 hosts The exact number of people who daily access Internet computer services is unknown; estimates range from 8 million to 15 million people worldwide excluding users on hosts that, for security reasons, are invisible on the Internet system.

Under the Reagan administration, guidelines restricting the use of Internet to academic and research facilities were modified to allow commercial organizations as well as private citizens to use the network. Effectively, anyone with a computer, modem and access to an Internet account is free to use the resources of the world's largest computer network: university libraries, enormous databases, access to government documents and research papers, global electronic mail and real-time conversations with other Internet users from around the world to name but a few.

The real potential of Internet is only now emerging. The increases in Internet data exchange rates currently in place, under development, or planned for the future, portend an information revolution which may dwarf all previous networking efforts. As schools, colleges, businesses and government agencies implement fiber optic systems and as high speed/high capacity data communications capabilities become available to individuals in their own homes, the introductory phase of the information revolution will end and a larger, globally transformative phase will begin.

The proposed Internet system will have more than enough capacity to support two-way, high resolution, audio/video digital telecommunications between groups or individuals anywhere in the world. Within the next decade, access to information in text, graphical, and auditory formats will become virtually instantaneous with vast musical libraries and digital

film/video archives readily available. In technologically advanced countries, it is likely that most aspects of work, social, political and simple daily life will be affected by these coming changes.

The way in which we conceptualize and actualize our educational system is likely to be changed by this emerging generation of high speed global networks. Internet provides the infrastructure with which to create an entirely new, and yet paradoxically classic, teaching/learning environment.

Communications on the Internet

Early in the development of the Internet system, users at remote sites found a need to communicate with one another in real time. Unlike electronic mail, "talking" in real-time on the Internet involved carrying on conversations by typing them at computer keyboards. Words and sentences appeared almost immediately on the computer terminals of everyone else taking part in the conversation. Although these early conversations were largely technical in nature and focused on the set-up and integration of Internet, they soon developed into a complex array of communications channels, each dedicated to a highly specific topic of conversation. A "conference calling system" in which conversations were written (text-based) rather than spoken quickly evolved. In time, this system of text based, real-time communication was formalized and refined to become Internet Relay Chat (IRC), a network of hundreds of conversational channels with each channel capable of supporting hundreds of simultaneous users. IRC can now be accessed by connecting, through the Internet to one of many networked servers across the country and around world.

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. Based loosely on the popular adventure game Dungeons and Dragons, they produced a real-time, text-based, multi-player environment called a MUD or Multi User Dungeon. Dictionaries on Internet terminology define a MUD as follows:

> *:MUD: /muhd/ [acronym, Multi-User Dungeon; alt. Multi-User Dimension] 1. n. A class of {virtual reality} experiments accessible via the Internet. These are real-time chat forums with structure; they have multiple 'locations' like an adventure game, and may include combat, traps, puzzles, magic, a simple economic system, and the capability for characters to build more structure onto the database that represents the existing world.* (Raymond, E. S.,1991.)

MUDs and MUSEs (Multi-User Simulated Environment) proliferated on Internet. Hosted primarily by colleges and universities, these early experimental systems offered users the ability to create richly described environments in which to meet and interact with other players. In time, quite complex programming languages were formulated for use in the development of these virtual environments. Users created a fabulous array of virtual places ranging from the bizarre to the sublime. Limited only by their imaginations, players created tropical islands and space stations, haunted castles and alien worlds. Advances in MUD/MUSE programming languages soon allowed for the creation of "smart", semi-autonomous robots, complex interactive objects, realistic simulations and improved methods for players to "see" and interact with one another in these virtual worlds. Although early MUDs and MUSEs were primarily intended for experimental and recreational purposes, the stage had been set for the next stage in their development.

In 1991, the first MUSE with an educational theme was built. Since that time, a variety of ever more complex and sophisticated virtual teaching/learning environments have been constructed. The most advanced example of these is MariMUSE, a virtual college sponsored by the Maricopa Community College District in Arizona (This study defines a virtual college as an Internet based computer simulation within which a location, room, or environment has been created by an instructor to support and facilitate teaching and learning. Virtual classrooms might be created to simulate traditional lecture halls or tropical rain forests, a chemistry laboratory or the inside of a nuclear reactor). MariMUSE is

staffed by college faculty, enrolls students from around the world, and offers a broad selection of transfer level courses.

PROBLEM STATEMENT

Little is know about the process of teaching and learning in a multi-user, interactive, virtual classroom. This exploratory study will examine the learning experiences of students participating in existing virtual classrooms in MariMUSE and propose a model for implementing a virtual classroom at De Anza College.

PURPOSE OF THE STUDY

An exploration of existing text-based virtual classrooms provides an important starting point for educators and other professionals wishing to better understand this emerging technology. The purpose of this study is to examine the reactions of students to virtual instruction as an aid to understanding and development of significantly more advanced virtual instructional environments in the near future.

Like a living novel in which the theme, plot line, and content are simultaneously written by multiple authors, text based virtual classrooms offer clear instructional insights into the dynamics of virtual teaching/learning which might otherwise be obscured by the compounding variables of graphics and sound. Although Internet facilitated virtual environments will likely acquire more capability such as two-way audio/video, high resolution graphics, and multimedia, the operational dynamics of such an environment can be readily examined in a virtual classroom where all communication and interaction takes place in written form.

