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Integrating distance learning technologies with information technology curricula: A solution for economic and workforce development at Mt. San Jacinto College

Guy Mitchell Reams

INTEGRATING DISTANCE LEARNING TECHNOLOGIES WITH

INFORMATION TECHNOLOGY CURRICULA: A SOLUTION FOR

ECONOMIC AND WORKFORCE DEVELOPMENT AT MT. SAN

JACINTO COLLEGE

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A Project

Presented to the

Faculty of

California State University,

San Bernardino

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In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Instructional Technology

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by

Guy Mitchell Reams

December 2002
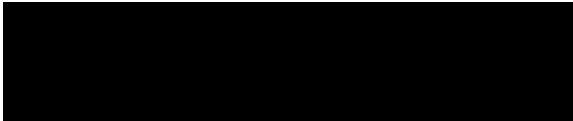
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ABSTRACT

This project develops a new instructional methodology based on the current literature for distance education. The project proposes the development of a new instructional model that integrates traditional classroom instruction with distance learning technologies, specifically streaming and on demand video. This project proposes a model program to serve as the basis for redesigning curriculum to fit the demands of a technology infrastructure required to offer courses remotely. This model is a unique strategy that provides solutions for flexibility in scheduling, faculty workload and the ability for students to pace their own instruction. This project proposes that this strategy be used to redesign the Information Technology program at Mt. San Jacinto College. A solution that links educational objectives with vendor certification is proposed as part of the development process. This is to target working adults and employers in a region that are seeking solutions for Information Technology training. The project also considers the required technology infrastructure required for this new instructional model. Analyzing each of the required components and proposing a budget and timeline for project implementation. The goal of this project being to provide a

unique strategy that integrates new curriculum, instructional methods, and distance technology to position higher education as a key participant in workforce and economic development. By using Mt. San Jacinto College as a case study, this project proposes several recommendations for implementing similar models at other colleges and universities.

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BACKGROUND

Introduction

The Computer Information Science department at Mt. San Jacinto College has been offering a series of courses designed to prepare students for obtaining relevant job skills in the networking or Information Technology field. The collection of these courses is called the Information Technology Program and maps tightly with curriculum designed by corporate sponsors such as Microsoft and Cisco. This project proposes several changes in the instructional curricula, design, and methodologies for this program in order to best meet the objectives of the institution.

Mt. San Jacinto College is potentially positioned as a key participant in an economic development strategy for southwestern Riverside County. Consistent with the goals for California Community Colleges, Mt. San Jacinto College has designed programs with an emphasis in career education in order to meet the demands being placed on the current labor force. As businesses are being attracted to the area by various economic factors, the demands for a specifically skilled workforce have grown exponentially. The objective,

for the Information Technology program in particular, is to develop a labor force skilled in Information Technology to meet this growing demand.

Although the Information Technology program has been popular, there is a serious concern that the program is not positioned correctly to meet the needs of the current and potential workforce. The main factor affecting the success of the program is the availability of the current population. Individuals that are disadvantaged due to economic factors, childcare, and other barriers are unable to devote the seat time required to attend the program. In addition, local businesses cannot afford the luxury of allowing employees the time to attend courses being held at the college. Another issue affecting the efficacy of the program is the ability to find qualified expert faculty that meet the necessary qualifications and are willing to work for comparatively less than corporate instructors. This project proposes a significant change in the current instructional methodology in order to overcome these growing concerns.

In order to arrive at this new methodology, or instructional design, an analysis was done on the current and future advances in distance learning. These advances in

distance learning were then compared with the instructional design of the current Information Technology program at Mt. San Jacinto College. After this process, specific distance learning technologies were selected based on the potential to solve the concerns outlined above. Once these technologies were decided upon, the curricula of the Information Technology program was reviewed to determine if the content could be delivered in the current state or if revisions needed to be made. Finally, organizational changes such as faculty load, staffing and support, and scheduling were evaluated based on potential success.

Each of these ideas was conceptualized by evaluating the changes that would be required to modify one of the beginning courses in the Information Technology program. Once this was completed, a detailed project proposal was created for the conversion of the entire program. The final concern was feasibility and budgeting issues, which ultimately will decide the fate of the proposed changes. The entire project was re-evaluated based on potential costs and staffing concerns. This process helped determine a rollout procedure for the entire project that will reduce the immediate cost burden and emphasize a more accountable approach.

An evaluation plan was then developed to monitor the progress of this proposed rollout to insure that the funds being directed to this project are being used properly. In addition to providing a relevant benchmark for evaluating the success the program is having toward meeting the needs of the current workforce. This evaluation plan will prove to be a valuable instrument in determining if the project proposal fulfills the goals of distance learning programs.

The value and merit of this project can be based then on the fulfillment of the following objectives:

1. The ability of this project proposal to develop a successful instructional methodology that meets the objectives of the institution and economic and workforce development requirements.

2. The application of this project proposal to other efforts in higher education to integrate distance learning in classroom instruction.

Significance of the Project

With the advent of new technologies, the methods of education are changing rapidly. This is evident with the rise of small private schools offering a wide range of educational options via distance learning technologies. The

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ability for public postsecondary institutions to adapt to this new climate and begin to offer curriculum in more flexible formats will become a key factor of success in the future. The demand for flexible and relevant training for today and tomorrows workforce is going to continue to grow exponentially. California Community Colleges can play a significant role in the economic development of specific regions by adapting to this demand.

Providing a qualified labor force is a key initiative in which community colleges such Mt. San Jacinto College must participate. A good example of how the college could have a significant impact on the economic development of a region is the City of Temecula. According to Husing (1998) the Temecula valley is at a significant disadvantage:

> In the modern economy, direct access to training programs from community colleges, advice from college and university professors, and access to college graduates and interns has become increasingly important. Here, Temecula's remote location places it at somewhat of a competitive disadvantage. (p. 3)

Mt. San Jacinto College is positioned, with the Menifee campus and other Temecula satellites, to help

provide a unique advantage to local employers. Husing

(1998) continues:

> One way in which Temecula can compensate for its
>
> relatively remote location is through offering
>
> skilled labor at below market rate. The
>
> willingness of city workers to work for less to
>
> avoid commuting is thus a significant potential
>
> economic advantage for the community. (p. 8)

Worker training is the key to providing incentives for

businesses to remain in Temecula and to provide incentives

for new recruitment. Although, Information Technology is

just one component of workforce development, within today's

economy it is a major one. So Mt. San Jacinto College must

begin to offer competitive workforce training. If the

college continues to rely on faculty to develop this effort

the issues outlined in this research will become

increasingly challenging. This was emphasized in the

conclusion of Husing's (1998) report on the economic

development strategy for the city of Temecula:

> As Temecula works to retain, expand and recruit
>
> businesses, an important tool available to some
>
> communities is the direct involvement of college
>
> representatives in continuous visitation programs

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to local employers, and as part of organized

efforts to retain and expand local firms. As

worker training is often key to such efforts,

greatly increased participation of Mt. San

Jacinto College in direct contacts with local

businesses is needed. (p. 33)

The demands on today's workforce are making formal

education programs an extremely difficult process. Working

adults who require specific training skills by their

employers are finding that obtaining such an education can

be considerable difficult, especially when combined with

family, social, and other obligations. If public post

secondary education is going to provide this service then

it must be willing to examine alternative methods to

providing education.

Barriers to providing alternative methods are centered

on tradition in public education and the lack of any

formalized process. This project proposes to offer a

formalized method for delivering relevant technology

training than encompasses both technology and educational

methodology. The specific goal being to provide a framework

for implementing such programs at Mt. San Jacinto Community

College District, but also providing a method for
implementing similar structures at other institutions.

Statement of the Needs

Community Colleges have joined with many other
institutions in investing significant dollars into distance
learning. Reports from the U.S. Department of Education
have indicated that over the last decade distance learning
programs have been a priority for postsecondary education.
In a report on distance education in post secondary
institutions, the National Center for Education Statistics
(1999) found that 78 percent of 4-year institutions and 62%
of 2-year institutions offered some form of distance
education courses. The major reason for this emphasis in
distance learning has been the objective to reach more
students. This project addresses a concern that many
institutions have, including Mt. San Jacinto College, which
is to make sure that funds directed toward efforts in
distance learning are used in the most efficient manner.
This equates to developing an instructional model that not
only has measurable outcomes, but also is able to deliver
the ultimate goal of investments in distance learning
programs, which is to reach students. As grant initiatives

and other funding sources become available for curriculum and programmatic development in unique and alternative methods of instruction, Mt. San Jacinto College needs to have a developed structure on which to base funding requests and grant proposal for the further development of distance learning.

The importance of developing new instructional methodologies for distance learning is easily realized when viewed from a fiscal vantage point. Community Colleges and other institutions continue to direct funds toward this effort, with trends showing an increase in enrollments in such programs. Despite criticism of distance learning efficacy, there has been a continued rise in student populations enrolled in distance learning programs. This is due in large part to the needs and requirements of an aging student population (Kliener, 2001).

The population that Mt. San Jacinto and other colleges seek to serve with new distance learning technologies cannot be ignored. Recent legislation and directives from state agencies have begun to emphasize this population. Community Colleges, especially in California, have been increasingly saddled with the burden of workforce development and economic development strategies. As stated

by the Chancellor's office one of the primary missions of the California Community College system is to "advance California's economic growth and global competitiveness through education, training, and services that contribute to continuous work force improvement" (Chancellor's Office, 2002, ¶ 2). In recent workforce and economic development legislation and grant initiatives the California Community College system has become a key partner in providing training, education, and services for workforce development. The intentions of the California Legislature were made clear when several changes were made to Title 5 of the California Code of Regulations in 1998. Many of these changes emphasized new definitions of regular contact between faculty and students.

However, despite the growing emphasis in distance learning methodologies in recent legislation, the Academic Senate for the California Community Colleges (1999) clarifies that Title 5 still requires that a local curriculum process approve all distance learning courses, and the methods of regular effective contact. This requires that the faculty and curriculum committees at community colleges make important decisions as to the requirements for effective distance learning frameworks. State and local

issues cause significant perceived barriers to implementing effective distance programs. In a statistical analysis report in 1997 on distance education by the National Center for Education Statistics, the top reasons schools gave for not implementing distance learning programs included:

> . . . inability to obtain state authorization (79 percent), restrictive federal, state, or local policies (58 percent), legal concerns (57 percent), lack of support from institution administrators (60 percent), and lack of fit with the institution's mission (58 percent). (p. 39)

The National Center for Education Statistics has confirmed that the primary reason that higher education institutions develop distance learning programs is to make courses available for students (National Center for Education Statistics [NCES], 1997, p. 31). Although this is an obvious intention of a distance program, what is more important is that the NCES has found that a majority (nearly 90 percent) of higher education institutions have meet or exceeded this goal since their last survey (NCES, 1997, p. 32). This means that distance learning programs are going to be increasingly used to develop programs of study that reach non – traditional students. In the

California Community College systems this means more specifically a potential labor force for local employers.

To provide alternative scheduling and convenient times for this potential labor force to take courses is a continuing issue for post secondary education. Many schools now provide extensive courses on weekends and evening to provide greater opportunity for working adults to receive the education that their current or future jobs require. In addition, employers that would choose a local community college as a solution for employment training and skills development require flexible scheduling and hours. Traditional academic schedules are also being challenged, as colleges face the demands of scheduling. Traditional 16-week semesters are not fast paced enough for the relevant skills training required by the modern workforce.

As technology has improved, many colleges have seen the opportunity to deliver education in convenient locations in addition to convenient scheduling times. This has taken the form of linked extension centers, remote video classrooms, satellite or local cable broadcasts, and with the advent of high-speed Internet access the ability to deliver education to homes and places of business. The potential of these new technologies have been discussed a

great deal in the distance education community. However,

successful implementation of these new technologies has

meet some resistance due to funding concerns, instructional

quality, and programmatic implementation at a local level.

Select programs have had significant success using Internet

related technologies to deliver remote education. In

addition, recent developments and the continuing

proliferation of DSL and Cable Internet access has provided

a window of opportunity for the development of

instructional methodologies that take advantage of remote

learning.

There are concerns in the vocational education

community regarding the extensive use of technology to

deliver education. Most of these concerns center on the

instructional quality and maintaining appropriate

instructional rigor.

Despite concerns over the impact of technology on

instruction, one of the key advantages is to be able to

deliver multiple methods of instruction that adapt to

individual learning styles. Developing educational systems

that address the specific needs of regions supported by the

California Community College system is critical to the

success of this and other workforce initiatives. The

ability for a Community College to address these needs is directly related to the college's efforts to extend education outside of the typical classroom boundaries. Mariani (2001), publisher for Occupational Outlook Quarterly, suggests that post secondary education that uses distance educational technology, "free learning from the limits of time or space makes education available to more people" (p. 2). Mariani (2001) continues:

> Some of those already in the labor force may find distance learning the only option for upgrading skills, finishing a degree, or pursuing another degree. (p. 2)

By considering alternative methods of instruction, colleges can begin to create learning methods that are more appropriate for a variety of student needs. Offering education in different formats and via distance learning technologies is an attempt to accomplish this.

Infusing the distance learning into current curriculum offers several advantages, however, these advantages cannot be realized until specific barriers to programmatic success are considered. Two potential issues in high technology training that must be dealt with are that of maintaining

enrollment numbers in advanced level courses and attracting
qualified faculty to teach technology related programs.

Table 1 provides a quick reference for linking each of
these needs with specific goals of this project (see Table
1). The goals will be discussed in the program plan.

Table 1.

Summary of Identified Needs with Associated Project Goals

Identified Needs	Goals
To provide a budget for distance learning technologies	Goal 4
To develop a framework for curricula that meets state and local requirements	Goal 1
To provide scheduling of courses that meets the demands of the workforce and employers	Goal 3
To provide instruction in various formats to meet the learning style requirements of the students	Goal 2
To provide new instructional technologies that enhance the ability for students to receive instruction remotely	Goal 4
To maintain instructional quality and integrity of programs	Goal 3
To maintain enrollment numbers for advanced level courses	Goal 3
To obtain qualified faculty to teach technology related programs	Goal 3

Program Plan

The primary purpose of this project is to provide a method for Mt. San Jacinto College to offer competitive programs in Information Technology. As discussed already, the mission of the California Community College system is centered in the potential role that colleges can play in economic and workforce development. By integrating unique delivery methods, scheduling, and relevant curriculum the college can begin to offer programs that are more attractive to the adult workforce and employers seeking solutions for staff development. The following outlines a plan for creating an instructional model that integrates traditional classroom instruction with distance learning technologies to produce a product that meets these identified needs.

Goal 1: To Provide
   Information Technology
   Curricula Targeted Toward
   Industry Driven Objectives

Objective 1: Define Educational Objectives Based on Vendor Certification that Meet the Needs of Students and Employers Prior to Developing Curriculum.

- Title: Educational Objectives

- Strategy 1: Identify industry certification programs in Information Technology that meet employer needs

- Strategy 2: Form key partnerships with vendors that offer certification programs

- Strategy 3: Define educational objectives based on vendor certification programs

- Measure: A list of objectives will be provided to the department as a basis for forming instructional technology curriculum before 3/1/02

Objective 2: To Develop a Model Program in Information Technology that can be Used to Develop Curriculum for the 2003/2004 School Year.

- Title: Model Program

- Strategy 1: Identify vendor certification program to serve as model program

- Strategy 2: Develop model components including courses, prerequisites, and requirements

- Measure: A model program will be submitted to curriculum committee by 3/14/02 to be used as a basis for further program development

Objective 3: To Test the Model Program by Offering the Program for One Semester as a Beta Examination.

- Title: Model Program Beta

- Strategy 1: Offer model program for the spring 2003 semester

- Strategy 2: Review implementation details and issues; make adjustments to the model as necessary

- Measure: Faculty will review the results of the beta test on 5/19/03

Objective 4: To Use Model Program to Redesign Current Department Programs and Submit for Approval Before the End of the 2001/2002 School Year.

- Title: Redesign Current Curriculum

- Strategy 1: Faculty will redesign current Information Technology programs based on the model program design

- Strategy 2: Faculty will develop necessary courses, prerequisites, and requirements for current programs

- Measure: Redesigned curriculum will be submitted for approval to the curriculum committee by 5/1/02

Objective 5: To Use Model Program to Develop New Curriculum and Submit for Approval During the First Semester of the 2002/2003 School Year.

- Title: Develop New Curriculum

- Strategy 1: Faculty will develop new Information Technology programs based on the model program design

- Strategy 2: Faculty will develop necessary courses, prerequisites, and requirements for current programs

- Measure: New curriculum will be submitted for approval to the curriculum committee by 9/1/02

Goal 2: To Develop Improved Instructional Methods that Will Work Within Both Traditional and Distance Formats

Objective 6: To Develop a Lecture Method Capable of Being Delivered in Traditional and Online Formats.

- Title: Lectures

- Strategy 1: Faculty will develop guidelines for lecture format

- Measure: A lecture method will be designed by 3/4/02

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Objective 7: To Develop a Panel Discussion Method that
Provides a Forum for Student Questions and Expert Analysis.

- Title: Panel Discussions

- Strategy 1: Faculty will develop guidelines for panel
  discussions

- Measure: A method for doing panel discussions will be
  designed by 3/12/02

Objective 8: To Provide Students with Valuable
Resources Through the Implementation of an Online Learning
Community.

- Title: Learning Community

- Strategy 1: Faculty will develop requirements of the
  online learning community

- Strategy 2: Technologies to be used in the online
  learning community will be analyzed

- Measure: A plan for offering an online learning
  community will be ready on 3/25/02

Objective 9: To Adequately Determine Mastery of Course Material by Developing a Unique Examination Process.

- Title: Exams

- Strategy 1: Faculty will determine examination requirements for each topic

- Strategy 2: Faculty will develop examinations

- Measure: Exams will be prepared for delivery on 5/27/02

Objective 10: To Integrate Hands on Experience and Application Through the Use of Guided Activities.

- Title: Guided Activities

- Strategy 1: Faculty will develop guidelines for guided activities

- Measure: A method for doing guided activities will be developed by 4/1/02

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Objective 11: To Provide Students with the Capability
of Gaining Practical Experience Through Self Guided
Activities.

- Title: Self-Guided Activities

- Strategy 1: Faculty will develop guidelines for self-guided activities

- Strategy 2: An equipment package will be offered to students

- Measure: A method for offering self-guided activities will be developed by 4/8/02

Objective 12: To Provide Opportunities for Students to
Work Individually with Instructors by Using Office Hours
Creatively.

- Title: Office Hours

- Strategy 1: Develop methods for using office hours to significantly benefit students

- Strategy 2: Consider methods to implement office hours using distance technology

- Measure: A plan and schedule of office hours for faculty will be ready on 3/29/02

Goal 3: To Develop an
   Instructional Plan that
   will Maintain Flexibility
   in Scheduling, Produce
   Better Outcomes and Meet
   the Needs of Faculty,
   Students and Local Business

   Objective 13: To Develop a Web Based Registration

Process for Students to Enroll Prior to the 2003/2004

Semesters.

- Title: Web-Based Registration

- Strategy 1: Examine college and state policy in regard

  to registration for programs

- Strategy 2: Faculty and staff will develop a process

  for program registration

- