NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

CASE STUDY OF THE NAVAL POSTGRADUATE SCHOOL'S DISTANCE LEARNING PROGRAM

by

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December 2001

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Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
19 Dec 2001	N/A	-

Title and Subtitle Case Study of the Naval Postgraduate School's Distance Learning Program	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Franklin, Matthew J. Sanders, Donald R.	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Naval Postgraduate School Monterey, California	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU
Number of Pages 92	

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** December 2001	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE: Case Study of the Naval Postgraduate School's Distance Learning Program		**5. FUNDING NUMBERS**	
6. AUTHOR(S) William T. Franklin and Donald R. Sanders			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		**8. PERFORMING ORGANIZATION REPORT NUMBER**	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited		**12b. DISTRIBUTION CODE**	

13. ABSTRACT ***(maximum 200 words)***

Amidst growing pressures of budgetary constraints and an era of downsizing, the Naval Postgraduate School must seek alternative ways of delivering quality education to its customers. NPS has turned to various forms of distance learning to provide education to officers unable to attend its resident programs. A particular challenge NPS faces in developing distance learning programs is determining their cost. While there have been numerous studies attempting to provide some insight into the costs of delivering distance education programs (i.e., *Technology, Open Learning and Distance Education* by Dr. Tony Bates of the Open Learning Agency in British Columbia, etc.), there are still many unanswered questions.

This thesis analyzed available educational literature on costing distance education programs to assist NPS policy makers in making better decisions. This thesis identified numerous variables that should be considered when developing a cost model for delivering distance education programs that use a combination of web-based instruction, video teleconferencing and traveling instructors. At a minimum, these variables should include: faculty, administrative, technical support, equipment, course development/delivery, consumable, infrastructure and maintenance costs. Of course, terminology and definitions will vary among researchers.

We quickly learned from our research that costing distance education programs is an extremely difficult task, specifically when considering web-based instruction. In an increasingly commercial environment, cost information is a very sensitive matter. Many institutions are not willing to release cost information for proprietary concerns and competition.

14. SUBJECT TERMS Costs of Distance Learning, Distributed Learning, On-line or Web-based Learning, Asynchronous Learning	**15. NUMBER OF PAGES** 92
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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CASE STUDY OF THE NAVAL POSTGRADUATE SCHOOL'S DISTANCE LEARNING PROGRAM

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MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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ACKNOWLEDGMENTS

We give all the praise and glory to God, our almighty father, for without him in our lives, nothing is possible.

We would like to give a special thanks to our wives and families: Wilda and TJ Franklin, and Sandra and Jazmine Sanders, for their patience, love and support over the past year and a half.

We would like to give a personal thanks to our advisors, Dr. William Gates and Dr. James Suchan for their professional support, guidance, and encouragement, who oftentimes reminded us that there was an end in sight.

We would also like to thank Greta E. Marlatt, Head of Information Services Dudley Knox Library, and her staff for their unwavering support during this project. Last, but not least, we would like to thank Liza Rosa, Personnel Management Specialist in the Human Resources Office, for her enthusiastic encouragement.

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I. INTRODUCTION

A. PURPOSE

This thesis examines the costs associated with delivering distance education programs at the Naval Postgraduate School and several other comparable universities via web-based instruction, video teleconferencing and traveling instructors. This thesis attempts to identify all relevant variables, which should be considered in developing a cost model for delivering distance education courses at the Naval Postgraduate School (NPS).

Amidst growing pressures of budgetary constraints and an era of downsizing, the Naval Postgraduate School must seek alternative ways of delivering quality education to its customers. While there have been numerous studies attempting to provide some insight into the costs of delivering distance education programs, such as *Technology, Open Learning and Distance Education* by Dr. Tony Bates of the Open Learning Agency in British Columbia; *The Costs and Economics of Open and Distance Learning* by Greville Rumble; and *Dollars, Distance, and Online Education* by Martin J. Finkelstein et al., there are still many unanswered questions. This thesis analyzes available educational literature on costing distance education programs that will assist NPS administrators in making better decisions.

Furthermore, we hope this thesis will inspire additional research in the area of distance education as a viable means of providing quality educational opportunities throughout the fleet and the Department of Defense.

B. BACKGROUND

The mission of the Naval Postgraduate School is to develop, strengthen and expand the knowledge, capability and innovative thinking of our officer corps to anticipate and meet the defense challenges of the 21st century. Throughout most of the 20th century, NPS provided graduate education and professional development to legions of military officers, both American and international, in a variety of technical, operational, management and strategic curricula (NPS OCL Home Page, 2001).

Characterized by unprecedented economic expansion and social reforms, the 20th century led to an explosive increase in the quest for knowledge, forcing universities and colleges to seek answers to the rising cost of higher education. With the rapid expansion of the World Wide Web and the Internet, the 21st century promises to be just as exciting and challenging. Continuous education and lifelong learning has become a necessity to remain employable in the fast-paced technologically changing environment. NPS must lead the way and keep pace with this dynamic new uncertain environment, supplying the Department of Defense with well-prepared knowledgeable officers to meet any challenges they may face.

Reskilling is becoming a requirement for employees. Companies are reengineering themselves and revamping fundamental work processes, resulting in fewer people left to do more things (Forman, 1995). According to the American Society for Training and Development, by the 2000, 75 percent of the current workforce will need to be retrained just to keep up (Twigg, 1996).

The Naval Postgraduate School is no exception. Faced with increasing budgetary constraints and pressures to downsize, NPS must find alternative, cost-efficient ways to compete for scarce resources within the Department of Navy. Private-sector universities and colleges have sought the answer in distance education programs.

For example, a 1999 report from the International Data Corporation (IDC) estimates that 2.2 million college students in the United States will be enrolled in some form of distance education by 2002, up from approximately 710,000 in 1998. IDC's research estimates that 85 percent of two-year collages in the United States and 84 percent of four-year colleges will offer distance learning courses by 2002 (Meriosotis, 2000).

Distance education must undoubtedly become part of the Naval Postgraduate School's strategic thinking for several reasons. Rising costs and decreased budgets have forced all agencies within the Department of Defense to seek better business practices.

Due to a reduction in personnel and increased operational commitments, potential students are no longer able to spend the required 18 to 27 months away from their

professional communities. Distance education reduces the time required to spend on campus.

In the technology driven 21st century, distance education will provide a means for lifelong learning. Distance education programs allow the flexibility of remaining on the job, while taking advantage of the opportunity for continued education.

Finally, utilizing distance education in short courses could allow savings in travel, lodging and opportunity costs for personnel who could take the same courses at their permanent commands vice traveling to NPS (Sorenson, 1998).

C. RESEARCH QUESTIONS

1. Primary Research Question

- What are the relevant variables to be considered in developing a cost model for distance education courses at the Naval Postgraduate School?

2. Secondary Research Questions

- What are other universities with on-line programs charging for their courses?
- What variables do these universities consider in determining costs of their programs?
- Is NPS using the same variables in determining costs, or are there other variables that should be considered?

D. SCOPE

Information technology and advanced communications are having a dramatic impact on the way education is delivered today and how it will be delivered in the future. Although there have been numerous studies attempting to address the issue of costs of these technology-based forms of learning (Milam, 2000), lack of a firm understanding of the cost-drivers still exists. There are still numerous questions to be answered. This scope of this thesis will include:

- A review of the history of distance learning and how it has evolved
- Identification of the relevant variables in determining costs of delivering distance education
- An in-depth analysis of the costs associated with distance learning programs
- An analysis of the procedures several other universities are using in determining costs

E. METHODOLOGY

The objective of this thesis is to identify all relevant variables that should be considered in determining the costs of delivering the distance education programs at the Naval Postgraduate School. The procedures used in this research consisted of the following steps:

- Conduct a literary search of books, magazines, government reports, Internet-based materials and other library information resources
- Conduct interviews, either by phone or in person, with faculty and staff personnel at other universities involved in distance education programs
- Conduct interviews with faculty and staff at the Naval Postgraduate School involved with the distance learning programs
- Identify all relevant variables for developing a cost model
- Develop a cost model for delivering distance education courses at NPS
- Conduct a comparable analysis of available cost data and charges administered for distance education courses obtained from other universities

F. ORGANIZATION

This thesis is organized into five chapters. Following the introduction to the research area in Chapter I, Chapter II provides a background for the thesis which includes the history of distance learning, how distance learning is defined, its modes of delivery, and the market for distance learning. Chapter III presents the cost model, which identifies the relevant variables, and explains the cost models. Chapter IV analyzes the available data and compares charges across various distance learning programs. Chapter V presents the conclusions, recommendations and suggests areas for further research.

G. BENEFITS OF THE STUDY

The Naval Postgraduate School is currently establishing a Masters of Business Administration program. Many students cannot afford to spend the required 18 months away from their professional communities. In an effort to shorten the length of stay that officers spend away from their operational tours, several classes will be taken online. Therefore, this thesis is intended to provide decision-makers with a better understanding of the costs involved in delivering classes online.

II. BACKGROUND

A. INTRODUCTION

Before attempting to develop a cost model for distance learning, it is important to know what distance learning is and how it has evolved since the early 1800s. Thus, this chapter provides some background information that includes detailed definitions of distance learning, the history of distance learning, and certain modes of delivery. This chapter also describes the market for distance learning and the current status of distance learning at the Naval Postgraduate School.

B. DISTANCE LEARNING DEFINED

Researchers have provided numerous definitions of distance learning. One very general definition defines distance learning, also known as distance education and most recently distributed learning, as instruction delivered to one or more persons located in one or more venues. It is simply any kind of learning that takes place when the instructor and student are not physically in the same place (Sawhney, 1997). Rumble (1997) states that the geographical distances may be relatively small, or very large. Most definitions recognize that there may be a degree of physical interaction between teacher and learner, but compared with the normal classroom experience, the actual amount of face-to-face contact is usually reduced or even nonexistent (Rumble, 1997). In distance learning, technology is used to substitute for the classroom experience (Sawhney, 1997).

For this study we define, distance learning as education or training courses predominately delivered to remote (off-site) location(s) via two-way interactive audio and video or courses using computer technologies (e.g., web-based instruction), including both synchronous and asynchronous instruction. In addition, for this study, distance learning includes courses in which the instructor travels to a remote site to deliver instruction in person (Statistical Analysis Report, 1999).

Another form of distance learning is distributed learning, in which technology is a tool used to complement the classroom experience. Professor Mohan Sawhney of Northwestern University's J. L. Kellogg Graduate School of Management describes technology's role in education as follows:

> Digital Technology will not and cannot substitute for the university as a physical place. Rather, technology will complement the mission of the university as a place. Classrooms will be utilized for discussions and other high-value social-learning experiences. Electronic channels will be used for self-directed exploration and other electronic interaction. Together they will enable anywhere, anytime, anyhow learning (Sawhney, 1997, p. 6).

Distributed learning is focused on increasing communication among those involved in the class beyond the limits of the class period. By complementing live class discussions with asynchronous communications, distributed learning allows students to ask questions which they might not want to ask in front of the class. Empirical evidence has shown that many students feel more comfortable asking questions via this channel of communication than in class or even during office hours (Sawhney, 1997).

C. HISTORY

1. First Generation

The history of distance education can be traced back as far as the 1830s with the advent of commercial correspondence courses (Statistical Analysis Report, 1999). The early development of correspondence education, in Lund, Sweden in 1833 and by Sir Isaac Pitman of Bath, England in 1840, led to the creation of private, commercial, correspondence schools and colleges. Sir Isaac Pitman taught secretarial skills to rural residents by having them translate the Bible into shorthand and mailing it back for grading (Delors et al., 1996). Thus, the earliest form of distance learning took place through correspondence courses in Europe. This medium was the accepted norm until the middle of this century, when instructional radio and television became popular.

The technologies predominately used in distance education in the early and mid-20th century, such as print, radio, and television, were one-way, narrowband communications. These first-generation distance education technologies (1850s - 1960) were best used to transfer information from faculty to student. This delivery mode only supported minimal interaction between student and faculty and typically no interaction among students. Broadcast technologies were time dependent in that radio and television broadcast only occurred at predetermined times (Statistical Analysis Report, 1999).

In the late 1950's and early 1960's, television production technology was largely confined to studios and live broadcasts, in which master teachers conducted widely broadcast classes. Unfortunately, teachers who were expert in the subject matter were not necessarily the best and most captivating television talent, nor was the dull "talking head" medium the best production method for holding the interest of the audience (Cambre, 1991).

2. Second Generation

Second generation technologies began to evolve in the 60's and lasted until the mid-1980s. VCR's and cable television came on the scene and enabled "time shifting" of the broadcast portion of distance education courses. In retrospect, however, this generation of technology was not very different from the previous generation in that there was little interaction among students and between students and faculty (Statistical Analysis Report, 1999).

In the early 1970's, the emphasis turned from bringing master teachers into the classroom to taking learners out of the classroom. This shift had the negative effect of relegating television to the position of educational enrichment, which was not perceived as really related to schoolwork. This trend was reversed later in the 1970's, as professionally designed and produced television series introduced students to new subject matter that was not being currently taught, yet was considered to be an important complement to the classroom curriculum.

In the 1980's, the major drawback of radio and broadcast television for instruction was the lack of a two-way communications channel between teacher and student. Increasingly sophisticated interactive communications technologies were adopted by distance educators as they became available (Cambre, 1991).

3. Third Generation

The personal computer had found its way into the educational system by the mid-1980s. This third generation of technology (1985–1995) allowed more interaction among students and between students and faculty through the use of electronic mail, chat rooms, and bulletin boards. The advent of computer-assisted instruction, simulations, and other electronic resources accessed via computer disk, CD-ROM, or the Internet, further

characterized this generation of distance education technology (Statistical Analysis Report, 1999).

The most popular media during this generation (1985-1995) were computer-based communication, including electronic mail (E-mail), bulletin board systems (BBSs), and Internet; telephone-based audio conferencing; and videoconferencing with 1- or 2-way video and 2-way audio via broadcast, cable, telephone, fiber optics, satellite, microwave, closed-circuit or low power television (refer to Table 1). Audio graphic teleconferencing using slow scan or compressed video and FAX was a low-cost solution for transmitting visuals as well as audio (Cambre, 1991).

4. Fourth Generation

The fourth generation (1995 – 2005 estimated) represents another advance in distance education technology. Once again, interaction among students and between students and faculty is potentially increased. Furthermore, with increased bandwidth capabilities, information exchange is significantly greater and takes less time to occur. The current landscape of distance education incorporates a number of these fourth generation technologies. For example, two-way video with two-way audio, one-way prerecorded video, Internet courses using synchronous and asynchronous computer-based instruction, and CD-ROM. Thus, advances in technology have resulted in the implementation of virtual universities (Statistical Analysis Report, 1999).

Table 1 summarizes the *Generations of Distance Education Technologies*, as described above.

	First Generation	Second Generation	Third Generation	Fourth Generation
Primary Feature	Predominantly one technology	Multiple technologies without computers	Multiple technologies including computers and computer networking	Multiple technologies including the beginning of high-band width-computer technologies
Timeframes	1850s to 1960	1960 to 1985	1985 to 1995	1995 to 2005 (est.)
Media	• Print (1890s) • Radio (1930s) • Television (1950s and 1960s)	• Audio cassettes • Television • Videocassettes • Fax • Print	• Electronic mail, chat sessions, and bulletin boards using computes and computer networks • Computer [programs and resources packaged on disks, CDs, and the Internet] • Audio conferencing • Seminar and large – room video-conferencing via terrestrial satellite, cable and phone technologies • Fax • Print	• Electronic mail, chat sessions, and bulletin boards using computer networks plus high band with transmission for individualized, customized, and live video interactive learning experiences • Computer programs and resources, packaged on disks, CDs, Internet • Audio conferencing • Desktop video-conferencing via terrestrial, satellite, cable, and phone technologies • Fax • Print
Communication Features	• Primarily one way communication • Interaction between faculty and student by telephone and mail • Occasionally supplemented by on-site facilitators and student mentors	• Primarily one way communication • Interaction between faculty and student by telephone and mail • Occasionally supplemented by face to face meetings	• Significant broadband communication from faculty to students via print, computer programs, and video-conferencing • Two way interactive capabilities enabling asynchronous communication between faculty and students and among students • Internet good for text, graphics, and video snippets	• Two way interactive real time capabilities of audio and video • Asynchronous communication between faculty and students and among students • Full 30 frame per second digital video transmission with databases of content resources available via Internet and World Wide Web • Lengthy digital video programming available on demand
Student Characteristics and Goals	• Student generally isolated from faculty member and other student • Students must be mature, highly motivated and disciplined	• Increased contact between faculty and students by telephone and occasional face to face meetings • Students generally still primarily isolated, studying in home, often at unusual times, by self • Students highly motivated and self-disciplined	• Increased contact between student and faculty via computer mediated communication • Increased contact and collaboration bet ween students in the same program • Technologies support the development of a learning community between the students and faculty	• Increased contact between student and faculty via computer mediated communication • Increased contact among other students in the same course or program • Technologies support the development of a learning community between the students and faculty
Student Characteristics and Goals Continued	• Students generally working on core educational requirements or lifelong enrichment • Occasionally used for large, isolated groups of students with site monitor or mentor	• Students generally working on core educational requirements, advanced degrees, or lifelong enrichment • Occasionally used for large, isolated groups of students with site monitor or mentor	• Increased face to face meetings, often for longer period, such as three to fourteen hours • May be working on core education requirements, advanced degrees, professional certification or	• Increased face to face meetings, often for longer period, such as three to fourteen hours; also face-to-face contact through desktop video-conferencing • Student may be working on core education requirements, advanced degrees, professional

	First Generation	Second Generation	Third Generation	Fourth Generation
			certification or lifelong learning • More faculty direction and support is possible; less disciplined learners can be supported • Goals to develop skills, knowledge, attitudes	degrees, professional certification • More faculty direction and support possible; less-disciplined learners can be supported. • Goal is to develop skills, knowledge, attitudes
Educational Philosophy and Curriculum Design	• Highly structured materials, such as programmed learning • Materials almost 100 percent prepackaged for stand-alone delivery, supplemented by tutor or mentor, a novice expert • View of student as empty vessel; primary goal is information dissemination	• Materials almost 100 percent prepackaged for stand-alone delivery, supplemented by tutor or mentor, a novice expert • Highly dependent on instructional systems design to compensate for lack of direct and immediate student-faculty interaction, spontaneity • View of student as empty vessel	• Materials must still be highly structured and instructionally designed; interactive technologies can provide more ad-hoc direction and support of learners • Materials may vary from 100 percent prepackaged to about 30 percent prepackaged, with more faculty or mentor direction and support • View of student as active learner, participant, and contributor	• Materials must still be highly structured and designed but interactive technologies can provide more ad-hoc support of learners • Materials may vary from 100 percent prepackaged to about 30 percent prepackaged, with more faculty or mentor direction and support • View of student as active learner, participant, and contributor
Infrastructure Components	• Postal Service for delivery of print materials • Radio technology in home • Radio and television broadcast stations and towers • Instructional program designers, developers, producers, • Significant up-front investment • Faculty tutor or site facilitator, depending on model	• Widespread television in homes and schools (1960) • Widespread audio and videocassette technology (1980) • Instructional program designers, developers and producers • Significant up-front investment • Faculty tutor or site facilitator, depending on model	• Widespread use of computers and multimedia • Critical mass of ownership of computers with online service (in 1996, about 8 percent in U.S. could access World Wide Web) • User friendly technologies are needed to ensure access • Instructional program designers, developers, producers • Significant up-front investment • Faculty tutors or site facilitators depending on model	• Critical mass of ownership of computers with online service (in 1996, about 8 percent in U.S. could access World Wide Web) • User friendly affordable multimedia Internet technologies needed to ensure access • User friendly technologies are needed to ensure access • Instructional program designers, developers, producers • Significant up-front investment • Faculty tutors or site facilitators depending on model • Improved development tools for complex media design and development

Table 1. Generations of Distance Education Technologies.

This table is from the unpublished manuscript of a white paper on distance learning at Florida State University edited by J. V. Boettcher And Barbara Foster (1996). The concept of generations of distance learning was adapted from A.W. Bates, Technology. Open Learning and Distance Education (London and New York: Routledge Publishing, 1995).

D. MODES OF DELIVERY

Depending on delivery mode, distance education can be expensive, and no matter what mode used it requires careful planning, management, and course design. Thus,

when choosing different delivery methods, institutions must consider whether the system can save money, reach its intended audience, and provide better instruction than traditional face-to-face instruction (Schamber, 1988).

The primary differentiating feature between the distance learning technologies of today and those of previous generations is the capability for timely and personal interaction, the basis of most satisfying relationships and increased learning. The next generation of technologies that will extend the communication features beyond today's capabilities will include wireless technologies so that one does not need to be "tethered" to access communication features (Rumble, 1997).

There are three modes of delivery that this thesis identifies, (1) web-based instruction, (2) video teleconferencing (VTC), and (3) traveling instructors (road warriors).

1. Web-Based Course Delivery

Fully Web-based courses are delivered through the Internet and are accessible anywhere, anytime. Web-based courses require substantial time and resources to produce. At the University of Central Florida (UCF), support for the development of Web-based courses and programs is provided to faculty in departments and programs identified through a planning process conducted by the Center for Distributed Learning (UCF, 2000).

One attribute, which is especially attractive to students worldwide, is the location independence associated with distance learning through online (Web-based) instruction. There is no need for students and professors to be in the same room or even the same hemisphere; they simply need to be able to access the same networks. For example, Rogers University currently offers 30 courses online via RU Online. Through a university survey performed on their students, the appreciation for location independence was a common sentiment. Thus, location independence provided education to individuals who previously did not have access (Sawhney, 1997).

Another example of the importance of Web-based instruction is shown in an agreement between Regis University and the Naval Station, San Diego. Regis University is regionally accredited by the North Central Association of Colleges and Schools. Regis

offers an Internet-based External Masters of Business Administration degree to the Naval Station sailors while based at sea (Sawhney, 1997).

As more and more colleges, universities, schools, companies, and private citizens connect to the Internet, opportunities increase for distance learning. Students can in essence communicate with teachers by electronic mail to exchange messages or other information with people via software through a computer network to a computer address or via bulletin boards (Gilbert, 2001).

Recent studies show that online classes can be more successful than traditional courses when they allow for active engagement and interaction (Gilbert, 2001). The World Wide Web provides Internet users with a uniform and convenient means of accessing a wide variety of media (pictures, text, data, sound, video). Software interfaces, such as Mosaic and Netscape, are used to facilitate navigation and use of the Web. Distance learning based on the Web can be self-contained in that the student does not need to meet in person with other learners or the instructor (Gilbert, 2001).

A final example of how an institution uses Web-based instruction can be seen at The University of Maryland University College (UMUC). UMUC online MBA program is delivered in module format, of 6 credit hours each, to the student cohorts. Since the program design is accelerated and is offered in an uninterrupted 24-month schedule, students must keep pace with the established schedule.

The online MBA program employs a variety of content methodologies in delivering this degree program. The highly interactive structure of the program requires individual and student team participation throughout the program. Faculty post weekly lectures and discussion questions. Student performance is based on the results of their exams, quizzes, and research papers as well as the quality of their class participation (e.g., chat sessions) as individuals and in groups. There is no face-to-face component requirement in the program (Bishop & SchWeber, 2000, p. 179).

2. Video Teleconferencing Course Delivery

Video teleconferencing can be of two kinds: from a central point, via satellite, to a number of reception sites; or point-to-point, linking two or more sites through telephone lines (Rumble, 1997). Video teleconferencing is a one-way or two-way electronic form

of communications that permits two or more people in different locations to engage in face-to-face audio and visual communication. Meetings, seminars, and conferences are conducted as if all participants are in the same room. Video teletraining is the use of teleconferencing point-to-point or multipoint to provide interactive remote site training (MIL-STD-188-331, 1993).

The presence of such two-way communication is synchronous (happening at the same time, as in a telephone conversation). Early forms of distance education used technologies where there was a built-in delay between the sending and receipt of a message. However, video teleconferencing, due to increases in bandwidth, has greatly reduced or even eliminated this delay (Rumble, 1997).

Video teleconferencing can be a full-motion, full-color system whose one-way or two-way video portion and two-way audio portion may be transmitted by satellite or telephone lines. This system permits range of information forms, including videotape, film, graphics, slides, and data. It is also a good medium for drama, demonstrations, and simulations. One problem that stems around communication is that multiple sites can hamper or dampen interaction among learners (Schamber, 1988).

Another term used interchangeably with video teleconferencing is audio graphic teleconferencing, which is the transmission of still images and audio signals over telephone lines. An example is an electronic blackboard where the image is drawn or written on a pressure-sensitive surface that converts the writing to audible telephone tones. The instructor's voice is transmitted over a second telephone line and amplified in the classroom. Two-way audio allows students to interact with instructors. A narrowband frequency transmits video over one line and audio over another line. Telewriters and electronic pens and tablets are variations of this technology (Schamber, 1988).

3. Traveling Instructors (Road Warriors)

Some institutions of higher learning use traveling instructors to deliver classroom instruction to students at remote sites or on college campuses. For example, instructors at NPS travel to the Naval Academy to provide educational instruction to students in the Leadership Education and Development (LEADS) program. NPS faculty who travel to

Annapolis for one to two week periods teach modularized courses. Thesis advising, faculty "office hours," and supplemental course work is provided by distance learning technology (LEADS, 2001). This program, which was designed by NPS and the United States Naval Academy (USNA) for Naval and Marine Corps Officers, represents a unique approach to graduate level education.

Though this mode of delivery is effective, institutions are leaning more towards web-based and VTC methods. Traveling Instructors, however, work in an environment that is no different from the traditional classroom setting.

E. DISTANCE LEARNING MARKET

All services are actively replacing traditional classrooms with distance learning technologies for both active and reserve components (Metzko, Redding & Fletcher, 1996). The Department of Defense (DoD) is changing its approach to training. It is moving away from training large groups of individuals in formal residential settings because of high travel costs and facility operating and maintenance costs. Distributed or distance learning is also replacing correspondence courses when instructors and students are geographically separated. The primary objective of distributed learning is to extend the learning environment to students at remote locations (Wisher, et al., 1999).

Today, political and public interest in distance education is especially high in areas where the student population is widely distributed. Each region of the United States has developed its own form of distance education in accordance with local resources, target audience, and philosophy of the organizations that provide the instruction. Many institutions, both public and private, offer university courses for self-motivated individuals through independent study programs. Students work on their own, with supplied course materials, print-based media and postal communication, some form of teleconferencing and/or electronic networking, and learner support from tutors and mentors via telephone or E-mail (Cambre, 1991).

Despite its increasing use, distance education is one of the fastest growing and most controversial forms of education today. Assessing the effectiveness of distance education is increasingly becoming a hotly debated issue. As institutions delve into distance learning, having a clear understanding of the costs of delivering distance

education programs is extremely important. On the heel of the dot-com shakeout, expectations for online M.B.A. programs are beginning to fade (Mangan, 2001).

A few years ago, dozens of business schools were jockeying for position in what promised to be a booming market for online M.B.A.'s. The Internet was going to revolutionize business education and any school that did not act fast would be left in the dust. Millions of dollars and countless hours of study later, the dust has settled on a less hopeful scenario. Many business-school administrators say they have been "spooked" not only by the nation's economic downturn, but also by the collapse of high profile e-learning companies that had besieged deans with offers of technical assistance and a share of the profits (Mangan, 2001). For example e-learning companies such as University Access and Pensare, despite having negotiated deals with prominent business schools such as Harvard, Duke's Fuqua School and Wharton school, are no longer in business. E-learning companies, being associated with the dot.com mania, are finding investors closing their wallets as the economy takes a downturn. UNext, another prominent competitor in the e-learning market, is showing signs of trouble. The Deerfield, Illinois based company cut its work force by 42 percent (0ctober 2001), laying off 135 of its 325 employees (Mangan, 2001). Many misread the market; however, the appeal for online M.B.A. courses may grow as companies tighten their training and travel budgets.

Internet-based learning has yet to sweep the nation's business schools (Mangan, 2001). According to Milton Blood, director of accreditation for the Association to Advance Collegiate Schools of Business, online programs are not stealing students away from traditional programs. Online courses are actually capturing a new market of students who do not have the time or are not in the right location to enroll in a traditional program. However, they are not capturing these students as quickly as predicted. Of the total 116,494 M.B.A. students who were taking courses during fall semester 2000, just 2.5 percent, or 2,967 were enrolled in online or other distance programs, according to an AACSB survey of 320 business schools nationwide (Mangan, 2001). However, the survey excluded executive M.B.A. programs, which represents a growing portion of the market and did not distinguish between purely online courses and those that require some face-to-face time.

Additionally, schools, which specialize in online education such as the University of Phoenix, were excluded. Enrollment in the University of Phoenix's standard online M.B.A. program grew 51 percent last year, to 2,008 from 1,328. The for-profit university has offered an online M.B.A. since 1989 (Mangan, 2001).

Traditional business schools, such as Harvard, Columbia, Stanford and the University of North Carolina at Chapel Hill, which joined forces with e-learning companies, are also having difficulties with their online programs. Others, such as Duke University's Fuqua School of Business and Babson College's Franklin W. Olin Graduate School of Business, formed their own spin off companies for delivering their online courses targeting working executives.

Despite sporting a healthy price tag of $95,500, Duke officials reported receiving almost 4,000 inquiries for a class starting in May 2002. Because of rigorous entrance requirements, they expect to receive about 200 applications for 100 positions in the program (Mangan, 2001). Duke has attracted employees of 130 of America's largest corporations. Fuqua's success is quickly legitimizing the online global executive M.B.A. (Vogelstein, 2001).

Still other universities are not quite ready for Internet based courses. For example, the distance M.B.A. program at Colorado State University relies mainly on videotapes of campus-based classes, which are mailed to students in remote locations. The program enrolls 374 students from 47 states and five foreign countries (Mangan, 2001).

Despite moderate to lukewarm success of many online M.B.A. programs, experts believe that as technology improves, the e-learning market will flourish. The eventual cost savings for institutions and the convenience of online programs for the working professional seeking continued educational opportunities will cause demand to increase. This demand will eventually not just be for an online M.B.A. program, but for other programs as well.

F. STATUS OF DISTANCE LEARNING AT NPS

The Naval Postgraduate School's Distance Learning Program was established in 1994. NPS currently offers four-degree programs from the following academic

departments: Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Graduate School of Business and Public Policy. There are several advantages offered through the Distance Learning Program.

First, the material is DoD relevant. The mission of NPS is to educate, train and prepare officers for the 21st Century Navy (Austin, 1988). Therefore, the distance learning programs offered are designed to meet current and future DoD needs in the areas of advanced military technology and operational capability.

Secondly, through the distance learning program, the courses and curricula are customized. The Office of Continuous Learning (OCL) assists the academic departments at NPS to design curricula that offer a variety of graduate courses and professional development opportunities to students whenever required, wherever they may be located, employing the most efficient and effective distributed learning methods (OCL Purpose, 2001).

A third advantage of the Distance Learning program at NPS is that of minimal job interference. One of the benefits includes reduction of time in residence for full-time graduate students who complete prerequisites and refresher courses before they arrive on campus (OCL Purpose, 2001). Students are, for the most part, not physically on campus but are virtually in residence at NPS through real-time, interactive-video-teleconferencing technology. These courses usually require up to three to five hours of classroom participation per week and are conducted during normal working hours (NPS Catalog, 2001). The use of online learning opportunities through web-based or supported education is also an attractive measure for delivering distance learning to students at offsite (remote) locations.

Fourth, through the Distance Learning program, quality learning is incorporated into courses. OCL is chartered to develop, coordinate, and deliver focused and relevant quality learning opportunities to both Navy and other DoD component personnel who are not able to attend NPS on a full-time residential basis (OCL Purpose, 2001). The advantage of office hours with the professors promotes effective student-to-teacher interaction. Through the use of Blackboard and other electronic means, students can

view course assignments, course syllabuses, course materials, etc., and also have an opportunity to clarify course concepts and homework assignments (NPS Catalog, 2001).

One final advantage of the Distance Learning program is that of cost effectiveness. According to the NPS Catalog, cost per student is highly competitive with the local universities or other distance learning options (NPS Catalog, 2001). The Navy possesses a wide geographic dispersal of homeports, fleet units, and Navy Reserve detachments. The costs associated with transporting Navy personnel to a few facilities for classroom training are great. These costs include transportation, travel expenses, and the travel time lost from duty. In spite of these factors, there is still a requirement to train Navy personnel who are geographically remote from training resources (Simpson, Pugh, 1992).

G. CHAPTER SUMMARY

Distance learning has evolved significantly since its inception in the early 1800s. Based on current research, distance learning is in and of itself a form of learning that results from interaction between teachers and remote students. Thus, teaching and learning are done by way of telecommunications.

Section B provides detailed definitions of Distance Learning. Section C gives an overview of the history of distance learning. It discusses the evolvement of the Generations of Distance Education Technologies from the early 1800s to present. This chapter also describes three modes of delivery, (1) web-based instruction, (2) video teleconferencing, and (3) traveling instructor.

Section E discusses the Distance Learning Market. Distance learning technologies are increasingly replacing traditional classrooms. Experts believe that, though some universities are not quite ready for Internet based courses, the eventual cost savings for institutions and the convenience of online programs for the working professional will cause demand to increase.

Lastly, Section F discusses the status of distance learning at NPS. The advantages offered through NPS's Distance Learning Program are (1) the material is DoD relevant, (2) the courses and curricula are customized, (3) there is minimal job interference, (4) quality learning is incorporated, and (5) it is cost effective. To educate, train and prepare

officers for the 21st Century Navy, NPS must be on the cutting edge of technology. Consequently, through its Office of Continuous Learning, NPS coordinates and supports the various academic schools and research and education centers in their efforts to expand their outreach well beyond the population of residential graduate students (OCL Purpose, 2001).

The next chapter will begin by examining educational literature for assessing and costing online delivery. Although there have been an increased number of studies into the field of costing distance education programs, specifically online instruction, costing it remains a very gray area. Ash and Bacsich relate costing to "weighing air," a phrase that "describes the process of quantifying something that quite definitely exists but is normally invisible and can only be measured by using special tools" (Ash and Bacsich, 1999, p. 2). This chapter will also provide a theoretical framework or model, which identifies the relevant variables to be considered in determining the costs of online (web-based) instruction, video teleconferencing, and the traveling instructor.

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III. COST MODELS

A. INTRODUCTION

The University, as an institution, began in Western Europe approximately 1,000 years ago, and quickly assumed the role of producer, guardian and transmitter of higher order scientific and humanistic knowledge across the globe. With its large and generally impressive lecture halls, the University campus came to symbolize higher education in different languages and cultures, industrialized and developing countries alike (Jurich, 2000, p. 38). However, political and economic changes during the Twentieth Century along with the rising costs of education is forcing institutions of higher learning to rethink the traditional form of delivering education. Increasingly, new developments in technology are providing the means for these new forms of delivery. Technology, however, is only a tool for delivery, just as the chalkboard in the traditional face-to-face classroom setting. Technology should be treated as the means to an end, and that end strictly depends upon the institution's objectives and goals.

For many universities, distance education has been deemed as the answer to the rising costs of higher education. Distance learning institutions are being asked to find the balance between cost effectiveness and educational quality, a balance that the traditional university could not find (Jurich, 2000, p. 39). However, these expectations may prove to be unreasonable because initially costs will increase due to large investments in infrastructure, technology, and above all organizational thinking (Jurich, 2000). Many universities who ventured into the distance education arena to make money are quickly realizing that putting programs or courses online doesn't necessary bring riches. Many are finding that the costs of providing such programs are higher than anticipated. The myth that online education is cheaper to deliver than the traditional face-to-face curricula is quickly being put to rest. In fact, several distance education leaders predict that some administrators will slow or stop their expansion into online learning as they develop a better sense of the costs (Carr, 2001, p. 1).

Nevertheless, providing courses online is one of the fastest growing modes of delivering distance education. However, as Morgan states, "before an institution of

higher education ventures into online education, a complete understanding of costs to be encountered is essential. Although dozens of methods for delivering courses through distance education have been utilized for years, offering online courses through the World Wide Web has existed for less than a decade. Many institutions at this time may not understand the full impact of costs of online education" (Morgan, 2001, p. 8). But as Dr. Tony Bates of the Open Learning Agency in British Columbia so eloquently states, "If we don't understand and measure costs, how can we make informed decisions?" (Bacsich et al, 1999, p. 3).

The Naval Postgraduate School is no exception. Although the Naval Postgraduate School is not an institution specifically concerned with generating profits, it does not operate with an unlimited budget; therefore, understanding the costs of the various modes of delivering education is essential for its success. In an environment characterized by constant change, NPS must position itself to take advantage of advances in technology.

Like many other universities, the Naval Postgraduate School is in its infancy stage in developing and delivering online courses. Currently, there are only four courses offered completely online at NPS. With the inception of the Masters of Business Administration program, the Graduate School of Business and Public Policy is considering offering the first two quarters of the program online, thus reducing the time required for officers to spend away from their fleet requirements.

Reducing the time required for officers to spend away from their fleet requirements provides a two-fold effect. First, by offering courses online, NPS can broaden the footprint of availability and opportunity for more officers to pursue their graduate education. In essence, this provides a continuum for a lifelong learning experience, preparing military personnel for the challenges the 21st century will present. Second, in light of increasing personnel shortages, having officers remain on the job provides an intangible cost savings to the Department of Defense.

As noted in Chapter II, researchers have defined distance education in a number of different ways with numerous methods of delivery. Recall, for the purposes of this thesis, we define distance education as courses delivered to remote (off-campus) locations via two-way interactive audio and video (VTC) or courses using computer

technologies (e.g., web-based instruction), including both synchronous and asynchronous instruction. The online or web-based instruction is considered to be instructor led. The definition also encompasses courses in which the professor travels to a remote site to deliver instruction in person, which the Graduate School of Business and Public Policy calls the "Road Warrior." Our model's primary focus is on three specific forms of distance education delivery: web based instruction (i.e. completely online), video teleconferencing (VTC) and the traveling instructor.

Similar to a blind man touching an elephant and trying to define the whole from the many vaguely defined parts, cost issues remain a mystery. Costing distance education programs, in particular web-based instruction, can be a very difficult task. A primary reason for this is that web-based instruction can encompass a wide range of possibilities. Definitions vary from one university to the next and sometimes even within the same university. It soon became apparent throughout our research that costing distance education programs must take an institutionalized approach. Every institution has its own mission and goals. The question ultimately boils down to, "Which cost model works best for a particular university?" We hope that the models developed in this thesis will provide the Naval Postgraduate School with a solid foundation in costing its distance education programs.

Chapter III begins by examining some of the educational literature for assessing and costing online delivery. Although there are an increasing number of studies about costing distance education programs, specifically online instruction, determining its cost remains difficult. Ash and Bacsich relate costing to "weighing air," a phrase that "describes the process of quantifying something that quite definitely exists but is normally invisible and can only be measured by using special tools" (Ash and Bacsich, 1999, p. 2). A large part of the literature discusses a cost-benefit analysis approach, which compares traditional face-to-face teaching with distance education. Although we acknowledge that considering the benefits of distance education is an important part of the economic analysis, this thesis will limit its discussion to costs. Chapter III discusses our attempts to gather pertinent data from other universities with successful distance education programs, as well as from the Naval Postgraduate School's limited experience in this area. Chapter III concludes by providing a theoretical framework or model which

identifies the relevant variables to be considered in determining the costs of three specific forms for delivering distance education: web based instruction (i.e. completely online), video teleconferencing (VTC), and the traveling instructor.

B. LITERATURE REVIEW

1. Introduction

The question of how to assign the various costs in distance learning is one of the most difficult tasks (Morgan, 2001).

> Orivel (1987) states that the most common classifications of costs associated with educational media are: administration costs; production costs; diffusion costs; and reception centres. Rumble (1989) believes costs can be classified by type as human resource costs; costs of developing, producing and delivering; capital equipment costs; consumables and expenses; and space and accommodation costs. Crabb (1990) used headings of: human resources; premises-related costs; equipment; consumables and expenses; central resources; and overheads in the two stages of development and delivery costs. Cukier (1997) follows in similar vein to Rumble by categorizing the costs of educational technology as: human resources; general administration; development; production and delivery; capital equipment and start-up; consumables and expenses; and space and accommodation. Moonen (1997) summarizes costs as: personnel costs; equipment costs; facilities costs; material costs and other costs, calculated in a 'cost per activity phase' breakdown of a development phase, and a delivery, operation and maintenance phases (Ash and Bacsich, 2000, p. 2).

2. Life-Cycle Model

Professor Paul Bacsich and Charlotte Ash of the Sheffield Hallam University propose a three-phase lifecycle model of networked learning. Their efforts were aimed at identifying the tangible as well as the intangible hidden costs to present a full cost approach of network learning. The three-phase model includes Planning & Development, Production & Delivery, and Maintenance & Evaluation. No matter which cost model or methodology is chosen, this three-phase model of costing educational technologies provides a robustness that fits any scenario. Finkelstein et al state that "the key steps in the framework are as follows:

- Defining the objectives, which includes identifying the need or the problem, considering the strategic context, and deciding on the objectives.
- Identifying the options.

- Assessing basic costs and benefits.
- Analyzing the information, which includes selecting a preferred solution and making an initial assessment of affordability.
- Presenting the results. (Finkelstein et al, 2000, p. 71)

3. A Framework for Comparative Analysis of Costs

Frank Jewett, Special Consultant at California State University, developed a framework for a comparative analysis of costs of classroom instruction versus distributed learning. His model uses an index of average learning outcomes to adjust Full Time Equivalent (or student credit units) as a measure of educational output. He suggests that costs and productivity cannot sensibly be discussed until output has been defined in terms of total learning outcomes. He derives an average cost function for higher education institutions, which includes measures of learning productivity and facility and staff productivity. His model clearly distinguishes classroom technology from distributed technology (Finkelstein et. al, 2000).

4. The Flashlight Project

The Flashlight Project, developed by the Teaching and Learning Technology Group, uses an Activity Based Costing methodology for costing distance education programs. It assists institutions in studying how technology can be used to enhance education. The Flashlight economic model is comprised of seven basic steps:

- Identify your business concerns and the specific questions you want answered.
- Identify your outputs.
- Identify the activities that are required to produce your outputs.
- Identify the academic and support units that participate in these activities.
- Identify the resources these units consume in their activities.
- Calculate costs for these activities using financial data about such resources as salaries and benefits, costs for supplies and equipment, building costs, and depreciation.
- Tally the costs of all activities to arrive at your output costs. (Delinger, 1999, p. 9)

This theoretical framework provides a systematic approach of thinking through the costing procedure. The model aids decision-makers at institutions in efficiently

allocating their time, money and efforts in developing and delivering instruction using computers, video, and telecommunications.

5. Actions Model

Dr. Tony Bates of the Open Learning Agency in British Columbia suggests a practical decision-making framework called the ACTIONS model. The criteria for the ACTIONS model are:

> **A** Access: how accessible is a particular technology for learners? How flexible is it for a particular target group?
>
> **C** Costs: what is the cost structure of each technology? What is the unit cost per learner?
>
> **T** Teaching and learning: what kinds of learning are needed? What instructional approaches will best meet these needs? What are the best technologies for supporting this teaching and learning?
>
> **I** Interactivity and user-friendliness: what kind of interaction does this technology enable? How easy is it to use?
>
> **O** Organizational issues: what are the organizational requirements, and the barriers to be removed, before this technology can be used successfully? What changes in organization need to be made?
>
> **N** Novelty: how new is this technology?
>
> **S** Speed: how quickly can courses be mounted with this technology? How quickly can materials be changed?"(Bates, 1995, p. 1)

Dr. Bates proposes that cost must be broken down into distinct cost categories to find the true underlying cause of these costs. The cost categories include: capital and recurrent costs, production and delivery, and fixed and variable costs. He argues that the most important element in costing educational technologies is the difference between fixed and variable costs (Bates, 1995).

In conventional education, teachers are a variable cost if the service is run on a set teacher-pupil ratio; the more pupils, the more teachers required. Since teachers account for about two-thirds of the costs of school education, the majority of costs in conventional education are variable, i.e. they depend on student numbers. The opposite is true for some technologies used in distance education (Bates, 1995, p. 38). For example, broadcast costs are unrelated to student numbers (i.e. once a program is made

and transmitted, the cost is fixed) (Cukier, 1997, p. 140). Accordingly, when fixed costs are a larger percentage of the total costs, it is necessary to keep output as close to maximum as possible within a certain range to keep average costs down. This is similar to running a factory at maximum capacity to lower unit costs of output. Therefore, in this case, a larger number of students are needed to offset high fixed costs. According to Cukier, "once a network is in place and terminal equipment established, some of the new tele-learning technologies, such as computer conferencing, can have quite low fixed costs and quite high variable costs. Others, such as networked multimedia, can have a more equal mix of fixed and variable costs" (Cukier, p. 140).

According to Dr. Bates, there are several factors, which clearly affect the costs of any given technology: the fixed cost including overheads; the costs of production and delivery; the amount of material/teaching produced (i.e. volume); the number of students or learners; the length of time the teaching material is available for use (Bates, 1995, p. 41).

6. Cost Analysis Model

Dr. John H. Milam, research associate professor at the Curry School of Education, University of Virginia, proposes a modified version of the Flashlight cost analysis. Recall the seven basic steps of the Flashlight model are:

- Identify your business concerns and the specific questions you want answered.
- Identify your outputs.
- Identify the activities that are required to produce your outputs.
- Identify the academic and support units that participate in these activities.
- Identify the resources these units consume in their activities.
- Calculate costs for these activities using financial data about such resources as salaries and benefits, costs for supplies and equipment, building costs, and depreciation.
- Tally the costs of all activities to arrive at your output costs. (Delinger, 1999, p. 9)

In Dr. Milam's model, step one is broken down into two steps for direct and indirect costs. Step 6 is also divided into two steps, which includes data pertaining to

enrollment. Additionally, a new step is added which calculates the revenue stream based on enrollment, tuition, fees and financial aid data. The revised model is as follows:

- Define the resource issues.
- Choose outputs and performance measures
- Document activities and tasks.
- Gather faculty and staff workload data.
- Collect data on direct costs.
- Calculate data on hidden, indirect or shared administrative costs
- Gather data on enrollment.
- Calculate results for each activity
- Calculate revenue stream.
- Summarize the results. (Milam, 2000, p. 8)

C. DATA COLLECTION

1. Introduction

Before proceeding with the task of developing a cost model, we felt it was both necessary and beneficial to contact an institution(s) with a successful online program to use as a proxy in determining whether the Naval Postgraduate School is considering the correct set of variables in costing its online courses. We focused our efforts on gathering cost data on online courses because NPS already has experience in VTC costing. The VTC program, known as Video Tele-education at NPS, has been in existence since 1994.

The institutions contacted were: The University of Central Florida, the University of Maryland and the University of Phoenix, all of which are reputable in the distance education arena. The Naval Postgraduate School has partnered with the University of Central Florida, a recognized leader in distance learning arena, to learn best practices for teaching online courses (DLRC website, 2001).

Despite the phenomenal growth in online courses, it soon became apparent that the information we were seeking could not easily be obtained. The reasons for this difficulty varied, but primarily people were not forthcoming because of proprietary concerns and competition. Institutions are positioning themselves to have a competitive advantage in a rapidly growing market and felt that releasing certain information would jeopardize their status in the market place. In addition, web-based instruction

encompasses a wide variety of possibilities. As we indicated earlier, definitions will vary from one institution to the next; therefore, costing issues should be institutionalized. And last, cost is a very ambiguous area. Many of the costs of networked learning are not recorded. For example, in the study conducted by Bacsich et al, only two of the one hundred seventy four institutions made presumptions of being organized in terms of costing networked learning. However, in the same breath statements such as the "costs of all university computing services are known, followed by 'no attempt is made to cost…'" were made (Bacsich et al, 1999, p. 24). We feel that many questions concerning cost issues are not yet known; and if the true costs of networked learning were known, many institutions probably would not enter into this area.

In the following paragraphs, we discuss our efforts to obtain pertinent cost data from the University of Central Florida, the University of Maryland, the University of Phoenix and the Naval Postgraduate School. We were also seeking to validate the variables chosen for our preliminary cost model shown in Table 4 discussed later in the chapter.

2. University of Central Florida

The University of Central Florida is a major metropolitan research university whose mission is to deliver a comprehensive program of teaching, research, and service. It provides intellectual leadership through quality undergraduate and graduate programs. It proudly identifies with its geographic region while striving for national and international excellence in selected programs of teaching and research. It serves students who are diverse in age, ethnic and racial identity, and socioeconomic background. It supports the cultural vitality of its region, serves as a major intellectual and creative resource, develops creative partnerships with public and private enterprise, and participates fully in the economic development of Florida (UCF Virtual Campus, 2001).

UCF is committed to the free expression of ideas, the equality of all people, and the dignity of the individual. The Commission on Colleges of the Southern Association of Colleges and Schools accredits it to award degrees at the associate, baccalaureate, master's and doctoral levels (UCF Virtual Campus, 2001).

At UCF, dynamic growth, changing student demographics, an increasing need for accessible lifelong learning, advances in information technologies, and the national movement from an industrial base to an information base are transforming the educational environment. The University of Central Florida is responding to these trends with a wide range of distributed learning strategies including web and video-based programs that provide flexibility and access to needed academic programs (UCF Virtual Campus, 2001).

In an interview with Joel Hartman, Vice Provost for Information Technologies and Resources of the DL department at UCF, we were told that UCF was not concerned with cost savings. He stated that UCF was concerned with the growth of its student population (e.g., the average distance learning class size grew from 20 students in 1996 to over 100 students currently). When asked about certain variables that should be considered when developing our cost model, he stated that we were indeed using the correct variables; however, UCF combines certain variables or categories (e.g., technical support, maintenance, and infrastructure).

In closing, the director stated that UCF invests internally, and elaborated on how UCF cut costs through its mixed mode program; online (Web-based) instruction, combined with VTC or online (Web-based) instruction, combined with face-to-face instruction. However, in relation to sharing cost information about developing online courses, the director was very hesitant because of proprietary concerns.

3. University of Maryland University College

Two faculty members of UMUC, Tana Bishop and Dr. Claudine SchWeber, built a cost model for their university. With the introduction of the online MBA program, these two faculty members provided a cost-effective model that could meet program demand and at the same time offer new intellectual challenges to the graduate faculty.

According to Woodhall, "cost-effectiveness is a technique for measuring the relationship between the total inputs, or costs, of a project or activity, and its outputs or objectives" (1995:348). Typically, there are two approaches to this analysis. One compares "alternative ways of achieving the same objective," while the other compares two or more products to determine "… which achieves the highest level of output or

results" (Woodhall, 1995:348). UMUC's Graduate School applied the former method by using the "ingredients" approach.

The interviewees built their model in an excel spreadsheet. They stated that opportunity cost, or what am I giving up, is always a serious issue when dealing with cost. They noted that because the Naval Postgraduate School's intent is to have its MBA program reach personnel that are land-based and ship-based, technological support is needed and the impacts of security are important (e.g., firewall issues are of grave concern).

One of the surprising factors noted during our interview with the two UMUC faculty members was the proprietary concern of sharing their cost information. However, they were able to share some relevant information with us. For example, UMUC uses a large number of adjunct faculty. Tana Bishop handles the contracts for faculty and uses an average cost, based on how much UMUC is spending, and then divides these costs by the number of faculty. She said that because NPS has a majority of full-time, tenured faculty, release time is an important issue when teaching an online course for the first time. First of all, faculty resistance may be paramount. Thus, NPS faculty members should be given some kind of stipend or reward for teaching an online course.

Consequently, Dr. SchWeber asked, "How do they (the faculty) fit the bells and whistles of Blackboard and have some kind of structural design that fits what learning is about?" She said the answer stems with instructional designers. Instructional Designers (ID), who fall under technology or curriculum development, make technology become a learning experience (e.g., IDL 6543) for faculty members. Thus, instructional designers play a key role in faculty members developing and teaching successful courses online. Tana Bishop made the following statement about instructional designers' responsibilities, "It is an actual conversion (pedagogical) from face-to-face to online. Face-to-face doesn't necessarily translate to one on one in email."

Dr. SchWeber said that when trying to cost online courses, the following types of questions should be asked, "How could you do this online, and should you do this online?" She stated that, "You can't just take someone from the traditional way of teaching to online teaching. Dr. SchWeber said that she taught a course online, which

included role-plays with groups of four to five members. She asked, "What is the purpose of role-play? What about simulations?" According to Dr. SchWeber, "You have to cost this information. Learning is about experience and application, and thus exists the need for instructional designers."

In closing, the authors noted three cost considerations, (1) release time, because someone has to teach this extra course while a faculty is developing an online course, (2) a stipend (reasonably done in places where they want to encourage or reward people), and (3) the instructional designer, who figures out how to make this technology a learning experience. The interviewees said that we were indeed considering the right variables to use in developing our cost model. They also said that there were other factors (as noted throughout the interview) that could be considered when building a cost model for this particular mode of distance learning.

4. University Of Phoenix

The University of Phoenix is a private, for-profit higher education institution whose mission is to provide high quality education to working adult students. The University identifies educational needs and provides educational access to working adults regardless of their geographical location through innovative instructional methods, including distance education technologies. The University provides general education and professional programs that prepare students to articulate and advance their personal and professional goals.

The University's educational philosophy and operational structure embody participative, collaborative, and applied problem-solving strategies that are facilitated by a faculty whose advanced academic preparation and professional experience help integrate academic theory with current practical application. The University assesses both the effectiveness of its academic offerings and the academic achievement of its students, and utilizes the results of these assessments to improve academic and institutional quality. With campuses in over 107 cities, and online instruction offered around the world, University of Phoenix is the nation's largest private accredited university, and a leading university for corporate America. The Commission on Institutions of Higher Education of the North Central Association of Colleges and Schools accredits the University of Phoenix.

The Director of Marketing at the University of Phoenix stated in a phone interview that there is no cost model currently used by the university. The director said that as far as costing of online courses, it was her experience that the University of Phoenix adds approximately 15 percent to its traditional face-to-face courses. When asked the basis of this figure, she said that she was rather new to the position and that there were no previous records to support how this figure could be derived.

5. Conclusion

It became evident throughout our efforts that discussing cost issues is a very touchy subject. Either because of proprietary concerns, competitiveness, an unwillingness to share data, or in some cases possibly a lack of accurate knowledge, obtaining the necessary data was not possible. What was truly surprising and mind boggling is that we encountered just as much resistance to share cost information within departments at the Naval Postgraduate School (i.e. who we are trying to help). Although we were not able to obtain the necessary cost data (i.e. actual figures) and procedures for developing a cost model for online courses from the institutions we visited, personnel in the distance education department at both the University of Central Florida and the University of Maryland validated the cost elements or categories we are considering. We believe a large part of the resistance to share information stems from a lack of knowledge in this area.

D. DEVELOPMENT OF COST MODEL FOR ONLINE COURSES

1. Introduction

Before providing the necessary funding for any project, decision-makers typically want to know "how much does it cost or what is the Return on Investment?" But before attempting to answer the question of costing an online course or program, there are several other questions that need to be considered. For example, what is the mission of our school? Who are the individuals we are trying to serve? Where are these individuals? Do they have the necessary equipment? Will technical support be required? Should this service be contracted out? Will faculty members need additional help in developing online courses? How elaborate should the course be? Which courses should be placed online?

Hopefully, it should be obvious that these are only a few of a long list of questions that need to be considered in costing online courses. In the following paragraphs, a cost model will be developed that will provide a framework or guide for attempting to answer these questions.

What we have provided is not an all-inclusive model, but merely a tool to assist decision-makers at NPS in making more informed cost decisions. The premise of this thesis is to generate results that are better than back of the envelope estimates; however, these results are not as precise as those that could be obtained if all transactional costs could be accounted for. Boeke, however, points out that "trying to account for every penny in the cost calculation can result in analytic costs far beyond the marginal improvements in results. The best advice is to err on the side of simplicity and add detail only in those few instances where either potential materiality (size of the potential change) or the politics of the decision-making process demand it" (Boeke, 2000, p. 16). If an attempt to account for all costs were made, the "costs of costing" would become too great. It would take an inordinate amount of effort to account for all costs, which in practical terms would not be worth the effort from an economic standpoint.

Everyone involved in this process should keep in mind that costs are only part of the economic equation. This thesis does not include the benefits obtained from distance education; however, they are an invaluable part of the economic decision-making process. Additionally, technology must match the desired outcome the learning environment is trying to achieve in order for distance education to be cost effective.

Costs can be broken down into tangible versus intangible cost categories. The tangible costs are those on which a price tag can ultimately be placed. For example, a university knows exactly how much a faculty member makes. However, many of the costs of developing and supporting Networked Learning are hidden: unrecorded academic staff time, increased demands on technical support, more complex administration, additional telephone costs, etc (Finkelstein et. al, 2000, p. 65).

There may also be other cultural or institutional resistances, which are costs that must be considered. What about the cost of getting faculty to buy into teaching online courses? What is the cost of not putting courses online (i.e. opportunity costs)? In other

words, there are additional intangibles to which an institution cannot necessarily attach a dollar figure, but it still needs to consider in costing an online course or program. However, what decision makers typically understand and want to hear about are the dollar figures associated with the tangible costs.

There does appear to be consensus throughout the costing literature about the cost categories or elements that should be considered in costing online courses. If all the categories were consolidated, the list would include at a minimum:

- Faculty costs
- Administrative costs
- Technical support costs
- Equipment costs
- Course development/delivery costs
- Consumable costs
- Infrastructure costs and maintenance costs.

Of course, terminology and definitions will vary among researchers.

One of the main expenses for institutions embarking upon Web-based or other electronic delivery courses is that of investment in infrastructure, such as IT-equipped lecture theatres and computer laboratories (Bacsich et al, 1999, p. 12). Jones and Simonson propose that a large percentage of these are start-up costs, which can be equivalent to five years worth of teachers' salaries (Jones and Simonson, 1993, p. 7). Only by amortizing these costs over a long period of time can economies of scale witnessed in first and second generations of distance learning be achieved.

Assessing faculty costs can also present a major problem because generally they are not paid in relation to the amount of time spent working on specific activities. The hidden cost of time invested by staff includes becoming familiar with new technologies, integrating computer-based learning materials with teaching, and developing course materials for technology-enabled learning (Finkelstein, et. al, p. 67).

Based on much anecdotal evidence gathered over the last 20 years of building computer-based material, a reasonable starting estimate is that it takes an average of 18 hours of faculty effort to create learning materials for an hour of student instruction on

the Web (Finkelstein et al, 2000, p.189). Table 2 presents estimates of the amount of academic work required to produce one hour of student learning for various media. It should be no surprise that it takes considerably more effort to produce an hour of instructional material using computer-aided technologies than regular face-to-face lecturing.

For example, consider a three credit hour course. If taken on a semester basis, this course requires 45 hours of classroom time. Multiplying the 45 hours of classroom time with the 18 hours of faculty effort, it will take 810 hours of faculty effort to move a course to the web. What if we add some additional time for faculty members having to learn the new technology and the new skills required to teach online. The time required to move a course to the web can quickly approach 1,000 professional hours. Additionally, faculty members have also reported increased student interaction while delivering online education courses which increases time devoted to instruction.

Media	**Hours of Academic Support**
Lecturing	2-10
Small group teaching	1-10
Teaching by telephone	2-10
Video-tape lectures (for tutored video instruction)	3-10
Audio vision	10-20
Teaching text	50-100*
Broadcast television	100*
Computer-aided learning	200*
Interactive video	300*

Table 2. Academic Work To Produce One Hour Of Student Learning.

* Requires additional support staff as well

Source: G Rumble, *The Costs and Economics of Open and Distance Learning.* London: Kogan Page, 1997, p. 79, based upon estimates from J. J. Sparkes, "Pedagogic Differences in Course Design." In A. W. Bates, ed. *The Role of Technology in Distance Education.* London: Croom Helm, 1984.

Instructors in an online environment have found that the time needed to deliver an online class is two to three times greater than to deliver a face-to-face class (Palloff &

Pratt, 1999). Table 3 illustrates this difference. Table 3 reflects a time comparison of an online versus a face-to-face class for one week by a professor teaching a graduate-level class that normally meets once a week for two and one-half hours. This table depicts actual time involved in delivering this course online for one week. The class consisted of twenty-three students and was delivered in a strictly asynchronous mode (Palloff & Pratt, 1999).

Instructor Activity	**Face-to-Face Class**	**Online Class**
Preparation	2 hours per week to: Review assigned reading Review lecture materials Review and prepare in-class activities	2 hours per week to: Review assigned reading Prepare discussion questions and "lecture" material in the form of a paragraph or two
Class time	2 ½ hours per week of assigned class time	2 hours daily to: Read student posts Respond to student posts
Follow-up	2 to 3 hours per week for: Individual contact with students Reading student assignments	2 to 3 hours per week for: Individual contact with students via e-mail and phone Reading student assignments
Totals for the week	**6 ½ to 7 ½ hours per week**	**18 to 19 hours per week**

Table 3. Time Comparison of an Online Versus a Face-to-Face Class for One Week.
Source: Palloff, R., and Pratt, K. "Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom," The Jossey-Bass higher and adult education series, First Edition, Copyright, 1999.

Note: Time involved with online classes is related to a number of variables such as the number of students enrolled in the class, the level of comfort with the technology on the part of both the instructor and the students, the encountering of technical difficulties, the degree to which discussion is an expected part of class activity, and the types of activities in which students are engaged.

For universities, distance education requires greater investment in student support, including the preparation and delivery of materials ahead of class time, ensuring office hours for student queries related to academic content and to technology issues, access to library and other resources, and an efficient system of tutoring and support (Jurich, 1997, p. 40).

2. Cost Model

Key to any model development is defining the objective. It is virtually impossible to develop a single model that covers every conceivable scenario or fits a wide variety of needs (Milam, 2000). The objective for this model is to identify all relevant variables, which should be considered in costing the delivery of web-based instruction (i.e. completely online) at the Naval Postgraduate School. A list of the cost elements we consider important are illustrated in Table 4.

Again, it is important to point out that the model does not account for all costs because further NPS institutional experience would be required to produce a model complex enough to capture all the costs involved in an online course. What the model does is raise issues and questions that must be addressed before offering an online course. We must also point out that a lack of available data precluded producing a working model.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ACADEMIC STAFF Costs						
Program Director						
Faculty Salary						
Faculty Professional Development/Training						
Faculty Workload/Compensation						
COURSE Costs						
Course Development/Preparation						
Course Update						
Course Evaluation						
DLRC Costs						
Infrastructure						
Technological Support						
Maintenance						
Administrative Overheads						
Online Student Services						
Marketing						
Spillover						

Table 4. Proposed Cost Model for Costing an Online Course.

In working with or building any model, a clear set of assumptions need to be made that will give an accurate picture of what the model can accomplish and its

limitations. However, since this is not a functioning model, we will leave it up to the individuals producing cost data to make their own assumptions. We hope that this model is robust enough (i.e. covers enough cost categories) that it will provide an accurate enough picture of the costs involved in developing and delivering an online course. We also hope that as NPS gains experience in delivering online courses, data will be gained to fill in the blanks to produce a working model.

Although we will not discuss assumptions for the model, we did feel it was necessary to discuss the categories we chose.

1. Any distance education program needs a Program Director, the person who will be the champion for DL and administer the program. His or her salary must be taken into account throughout the life of the program.

2. For the Graduate School of Business and Public Policy, faculty salary is broken down into steps ranging from step 35 to step 70. This range of salaries must be considered when figuring cost.

3. Faculty Professional Development/Training is considered to be such costs as the IDL 6543 class that the University of Central Florida is administering to NPS faculty. All faculty teaching an online course must attend this class. However, this original class only includes instruction for one module to be placed online. Faculty will need additional training as more classes are offered online and improvements are made to the classes.

4. Faculty Workload/Compensation must be taken into account because teaching an online course involves considerably more work than teaching a face-to-face course. The time invested by academic staff can include familiarization with new technologies, integration of computer-based learning materials in teaching, and developing course material for technology-enabled learning. Institutions must also provide incentives for faculty members to teach online courses, especially tenured faculty who typically resist teaching online classes. Some universities offer monetary incentives (i.e. a stipend) along with release time from their regular teaching assignments. The Graduate School of Business and Public Policy has developed its own faculty workload matrix for compensating faculty members.

5. Course Development/Preparation costs are all those encountered when placing a traditional face-to-face course completely online. Of course, this will depend on the course, course content and course design. This category should include the cost of instructional designers who assist faculty members in placing the course online. The range of reported costs for developing an online course vary widely. "Bates (1995:197) gave a range from Canadian $2600 to $21,170 per student-hour for development of computer-based learning materials. Arizona Learning Systems (1998:13-14), noting many forms that an Internet course may take, cite course development costs from US$6000 to $1,000,000 for a three unit course, depending on the technologies used (Rumble, 1999, p. 3)."

6. Course update costs are those arising from modifying the online materials, including faculty labor cost. This can be considered as a recurring cost because faculty will typically add to and take away from the course as students give feedback on the course's strengths and weaknesses.

7. Course evaluation is a fixed cost. Feedback from students is an essential part of both the online environment and the traditional classroom setting. Someone's effort equates to time, which has a cost associated with it.

8. One of the main expenses for institutions embarking upon Web-based or other electronic delivery courses is investment in infrastructure, such as IT-equipped lecture theatres and computer laboratories (Bacsich et al, 1999, p. 12). The initial costs of creating a virtual campus can be very expensive. For example, Rumble reports initial development costs of 1.54 million pounds.

9. The technological support category can be broken down into two types of support:

- Hardware and Software support (Computer Support department)
- Content (Distance Learning Resource Center)

According to Mr. Halwachs, head of computer support, NPS is currently running a 24/7 support structure; therefore, NPS will not need to hire additional staff in this area. Technological support costs also include continuous assistance for both staff and students during program or course delivery.

10. From the DLRC prospective, maintenance (i.e. considered web maintenance) is the outsourced IT support, which includes people, services, hardware and software.

11. Administrative overheads are the portion of time others in the institution, excluding faculty members, spend supporting distance education programs.

12. In order for distance education, specifically web-based instruction, to gain accreditation and acceptance in the academic world, the same services offered to on-campus students must also be made available to students over the Internet. These online services will come at a price.

13. Marketing is the costs associated with ensuring the fleet is aware that NPS offers online courses.

14. Spillover costs are intangible costs that occur when others benefit that are not targeted. As the online initiative gathers steam, many on-campus students will want to take part in such things as online registration because of the convenience the online environment offers.

We have not intentionally left out certain costs, but as stated earlier, trying to develop a list that covers every possible cost would be impossible. For example, there was no mention of overhead costs or copyright/license fees for using third party materials.

Policy makers must decide how complex they want the model to be. We hope this model provides a platform to begin building an understanding of the cost of delivering an online course.

E. COST MODEL FOR VIDEO TELECONFERENCING

Unlike costing an online course, costing video teleconferencing proved to be a more straightforward. Video teleconferencing, known as video tele-education at NPS, refers to courses delivered via two-way interactive audio and video. Currently, the Naval Postgraduate School offers four degree programs through VTC including: Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Systems Management.

As stated earlier, before building any model a clear set of assumptions needs to be made that will give an accurate picture of the limitations of the model. The assumptions for this model are as follows:

1. Software Requirements

All calculations were made using crystal ball in Excel. Crystal ball is an add-in program in Excel that allows the user to run a Monte Carlo simulation. A Monte Carlo simulation is used to "simulate the way various external variables may combine as the future unfolds, thus extracting the maximum information about the characteristics of the distribution of possible outcomes" (Liao, p. 23).

2. Video Teleconferencing System Costs (DL Office Charges/Class)

Distance Learning Technician Support:	$1320/class
Distance Learning Equipment Costs:	$938/class
Communication Costs ($50/class):	$50/class
Set-up Fee:	$250/class
Total:	**$4508/class**

Note: The communication costs are $50/class if NPS dials to the remote site.

3. Based on Graduate School of Business and Public Policy Cost Recovery for New System

- The video teleconferencing system costs are based on charges per class.
- The base case includes a video teleconferencing system cost of $200,000 for high-end system with a system life of 2, 3 or 5 years.
- With connection time requirements between classes, one classroom can support up to 3 two-hour or 6 one-hour classes per day, or 30-4 unit classes per year.
- Costs are amortized over the life of system. System life is assumed to be 2, 3 and 5 years.
- Annual equipment operations and maintenance costs are $25,000/year.
- One GS-9 equivalent can simultaneously support two classrooms (i.e. connection, etc), including routine maintenance requirements.
- Each classroom requires three Integrated Systems Digital Network lines.
- Installation charges for these lines are $220/line, including a monthly service fee of $40/line. The life expectancy for these lines is the same as VTC equipment.
- Installation and system design requires forty hours of work of a GS-13 equivalent annually.

4. Faculty Costs

- The contact credit hour is based on a forty-four hour workload model illustrated in Appendix A. The faculty workload matrix was developed for use in the Graduate School of Business and Public Policy.
- Faculty salaries range from step 35 to 70. We assumed a uniform distribution for the crystal ball simulation. Using crystal ball, simulation expected value was 52.
- 20% of classes are to 3 or more sites which constitutes a higher workload credit.
- 50% of classes require no updating, 30% will require 1 credit hour of updating and 20% require 2 credit hours of updating.
- New module costs are treated as a cost add-on.
- All labor costs include a 43% escalation for leave, benefits and staff support.
- Travel costs include estimates for two trips to the distance learning site ($1200/trip). Additional trips are treated as a cost add-on.
- The discount rate used for capital recovery is OMB real discount rate for 3-30 year projects (OMB A94, Appendix C Jan 2001).

Tables 5 and 6 provide estimates for a mean faculty salary module and a 90% faculty salary module (conservative) for the base case of a $200,000 video teleconferencing system cost, 3-year capital recovery and system costs spread over 20 classes per year in the VTC classroom. The cost per class is highlighted in each table. The tables give cost estimates for capital recovery, faculty salary, etc. that NPS must charge for the base case capital recovery scenario. For example, column one of Table 5 illustrates that NPS must charge $36,021 for one class offered to a single student. Note in each column as the number of students per class increases, the cost NPS must charge decreases. However, with the increased workload and student interactivity that accompanies a course delivered via distance education, the question ultimately becomes how many students can a faculty member effectively teach? The remaining columns in Tables 5 and 6 can be calculated by multiplying the program charge for one class by the number of classes in degree program (or per quarter, year, etc.) to calculate the total charge per degree (quarter, year, etc.).

Tables 7 and 8 provide total charges per student for a single distance learning program given a $200,000 video teleconferencing system cost; 2, 3 or 5 year system life (i.e. capital recovery period) where the VTC classroom is used for 15, 20 or 30 classes per year for capital recovery calculations. The base case discussed above is also highlighted in these tables.

Table 9 provides a general framework (i.e. a wide angle view) identifying the costs of delivering a video teleconferencing course. This list may not be all inclusive for every situation, but to build a list that includes every cost element for every situation would be virtually impossible. We have also not included certain costs in the calculations described above and summarized in Tables 5-8. For example, program director costs and administrative overheads were not included. These costs were also excluded from our calculations for the "Traveling Instructor" cost model.

The checklist we have provided in Table 9 is offered as a next step toward developing a more comprehensive dynamic view of the costs involved in the rapidly changing world of distance learning. It also gives insight into the activities that are involved in the restructuring or re-engineering the educational process.

Students/Class	DL Classes/Program 1	4	8	12	16	20	24
1	$ 36,021	$ 144,086	$ 288,172	$ 432,257	$576,343	$720,429	$ 864,515
5	$ 7,204	$ 28,817	$ 57,634	$ 86,451	$115,269	$144,086	$ 172,903
10	$ 3,602	$ 14,409	$ 28,817	$ 43,226	$ 57,634	$ 72,043	$ 86,451
15	$ 2,401	$ 9,606	$ 19,211	$ 28,817	$ 38,423	$ 48,029	$ 57,634
20	$ 1,801	$ 7,204	$ 14,409	$ 21,613	$ 28,817	$ 36,021	$ 43,226
25	$ 1,441	$ 5,763	$ 11,527	$ 17,290	$ 23,054	$ 28,817	$ 34,581
30	$ 1,201	$ 4,803	$ 9,606	$ 14,409	$ 19,211	$ 24,014	$ 28,817

Table 5. Mean Faculty Salary for Base Case.

Students/Class	DL Classes/Program 1	4	8	12	16	20	24
1	$ 44,228	$176,913	$ 353,826	$ 530,739	$707,651	$884,564	$1,061,477
5	$ 8,846	$ 35,383	$ 70,765	$ 106,148	$141,530	$176,913	$ 212,295
10	$ 4,423	$ 17,691	$ 35,383	$ 53,074	$ 70,765	$ 88,456	$ 106,148
15	$ 2,949	$ 11,794	$ 23,588	$ 35,383	$ 47,177	$ 58,971	$ 70,765
20	$ 2,211	$ 8,846	$ 17,691	$ 26,537	$ 35,383	$ 44,228	$ 53,074
25	$ 1,769	$ 7,077	$ 14,153	$ 21,230	$ 28,306	$ 35,383	$ 42,459
30	$ 1,474	$ 5,897	$ 11,794	$ 17,691	$ 23,588	$ 29,485	$ 35,383

Table 6. 90% Faculty Salary for Base Case.

	2 Year Capital			3 Year Capital			5 Year Capital		
Students/Class	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr
1	$ 39,832	$37,667	$ 35,501	$37,639	$36,021	$34,404	$35,885	$34,706	$33,528
5	$ 7,966	$ 7,533	$ 7,100	$ 7,528	$ 7,204	$ 6,881	$ 7,177	$ 6,941	$ 6,706
10	$ 3,983	$ 3,767	$ 3,550	$ 3,764	$ 3,602	$ 3,440	$ 3,588	$ 3,471	$ 3,353
15	$ 2,655	$ 2,511	$ 2,367	$ 2,509	$ 2,401	$ 2,294	$ 2,392	$ 2,314	$ 2,235
20	$ 1,992	$ 1,883	$ 1,775	$ 1,882	$ 1,801	$ 1,720	$ 1,794	$ 1,735	$ 1,676
25	$ 1,593	$ 1,507	$ 1,420	$ 1,506	$ 1,441	$ 1,376	$ 1,435	$ 1,388	$ 1,341
30	$ 1,328	$ 1,256	$ 1,183	$ 1,255	$ 1,201	$ 1,147	$ 1,196	$ 1,157	$ 1,118

Table 7. Total Charge per Student for Single Program (Mean Faculty).

	2 Year Capital			3 Year Capital			5 Year Capital		
Students/Class	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr	15 Cls/Yr	20 Cls/Yr	30 Cls/Yr
1	$ 48,039	$ 45,874	$ 43,708	$ 45,846	$ 44,228	$ 42,611	$ 44,092	$ 42,913	$ 41,735
5	$ 9,608	$ 9,175	$ 8,742	$ 9,169	$ 8,846	$ 8,522	$ 8,818	$ 8,583	$ 8,347
10	$ 4,804	$ 4,587	$ 4,371	$ 4,585	$ 4,423	$ 4,261	$ 4,409	$ 4,291	$ 4,173
15	$ 3,203	$ 3,058	$ 2,914	$ 3,056	$ 2,949	$ 2,841	$ 2,939	$ 2,861	$ 2,782
20	$ 2,402	$ 2,294	$ 2,185	$ 2,292	$ 2,211	$ 2,131	$ 2,205	$ 2,146	$ 2,087
25	$ 1,922	$ 1,835	$ 1,748	$ 1,834	$ 1,769	$ 1,704	$ 1,764	$ 1,717	$ 1,669
30	$ 1,601	$ 1,529	$ 1,457	$ 1,528	$ 1,474	$ 1,420	$ 1,470	$ 1,430	$ 1,391

Table 8. Total Charge per Student for Single Program (90% Faculty Salary).

Cost Elements
Software Requirements - Excel - Lotus
Video Teleconferencing System Costs - Distance Learning Tech Support - Distance Learning Equipment - Communication/Transmission - Connection time between classes - Set-up Fee - Video teleconferencing system ($200K for high-end system) - Amortization costs over system life - Annual equipment operations and maintenance - Technical Support personnel (1 GS-9 equivalent) - 3 ISDN lines - Installation charges for ISDN lines, including monthly service charge - Installation and System design (Labor charge of GS-13 equivalent annually) - Capital recovery discount rate (3.2% OMB real discount rate for 3-30 yr projects)
Program Director - Allocation of salary to DL program
Faculty Costs - Contact credit hour based on 44 hour workload matrix, Appendix A) - Faculty labor costs - Travel Costs - 43% escalation of faculty labor for leave, benefits and staff support - New module costs - Multiple site faculty workload/ compensation - Course updating
Administrative overheads - Percentage of time others in the institution spend in support of DL program

Table 9. General Framework for Identifying Costs of VTC Course.

F. COST MODEL FOR TRAVELING INSTRUCTOR

1. Introduction

The traveling instructor, known at NPS as the "Road Warrior," is also an effective means of distance education. NPS, instructors travel to the Naval Academy to provide educational instruction to students in the Leadership Education and Development (LEADS) program. NPS faculty who travel to Annapolis for one to two-week periods

teach modularized courses. Thesis advising, faculty "office hours," and supplemental course work is provided by distance learning technology (LEADS, 2001). This program, which was designed by NPS and the United States Naval Academy (USNA) for Naval and Marine Corps Officers, represents a unique approach to graduate level education.

Traveling Instructors work in an environment that is no different from the traditional classroom setting.

2. Cost Model for Traveling Instructor

Many of the same assumptions used in the VTC model were applied in this model. The assumptions we used are as follows:

a. Faculty Costs

- Faculty contact credit hour is based on a forty-four hour workload matrix illustrated in Appendix A. The faculty workload matrix was developed for use in the Graduate School of Business and Public Policy.
- Faculty salaries range from step 35 to 70. We assumed a uniform distribution for the crystal ball simulation. Using crystal ball simulation, expected value was 52.
- It was assumed that 10% of the classes involved new faculty members, which includes two-week faculty development plus an allowance for adapting an existing course mode with one trip to the remote site at a cost of $1200 per trip.
- All labor costs include a 43% escalation for leave, benefits and staff support.
- No indirect costs were included.

b. Travel Costs

- An air fair of $600 was used.
- Per diem that includes lodging, food, rental car, parking etc. is assumed to be $250 per day. Six days is used for a one-week class and thirteen days constitutes a two-week class.

The estimates provided in Table 10 are for a mean faculty salary module and 90% faculty salary module (conservative). The total cost for a one-week and two week course is provided.

Table 11 provides a general framework for identifying the costs of a "traveling instructor." The same theory applied above for the online and VTC framework holds here. We have only provided a checklist, not completely comprehensive for all

circumstances, but robust enough to give policy makers an accurate picture of the typical costs involved with the various methods of distance learning.

	Faculty Salary		Travel	Total Cost	
	Mean	90%		Mean	90%
One Week	$ 11,250	$ 16,300	$ 2,100	$ 13,350	$ 18,400
Two Weeks	$ 14,750	$ 20,450	$ 3,850	$ 18,600	$ 24,300

Table 10. Results for Traveling Instructor

Program Director
• Allocation of salary to DL program
Faculty Costs
• Contact credit hour based on 44 hour workload matrix, Appendix A)
• Faculty labor costs
• 43% escalation of faculty labor for leave, benefits and staff support
• New module costs
• Course updating
Travel Costs
• Air fair
• Per diem including lodging, food, rental car, etc.
Administrative overheads
• Percentage of time others in the institution spend in support of DL program

Table 11. General Framework for Identifying Costs of "Traveling Instructor".

G. CHAPTER SUMMARY

By now we hope that it is evident that one of the most important factors to consider when planning a distance education program is the cost. The purpose of Chapter 3 was to provide a framework or cost model for costing web-based instruction (i.e. completely online), video teleconferencing and the traveling instructor.

Section B discussed some of the cost models and methodologies present in the research literature for costing online courses or programs. Although there have been an increased number of studies since the mid-1990s into this area, the lack of hard cost data makes it difficult to have an accurate picture of the true cost of the online environment.

Section C discussed our attempts to gather pertinent data from other universities with successful distance education programs as well as from the Naval Postgraduate School. Our efforts illustrated that in an increasingly commercial environment, cost information is a very sensitive matter.

Section D identified the variables we felt important to consider when costing an online course. Section E and F discussed the development of the cost models for video teleconferencing and the traveling instructor.

Although we have not discussed pricing policies for NPS, we felt that it would be beneficial to look at what other universities are charging for their online courses and programs. The next chapter will examine institutions with established online degree programs.

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IV. COMPARISON OF CHARGES

A. INTRODUCTION

Several higher learning institutions offer established online degree programs (See Table 12). To educate, train and prepare officers for the 21st Century, the Graduate School of Business and Public Policy is considering establishing an online portion for its upcoming Executive Masters of Business Administration (EMBA) and Joint Masters of Business Administration (JMBA) programs. In Chapter III, we did not include actual dollar figures in our online cost model. Thus, we were unable to predict the cost per graduate credit hour that NPS should charge for the online portion of its EMBA and JMBA programs. However, based on our cost model for video teleconferencing, we were able to determine the cost per graduate credit hour charged by NPS. Based on the mean faculty salary, 16 distance-learning classes per year with 25 students per class for a 4 credit class, the total cost of $230.54 would be charged per graduate credit hour to break even (i.e., numbers taken from Table 5). We felt it was necessary to calculate the VTC cost per credit hour because most institutions of higher learning charge the same price for both online and VTC courses (e.g., they offset the price difference).

The focus of this chapter is to determine what established online degree programs are charging per graduate credit hour for their courses, and to give a brief overview of background information on the schools with graduate online degree programs. These schools were selected for the analysis because they meet the following requirements:

- They are regionally accredited
- All courses required for the degree are offered 100% online
- The schools have graduated at least some students solely through their online program
- All graduation requirements can be met through successful participation in the online learning environment

Our purpose for looking at these universities is not to academically compare them to the Naval Postgraduate School. We are merely attempting to compare actual charges for online graduate courses per credit hour to NPS' anticipated online graduate courses per credit hour.

B. SCHOOLS WITH ESTABLISHED ONLINE DEGREE PROGRAMS

1. Baker College

Baker College Online is a division of Baker College, a fully regionally accredited, private, not-for-profit career college system established in 1911. The North Central Association of Colleges and Schools Commission on Institutions of Higher Education accredits Baker College. Baker College currently charges $220.00 per graduate credit hour for its online degree (See Table 12).

Baker College Online offers a Master's Degree, Bachelor Degree, Associate Degree and Certificate through its online program. Baker On-Line offers the convenience of classroom accessibility 24 hours a day, seven days a week, from virtually anywhere in the world by using the Internet to link faculty and students.

The Baker College mission is to provide quality higher education and training that enables graduates to be successful throughout challenging and rewarding careers. To this end, the following purposes have been established:

- To prepare students for competency in Business, Health and Human Service, and Technical careers in today's global economy
- To provide general education which expands students' horizons, developing strong communication skills, and encouraging critical thinking
- To provide students with practical experience and training in a chosen field of study
- To encourage social and classroom related activities that promote both personal and professional growth
- To assist graduates throughout their careers in securing employment and improving career opportunities
- To encourage graduates to continue their education and to lead effectively through service in a world without boundaries (Baker College, 2001)

2. Boise State University

Boise State University is a state-supported comprehensive institution. The Northwest Association of Schools and Colleges accredits Boise State University. Boise State University currently charges $365.00 per graduate credit hour for its online degree (See Table 12).

The university offered distance-learning courses in 1987. In 1999-2000, it offered 110 courses through distance learning. In fall 1999, there were 1,041 students enrolled in distance learning courses.

The university is committed to providing convenient, flexible access to learning. Boise State University has an Educational Outreach program for students that have the drive and the desire to continue their education. The Divisions of Extended Studies offers classes in remote locations in the evenings and on weekends and during summer school through distance education (Boise State University, 2001).

3. Capella University

The Higher Learning Commission, Member of the North Central Association of Colleges and Schools, accredits Capella University. Capella University currently charges $231.00 per graduate credit hour for its online degree (See Table 12).

Founded in 1993, Capella University is an institution of higher education that offers undergraduate and graduate degree programs, certificates, and continuing education to adult learners who seek to integrate advanced study with their professional lives. Its mission is to deliver high quality programs that provide traditional and contemporary knowledge through flexible and innovative forms of distance learning.

Capella University embraces a learner-centered educational philosophy. It recognizes that education and learning must be a continuous, lifelong process in our constantly changing world. For this reason, Capella places special emphasis on helping learners develop self-managed learning skills and personal leadership attributes.

Capella University's online course delivery format leverages the speed, convenience, and flexibility of the Internet to provide a quality education at a time and place most convenient for its students. Capella University offers over 500 online courses, as well as undergraduate and graduate degree programs in 40 areas of specialization (Capella University, 2001).

4. Embry-Riddle Aeronautical University

The Commission on Colleges of the Southern Association of Colleges and Schools accredits Embry-Riddle to award degrees at the associate, bachelor's, and

master's levels. Embry-Riddle Aeronautical University currently charges $316.00 per graduate credit hour (See Table 12).

Embry-Riddle Aeronautical University is an independent, nonsectarian, not-for-profit, coeducational university with a history dating back to the early days of aviation. The purpose of Embry-Riddle Aeronautical University is to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship with special emphasis on the needs of aviation, aerospace, engineering and related fields (Embry-Riddle, 2001).

The university serves culturally diverse students motivated toward careers in aviation and aerospace. It is a global institution that holds a prominent position in aviation/aerospace education. The University is the world's largest independent aeronautical university and boasts a student body of 21,000 who come from all 50 states and more than 100 nations. The University offers over 30 degree programs, with 10 offered at the master's level. Many students receive their degrees from over 100 education centers located in the United States and Europe.

Embry-Riddle also provides flexible educational services to thousands of working adults through the Extended Campus or distance learning. Embry-Riddle Online provides a centralized environment to facilitate web-enabled services for all its students regardless of where they attend class. The services are 1) access to web-enhanced course materials, 2) web access to student information services, 3) web access to library services, and 4) web access to services and activities that build community among the entire student body (Embry-Riddle, 2001).

5. Florida Institute of Technology

Florida Institute of Technology is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS). Florida Institute of Technology currently charges $330.00 per graduate credit hour (See Table 12).

Dr. Lynn Edward Weaver, President of Florida Tech, established the Florida Tech Center for Distance Learning (CDL) in July 1999. In establishing the center, President Weaver envisioned the Center "would position the university to address the opportunities and threats presented by the rapid advancement of information technology." The Center

for Distance Learning (CDL) Advisory Board took the lead in developing and promulgating a set of policies and procedures that assured Florida Tech's distance learning programs were of the highest quality and as educationally effective as possible. CDL identified policies and procedures needed by developing distance education programs, coordinated marketing for distance education programs, and provided leadership and expertise related to teaching and learning at a distance (Florida Tech, 2001).

The School of Extended Graduate Studies offers graduate degrees via distance learning and a traditional classroom setting as well as graduate certificate programs at numerous graduate centers across the United States. Some of the degree programs offered through distance learning are: Professional Masters of Business Administration, Master of Public Administration, MS in Systems Management, MS in Acquisition and Contract Management, MS in Human Resources Management, MS in Logistics Management and MS in Operations Research.

6. Regis University

Regis University is regionally accredited by the North Central Association of Colleges and Schools (NCA) – the same organization that accredits Northwestern, Ohio State, Loyola University and the University of Chicago (Regis University, 2001). Regis University currently charges $396.00 per graduate credit hour for its online degree (See Table 12).

Serving the educational needs of over 11,000 students on eight campuses in Colorado and Wyoming, Regis University is one of 28 universities and colleges nationwide which exemplify the 500-year-old Jesuit tradition of providing value-centered education and academic excellence – other prominent Jesuit schools include Georgetown, Boston College, Fordham University and the University of San Francisco (University Alliance, 2001).

Regis' School of Professional Studies was established in the 1970's to offer programs designed specifically for adults. Today, the School for Professional Studies is recognized as leader in adult higher education, offering both classroom based and

innovative online courses. Regis University offers the largest Internet-based MBA Program in the nation (University Alliance, 2001).

7. Rochester Institute of Technology

Rochester Institute of Technology (RIT) is regionally accredited by the Middle States Association of Colleges and Schools. In addition, individual colleges have professional accreditation for specific programs. RIT currently charges $587.00 per graduate credit hour for its online degree (See Table 12).

Online Learning at RIT offers a broad selection of courses and full degree programs, all regionally accredited by the Middle States Association of Colleges and Schools. With more than 20 years of experience in distance education, RIT offers one of the largest online learning programs in the United States. RIT is chartered by the legislature of the state of New York (RIT, 2001).

8. University of Baltimore (UB Online)

The University of Baltimore is accredited by the Association to Advance Collegiate Schools of Business (AACSB). Only 25% of business programs in the United States have achieved this highest accreditation distinction (UB Online, 2001). The University of Baltimore (UB Online) currently charges $420.00 per graduate credit hour for its online degree (See Table 12).

The Merrick School's *web*MBA program allows students to learn anywhere, at any time. Not bound by geography, the program offers opportunities to interact with business professionals, experts, and peers in a global context. Equally important, the *web*MBA teaches students to access, evaluate, manage, and use the vast array of information on the Internet to create effective management solutions.

Merrick *web*MBA students learn from a full-time faculty with doctoral degrees from such universities as Harvard, MIT, Michigan, UCLA, NYU, Purdue, Cornell, and Wisconsin. Professors are accessible to students through e-mail and telephone, and they have regular office hours on the web.

9. University of Maryland University College

University of Maryland University College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools. The

University of Maryland University College currently charges $500.00 per credit hour for its online Graduate MBA degree (See Table 12).

University of Maryland University College is one of 11 accredited degree-granting institutions in the University System of Maryland. For 50 years, the university has fulfilled its principal mission: to serve adult, part-time students through high-quality educational opportunities. The Office of Distance Education & Lifelong Learning supports UMUC's global virtual university by providing leadership in research, faculty development, intellectual property, technology assessment, multi-media services, pedagogy and instructional applications, and e-commerce licensing and sales.

With more than 20 complete degree programs available online (and more added each semester), UMUC students around the world can complete their degree without having to set foot in a classroom. Online programs at University of Maryland University College are very user friendly, allowing the student to interact directly with instructors and fellow classmates through WebTycho, the university's own online delivery software (UMUC, 2001).

10. University of Phoenix-Online

The Commission on Institutions of Higher Education of the North Central Association of Colleges and Schools accredits the University of Phoenix. The University of Phoenix-Online currently charges $495.00 per credit hour for its online Graduate degree (See Table 12).

The University of Phoenix is a private, for-profit higher education institution whose mission is to provide high quality education to working adult students. The University identifies educational needs and provides access to education for working adults, regardless of their geographical location, through innovative methods, including distance education technologies. The University provides general education and professional programs that prepare students to articulate and advance their personal and professional goals.

The University's educational philosophy and operational structure embody participative, collaborative, and applied problem-solving strategies that are facilitated by a faculty whose advanced academic preparation and professional experience help

integrate academic theory with current practical application. The University assesses both the effectiveness of its academic offerings and the academic achievement of its students, and utilizes the results of these assessments to improve academic and institutional quality. The University of Phoenix has campuses in over 107 cities and offers online instruction around the world (University of Phoenix-Online, 2001).

INSTITUTION	***TUITION*** *(per Credit Hour)*	***DEGREE OFFERED***	***NUMBER OF STUDENTS***
Baker College	Undergraduate: $145 Graduate: $220	AA, Bachelor's Master's	Enrolled: 1,900 Graduated: 890
Boise State University	Graduate: $365	Master's	Enrolled: 224 Graduated: 145
Capella University	Graduate: $231	Master's Doctorate	Enrolled: 2,800 Graduated: 350
Embry-Riddle Aeronautical University	Graduate: $316	Master's	Enrolled: 1,500 Graduated: 750
Florida Institute of Technology	Graduate: $330	Master's	Enrolled: 450 Graduated: 006
Lakeland College	Undergraduate: $195	Bachelor's	Enrolled: 1,000 Graduated: 050
New York Institute of Technology	Undergraduate: $470	Bachelor's	Enrolled: 350 Graduated: 311
Regis University	Graduate: $396	Master's	Enrolled: 2,000 Graduated: 350
Rochester Institute of Technology	Undergraduate: $268-294 Graduate: $587	Bachelor's Master's	Enrolled: 8,200 Graduated: 1,200
Saint Leo University	Military: $265 Non-military: $310	Bachelor's	Enrolled: 3,000 Graduated: 050
University of Baltimore UB*Online*	Undergraduate: N/A Graduate: $420	MBA	Enrolled: * Graduated: 006
U. of Maryland University College	Undergraduate: $350 Graduate: $475 ($500 MBA)	Bachelor's Master's	Enrolled: 14,237 Graduated: 1,086
University of Phoenix-Online	Undergraduate: $400 Graduate: $495	Bachelor's Master's	Enrolled: 25,700 Graduated: 11,804

Table 12. Schools with Established Online Degree Programs.
This table depicts a price comparison of Universities from different regions that offer online programs. This table was taken from the following website: www.intered.com/news/dlearn3.htm

C. CHAPTER SUMMARY

As mentioned at the beginning of the chapter, there are several higher learning institutions that offer established online degree programs. This chapter described each school's online degree program and outlined what each school charges for its Graduate courses per credit hour. There are indeed numerous higher learning institutions that offer online courses; however, this chapter focused on those institutions that have graduated students through their online degree program.

The goal of this chapter was not to focus on schools that are only AACSB accredited because only 25% of business programs in the United States have achieved this highest accreditation distinction (UB Online, 2001). However, all institutions discussed are regionally accredited and have graduated students through their 100% online degree programs. It was determined that the average cost per graduate credit hour offered by these institutions is $386.00. Consequently, the total cost of $230.54 offered by NPS is below the average cost (based on simple average) per credit hour charged by these other institutions.

The final chapter discusses some of the conclusions drawn from our research and the results of our analysis, which is based on our primary and secondary research questions. This chapter also provides recommendations for further study in the distance learning area.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This thesis provides policy makers at the Naval Postgraduate School with a general framework (i.e. costing methodology) that identifies all the relevant variables that should be considered when performing a cost analysis of the distance education programs delivered via web-based instruction, video teleconferencing, and traveling instructors. This chapter discusses the conclusions drawn from our research efforts, provides recommendations that the Graduate School of Business and Public Policy might consider when costing its distance education programs and provides recommendations for further study in this area.

B. CONCLUSIONS

While there is great flexibility in the methods of delivery of distance education programs, institutions of higher education operate within many financial constraints. By now, we hope it is evident that one of the most important factors to consider when planning a distance education program involves cost.

Our primary research question was to identify the relevant variables to be considered in developing a model for costing various methods of delivering distance education. The three methods of delivery we discussed were web-based instruction (i.e. completely online), video teleconferencing, and "traveling instructor." Additionally, we attempted to gather information from other universities on the variables they used in determining the costs of their courses or programs and what they were charging for their online programs for comparison with our model. Our efforts were focused mainly on gathering cost data on online courses because NPS already has experience in VTC costing.

We quickly learned from our research that costing distance education programs is an extremely difficult task, specifically when considering web-based instruction. Additionally, in an increasingly commercial environment, cost information is a very sensitive matter. Many institutions are not willing to release cost information for proprietary concerns and competition.

1. Online

Despite the difficulties we faced and the complexity of costing a distance education program, several conclusions were drawn from our research. First, both in the online and VTC arena, program design drives the cost of the program. The answer to the question of "how much it costs to put a course online line," depends. Institutions can spend as much as they want or as little as they want within a wide range of possibilities. Depending on a number of factors such as course content and course design, estimates range from as low as $200,000 to as high as $1 million dollars to put a course online (Hazard, 2001, interview). This range of possibilities makes it almost impossible to place a specific price tag on course development costs. Clearly, the more sophisticated the course (i.e., graphics, streaming video, simulation, etc.) the higher the cost.

Dr. Tony Bates, of the Open Learning Agency in British Columbia, gives a cost range of (Canadian) $2,593 to $21,170 per hour for developing computer-based learning materials. Recall, based on much anecdotal evidence gathered over the last 20 years of building computer-based material, a reasonable starting estimate is that it takes an average of 18 hours of faculty effort to create learning materials for an hour of student instruction on the Web (Finkelstein et al, 2000, p.189).

The Arizona Learning Systems also cites a wide range of course development costs from $6,000 to $1 million depending on the technologies used. Simple outlines and assignments are the cheapest at $6,000 followed by text ($12,000), text with reference materials ($18,000), images ($37,500), audio and video ($120,000), simulations ($250,000) and virtual reality ($1 million) (Rumble 1999, p. 3).

The number of different variables (i.e., faculty, administrative, technical support, equipment, course development/delivery, consumable, infrastructure, and maintenance costs) and questions to consider is likely to cause administrators great confusion when determining the cost of an online course. There is no simple answer to the question of "how much does it cost to put a course or program online?" While using the Web may be emerging as a new and exciting place for teaching and learning, we have only begun to scratch the surface of understanding the costs involved in this new environment.

The phrase "a course on the web" has meaning to everyone we spoke to; however, its meaning varied considerably. For example, many people define a web course as one in which documents pertaining to the class, such as class syllabus, instructor notes (i.e., power point slides) or course calendar are available on the web. Others define web courses as a CD-ROM in a server providing learning opportunities for anyone in the networked environment to assess at anytime. Still others migrate to the far end of the spectrum and define a course online as a web-based asynchronous instructor led course (i.e. 100% online). What is evident is that a clear definition of what is meant by a "course on the web" is the first step in determining the cost of putting a course on the web.

2. Video Teleconferencing

Costing video teleconferencing is more straightforward. Video teleconferencing, known as video tele-education at NPS, refers to courses delivered via two-way interactive audio and video. Quality distance education depends on learner interaction and participation. Thus, a logical assumption would be that the key to improving distance education programs is improving the technology that links learners and teachers. However, advances in technology come with a price.

Similar to the online environment, there are a number of factors to consider when costing the VTC program. These factors include at a minimum:

- Faculty labor cost
- Initial equipment/design cost
- Operation and maintenance cost
- Labor support cost
- Transmission/connectivity costs
- Administrative overheads
- Travel cost

Equipment costs are an important element to consider when designing a program. VTC equipment costs can range from a low end no frills system of 20K to a high-end system of 200K. The initial equipment/design costs also include the cost of installation and set-up of a distance learning classroom. In designing a distance education program,

"a large portion of the expenses are start-up costs, which in effect, can be the equivalent of five years worth of teacher costs (Jones and Simpson, 1993, p. 7).

Along with the faculty labor cost, there is a cost of convenience to faculty members to teach distance education courses. Institutions must provide incentives for faculty members to teach distance learning courses, especially tenured faculty members who typically resist teaching in the distance learning environment. Some universities offer monetary incentives (i.e. a stipend) along with release time from their regular teaching assignments.

Operations and maintenance costs are recurring costs that must be taken into account throughout the life of the program.

Labor support cost is a variable cost that can become significant as the number of VTC courses/programs increases. For example, NPS uses one GS-9 to simultaneously support two classrooms.

Travel expenses for instructors traveling to the remote cite(s) are important cost considerations in costing the VTC program.

3. Traveling Instructor

The traveling instructor, known at the Graduate School of Business and Public Policy as the "Road Warrior," is an effective means of distance education. NPS, instructors travel to the Naval Academy to provide educational instruction to students in the Leadership Education and Development (LEADS) program.

Since this form of education is just the instructor traveling to a remote location, the only significant expense is the cost of travel, which includes such things as air fair, lodging, food, rental car, etc. These charges, of course, are variable depending on length of stay and location.

As stated earlier however, there may be resistance from instructors to teach distance education courses. There is a cost associated with getting faculty to "buy-in" to teaching any form of distance education.

4. Recommendation For Conducting Cost Analysis

Regardless of which delivery method is chosen, there is a general underlying framework, which can be followed in the cost analysis process. It is divided into three distinct phases:

- A Planning phase
- A Production and Delivery phase
- An Evaluation and Assessment phase

A cost analysis is a process of determining all the costs involved in a particular activity or project. Chapter III discussed several methods for costing online courses. We feel that the best method to use is an Activity Based Costing approach similar to the methodology followed in the Flashlight project run by the Teaching, Learning and Technology Group.

Activity based management is a means of identifying the true costs of products or services. Traditional accounting systems that classify cost measurements as fixed, variable, or semi variable are proving to be ineffective in costing distance education programs. NPS, like any other organization, must remove non-value added activities. Activities are processes that consume resources whereby work gets accomplished. An activity based management approach provides a means for organizations to identify and eliminate wasted activities.

Activity-based costing provides senior managers with insight into the behavior of costs. As Forrest points out, "the goal of every activity in a business should be to provide value to the customer at a reasonable cost. Senior managers need timely and accurate information to compare the competitiveness and cost of each activity's output with the next best alternative (e.g., zero-based budgeting) to make an informed decision about that alternative, whether it is inside or outside the company. Activity-based costing provides the vehicle to produce the applicable data to make an informed decision." (Forrest, 1996, pp. 302-303).

C. RECOMMENDATIONS FOR FURTHER STUDY

Distance education has been deemed by many as a viable alternative to the traditional face-to-face classroom setting. Technology is being used to link teachers and learners at all levels of education from elementary to postsecondary schools, thus

bringing a diverse body of expertise and information into the classroom. Distance education allows institutions to increase educational opportunities by reaching more students and by using technology in creative ways to enrich their learning experiences. However, these increased opportunities do not come without a price. The use of technology creates problems. There are still a number of issues concerning distance education that need further research.

1. The Effectiveness Debate

While the use of technology is rapidly gaining prominence and popularity, one of the most hotly debated issues in the arena of distance education is the "effectiveness" debate. The "effectiveness" issue raises the question of whether there is any significant difference between the traditional face-to-face classroom setting and the online environment? As advances in technology make distance education more common, this will only fuel an already heated debate. Is distance education as effective as the traditional face-to-face classroom environment?

2. Faculty Buy-In And Incentives

Research has shown that many faculty are unwilling to teach distance education courses. A large percentage of these faculty members are tenured professors. There are a number of reasons for this, but one of the primary concerns is the increased workload that accompanies teaching an online course. Some universities are designing incentive systems to encourage faculty to teach distance education courses. Additionally, what is seen as traditional is seen as better by some faculty. Many faculty question the quality of education at a distance, specifically web-based instruction. Some are unclear of the effect technology will have on their role as faculty members. And still others just prefer the traditional face-to-face classroom environment. A better understanding of faculty resistance and the incentives necessary to encourage teaching distance education programs is crucial for their success.

3. Instructor/Student Ratio

Distance education provides a means for increased access to a larger number of students. In the online environment, there is also the opportunity for increased faculty/student interactivity. What is the optimum faculty/student ratio for online education to be cost effective?

4. The End of University Campus

Although the goals of distance education programs may not always be clear, it is evident that the marriage of technology and education will last. With the increased usage of the World Wide Web and the phenomenal growth in virtual campuses (e.g., cyber colleges and distance education programs), some people are asking does this mean the end for the traditional brick and mortar university?

5. Technology Issues

As technology advances, NPS must position itself to take full advantage of this rapidly changing environment. For example, microprocessor performance has been increasing at a relatively constant rate, doubling about every 18 months. Computing power and bandwidth are also expected to see revolutionary changes within the next decade. How can a better understanding of both current and new emerging technologies be leveraged by NPS to improve its distance education programs?

6. Course Material

Cultural barriers and bureaucratic processes prohibit some institutions from developing successful online courses and programs, and those who do enter the online arena must decide which courses should be placed on the web. Just as every university is not necessarily fit to venture into the online arena, all courses are not necessarily fit to be placed on the web. What programs or courses should be offered online?

7. Outsourcing or Other Available Options

Outsourcing is a word familiar to government organizations. Is outsourcing course development and preparation an option for NPS? For example, coursecompass, a dynamic new interactive online learning environment, allows instructors to access their website to develop and deliver online courses for a fee. Instructors can use pre-loaded course content or build their own from scratch. Students are required to purchase access codes from the campus bookstores either as stand alone access code cards or as a bundled package with new textbooks at discounted prices.

Many of the same courses taught at NPS have already been developed and put online. Are we duplicating our efforts?

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APPENDIX A: FACULTY WORKLOAD MATRIX AND CRITERIA

	Criteria					
Programs	First Time Through			Subsequent Offerings		
	Faculty Development (Not Course Development)	Course/Module Design Using an Existing Course/Module	Course/Module Design Using a New Course/Module	Course/Module Delivery and Management	Course/Module Maintenance and Updating	DL adjustment
Road Warrior; Remote Residence:						
• One Week (one two-hour course)	2 weeks	5 days for adapting an existing course/module	Negotiable	Same as campus	Nothing	4 days
• Two Weeks	2 weeks	7 days for adapting an existing course/module	Negotiable	Same as campus	Nothing	5 days
VTE: a single four unit class						
• Single Remote	Collapse with course development	4 units (based on 11 units per quarter)	8 units	6 units (includes site visits)	0-2 units (depending on rate of change of the technology used)	Nothing
• Multiple (three or more sites)		6 units	10 units	8 units if > 5 locations and > 15 students	0-2 units (depending on rate of change of the technology used	Nothing
Web Based (Hybrid)						
• < 25-75 %	Collapse with course development	4-9 units	8-15 units	2-6 units	0-3 units	Nothing
• 100%	Collapse with course development	11 units	15-22 units	6-8 units	0-4 units	Nothing

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LIST OF REFERENCES

Arizona Learning Systems, *Preliminary Cost Methodology for Distance Learning*, Report dated 21st August 1998, Arizona Learning Systems and the State Board of Directors for Community Colleges of Arizona.

Ash, C., & Bacsich, P., "Costing the Lifecycle of Networked Learning: Documenting the Costs from Conception to Evaluation," pp. 2-3, 12, 24. Paper presented at the Association for Learning Technology Conference (ALT-C); held between 21st – 23rd September 1999 at The University of Bristol, in England; and hosted by CTI, ILRT and JISC.

Ash, C., & Bacsich, P., "The Costs of Networked Learning," in Steeples, C. and Jones, C. (eds) (2001), *Networked Learning in Higher Education,* in print.

Bakia, M., "Costs of ICT Use in Higher Education: What little we know," in *TechKnowLogia*, vol. 2, no. 1, 2000.

Bates, A.W., "Media and Technology in European Distance Education," Milton Keynes, Open University, 1990.

Bates, A.W., Technology, Open Leaning and Distance Education. New York, London, Routledge, p. 1, 38, 41, 197, 1995.

Bates, A.W., Managing Technological Change. San Francisco: Jossey-Bass Publishers, 2000.

Biggs, C. H., *Distance Education: A Case Study with Application for DoD and the Marine Corps*, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1994.

Bishop, T. & SchWeber, C., "UMUC's Online MBA Program: A Case Study of Cost-Effectiveness and the Implications for Large-scale Programs," p. 179, 2001.

Bishop, T. & SchWeber, C., *Personal Interview*, University of Maryland University College, October 2001.

Boeke, M., "Procedures for Calculating the Costs of Alternative Modes of Instructional Delivery," p. 16, WCET/NCHEMS, 2000.

Cambre, M. A., "The state of the art of instructional television." In G.J. Anglin, (ed.), Instructional Technology, Past, Present, and Future (pp. 267-275). Englewood, CO: Libraries Unlimited, 1991.

Carr, S., "Is Anyone Making Money on Distance Education? Colleges struggle to figure out how much they are spending on online programs," p. 1, *The Chronicle of Higher Education*, 1995. Available at http://chronicle.com.

Crabb, G., "Costing Open and Flexible Learning," Coventry (UK), NCET, (ed.) (1990).

Cukier, J., "Cost-benefit Analysis of Telelearning: Developing a methodology framework," in Distance Education, vol. 18, no. 1, pp. 137-152, 1997.

Delors, J, al Mufti, Amagi, I et al., *L'Education: Un Tresor est Cache Dedans*, Editions UNESCO and Editions Odile Jacobs, Paris, 1996.

Denlinger, L. Economic Model Development Guidebook. Created for the Flashlight Project of the TLT Group, an affiliate of the American Association for Higher Education, p. 9, Management Advisory Services, Indiana University, 1999.

Ehrmann, S., & Milam, J. Flashlight™ Cost Analysis Handbook Version 1.0. "Modeling resource use in teaching and learning with technology," Washington, TLT Group, 1999.

Finkelstein, M. J., Frances, C., Jewitt, F. I., & Scholz, B.W., Dollars, Distance, and Online Education. "The New Economics of College Teaching and Learning," pp. 65, 67, 71, 189. American Council on Education', ORYX Press, Series on Higher Education, Phoenix, AZ, 2000.

Gilbert, S.D., "How to Be a Successful Online Student," McGraw-Hill, Two Penn Plaza, New York, NY, pp. 31-40, 2001. Forrest, E., "Activity-Based Management: A Comprehensive Implementation Guide," Productivity Consulting, Ltd., Roslyn, New York, 1996.

Inglis, A., "Is Online Delivery Less Costly than Print and as it Meaningful to Ask?" Distance Education, 20, 220-239, 1999.

Jonassen, D.H., "Applications and Limitations of Hypertext Technology for Distance Learning," Paper presented at the Distance Learning Workshop, Armstrong Laboratory, San Antonio, TX, 1992.

Jones, J. I., & Simonson, M., Distance Education: A Cost Analysis, p. 7, New Orleans, LA, 1993.

Jung, I., & Rha, I., "Effectiveness and Cost-Effectiveness of Online Education: A Review of the Literature," Educational Technology, July- August 2000.

Jurich, S., The End of the Campus University? "What the Literature Says about Distance Learning," pp. 38-40, TechKnowLogia, 2000.

Keegan, D., "*The Foundations of Distance Education*." London: Croom Helm, 1986.

Liao, S. S., "Spreadsheet Skills for Decision Support Modeling," Material written for Naval Postgraduate School, p. 23, 2001.

Leadership Education and Development (LEADS) program, 2001. Available at http://sm.nps.navy.mil/lead.

Mangan, K. S., "Expectations Evaporate for Online MBA Programs," *The Chronicle of Higher Education*, 5 October 2001. Available at http://chronicle.com/distance.

Mantyla, K., The 2000/2001 ASTD Distance Learning Yearbook. McGraw-Hill, 2000.

Merisotis, J. P. & Olsen, J. K., "The 'Effectiveness' Debate: What We Know about the Quality of Distance Learning in the U.S.," *TechKnowLogia*, 2000.

Metzko, J., Redding, G. A., & Fletcher, J., "Distance Learning and the Reserve Components (IDA Document D-1941)." Alexandria, VA: Institute for Defense Analyses, 1996.

Milam, J. H., "Cost Analysis of Online Courses: AIR Forum Paper," p. 8, Charlottesville, VA, 2000.

MIL-STD-188-331 (Draft), *Draft Military Standard Interoperability and Performance Standard for Video Teleconferencing*, Defense Information Systems Agency, Washington, DC, 10 November 1993.

Moonen, J., "The Efficiency of Telelearning," *Journal of Asynchronous Learning Networks*, vol. 1, no. 2 ONLINE, 1997. Available at http://www.aln.org/alnweb/journal/issue2/moonen.htm.

Morgan, B. M., "Is Distance Learning Worth It? Helping to Determine the Costs of Online Courses," p. 8, Marshall University, 2001.

National Center for Education Statistics, *Statistical Analysis Report – December 1999*, "Distance Education at Postsecondary Education Institutions," 1997-98.

Naval Postgraduate School Distance Learning Resource Center (DLRC), "New Directions for Learning," September 26, 2001. Available at http://www.dlrc.nps.navy.mil//faculty_development/faculty_development_overview.htm.

Naval Postgraduate School General Catalog, 2001. Available at http://www.nps.navy.mil.

"Office of Continuous Learning (OCL) Purpose" – Naval Postgraduate School, September 18, 2001. Available at http://www.ocl.nps.navy.mil.

OMB Circular A94, Appendix C, Jan 2001.

Orivel, F., "Analyzing Costs in Distance Education Systems: A Methodological Approach," IREDU, Dijon, Université de Bourgogne, 1987.

Palloff, R., and Pratt, K., "Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom," The Jossey-Bass higher and adult education series, First Edition, Copyright, 1999.

Perraton, H., "A Theory for Distance Education," In D. Sewart, D. Keegan, & B. Holmberg (Ed.), Distance Education: International Perspectives (pp. 34-45). New York: Routledge, 1988.

Rumble, G., "Online Costs: Interactivity at a Price", in Mason, R. and Kaye, A., Mindweave: Communication, Computers and Distance Education, Oxford, Permagon Press, (eds) (1989).
Rumble, G., "The Costs and Economics of Open and Distance Learning," London, Kopan Page Limited, pp. 2-4, 1997.

Rumble, G., "The Costs of Networked Learning: What Have we Learnt?" p. 3. Available at http://www.shu.ac.uk/flish/rumblep.htm.

Sawhney, M., "Lecture. Widening Our World," Northwestern University J. L. Kellogg Graduate School of Management, Evanston, IL, 24 September 1997.

Schamber, L., "Delivery Systems for Distance Education," ERIC Digest. ERIC Clearinghouse on Information Resources, Syracuse, NY, 1988. Available at http://www.ed.gov/databases/ERIC_Digests/ed304111.html.

Schools with established Online Degree Programs, 2001. Available at http://www.intered.com/news/dlearn3.htm.

Sherron, G. T., & Boettcher, J. V., "Distance Learning: The Shift to Interactivity," CAUSE Professional Paper Series, #17, Boulder, Colorado, 1997.

Simpson, H., Pugh, H. L., & Parchman, S. W., *The Use of Videoteletraining to Deliver Hands-on Training: Concept Test and Evaluation Technical Report*, TN-92-14, Navy Personnel Research and Development Center, San Diego, California, May, 1992.

Sorenson, B. K., *Costs and Benefits of Network Based Instruction at the Naval Postgraduate School*, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1998.

Twigg, C. A., and Oblinger, D. G., "A Report from a Joint Educom/IBM Roundtable," *The Virtual University*, Washington, D.C., November 5-6, 1996.

University of Central Florida Virtual Campus, "The Center for Distributed Learning: Scope and Policies," July 19, 2000. Available at http://distrib.ucf.edu.

Vogelstein, F., "The $85,000 Distance Degree. The Best Distance Learning Graduate School," Princeton Review Publishers, 1999. Education: Graduate School. Available at http://usnews.com.

Wisher, R.A.; Matthew, V.; Champagne; Pawluk, J.L.; Eaton, A.; Thornton, D.M.; Curnow, C.K. "Training Through Distance Learning: An Assessment of Research Findings," Technical Report 1095, U.S. Army Research Institute for the Behavioral & Social Sciences, June, 1999. Available at http://www.ott.navy.mil/view_detail.cfm.

Woodhall, M., "Cost-Effectiveness Analysis in Education," in G. Psacharopoulos (ed.). Economics of Education. Oxford: Pergamon, 1987.

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