Using exploratory and quantative research methods, this study will examine student responses to the structure, content, and operational methodology of existing virtual classrooms. Information will be gathered through survey instruments and observation of students and faculty

participating in the virtual college. Given the highly experimental nature of virtual instruction, the exploratory research methods which will be employed lend themselves well to the study.

RESEARCH QUESTIONS

This study will employ survey data collected from student participants to answer the following questions:

• What do students in a virtual classroom perceive as the role of the instructor?

• What did students expect to learn in the virtual classroom?

• What did students perceive as the teaching styles of instructors they encountered in the virtual classroom?

• What aspects of the course did students think were best/least supported by the virtual classroom?

• As little is know about the demographic characteristics of students who have distinctly positive/negative experiences in the virtual classroom, this study will describe some basic demographic characteristics of student participants as a starting point in determining whether these characteristics are borne out in any future large scale studies.

Unlike conventional classrooms, little is known about effective design of virtual classroom environments. This study will employ data collected through observation to explore the mechanics of teaching/learning in a virtual classroom by exploring student responses to such questions as:

- how is dialogue created?
- how is homework distributed/collected?
- how is information presented?
- what unique instructional resources are available?

- how are these resources utilized?

OPERATIONAL DEFINITIONS

Although this study explores a highly experimental use of global networking and computer facilitated instruction, it deals with teaching/learning considerations which have remained functional unchanged for thousands of years. A deliberate effort has been made by the author to restrict the use of technical terms and jargon to only those areas in which it lends a clearer understanding to the topic under discussion.

In order to provide clarity and continuity of meaning, this study employs the following set of definitions:

Character: the players persona in a virtual world. Descriptions of characters generally, but not always, include: gender, appearance, age, and personal attributes.

Graphics: non text-based information appearing on a computer screen (i.e. charts, graphs, drawings and other high resolution images presented with or without color);

Internet: a high speed network of interconnected computer networks incorporating modems, telephone lines, optical fiber and satellite relay systems to link together computers from around the world.

MOO: Multi user simulated environment Object Oriented, the most advanced and comple of all virtual reality generators, MOOs can incorporate graphics, sound and two-way video/audio.

MUD: Multi User Dimension, one of the earliest of the text based virtual reality generators.

MUSE: Multi User Simulated Environment, a text based virtual reality generator offering more advanced programming and player interaction options.

Object: the things, rooms, places, and entities created to fill a virtual place. Objects might be as simple as a blue rubber ball or as complex and interactive as a working simulation of Moscow.

Text based: employing no graphics or text formatting (i.e., no bold face, italic, underlined or varying type sizes);

Virtual Classroom: a location, room, or environment located within a computer simulation and designed to support and facilitate teaching and learning. Virtual classrooms might be defined as traditional lecture halls or tropical rain forests, a chemistry laboratory or the inside of a nuclear reactor.

Virtual College: a location on the Internet which provides a setting for the development of virtual classrooms.

Virtual Reality: A computer synthesized environment designed to mimic reality as a mechanism for allowing participants to interact with the simulation as if it were real

LIMITATIONS OF THE STUDY

Due to the limited availability of operational virtual college and classroom locations, this study will confine itself to an exploration of one site, MariMUSE, a virtual college within the Maricopa Community College District in Phoenix, Arizona. It must be further noted that the limited number of virtual classrooms in operation and the limited number of virtual classroom students available for interview limit the study to a small "n." This study will not evaluate the content, methodology, design or instructional effectiveness of the MariMUSE sites. It is delimited to describing student responses to selected aspects of this environment as it presently exists.

The recency of virtual classrooms imposes severe constraints on the availability of literature specifically addressing this topic. Although a small but growing, body of background literature does exist on topics related to virtual reality (i.e. history, sociology, communications, ethnography, and technical computer issues) and virtual communities,

even these resources are available largly through electronic media rather than in print format. Lastly, as with any such work, this study is subject to limitations imposed by the skills and abilities of its author.

STATEMENT OF SIGNIFICANCE

It is reasonable to expect that the informational possibilities offered by high speed data networks like Internet may radically alter conventional beliefs about the form and function of education. Colleges and universities could well find their long standing monopoly on the provision of higher education challenged by private industry, particularly the film, television and entertainment industry. In the near future, students might soon be able to choose between a variety of classroom opportunities. Traditional classroom settings in which students, instructor and instructional resources are present at a physical location will certainly continue. They might be joined, however, by virtual classrooms in which students are scattered around the globe, the instructor is sitting comfortably at home and the instructional resources are the collected body of on-line simulations, multi-media applications, university libraries and other facilities available through the global Internet system.

Much of the instructional methodology of higher education is based on models whose origins can be traced to ancient Greek history and beyond. The collateral effects of the second and third waves of global networking will permanently alter the comfortable assumptions upon which this long history has been established. The spiraling costs of higher education, an urgent need to provide equal access to education for all citizens, state and federal mandates to better utilize existing and future instructional resources, and the immediately observable trend for corporate partnerships between computer hardware/software companies and the entertainment industry all suggest that the time has come to consider major change in our conventional approach to higher education.

The creation of virtual colleges, the design of virtual classrooms, and the training of faculty to teach in these environments may well be essential

for colleges and universities struggling to bring post-secondary education into the twenty-first century. This study will incorporate its observations into a set of recommendations which will be used in formulating a model for the implementation of a virtual classroom at De Anza college. It is anticipated that this information may well form the basis for a significant addition to traditional educational methods and practices at De Anza College as well as other post-secondary institutions wishing to explore alternative instructional settings. This study represents a first step in exploring the implications of virtual reality on the future of education.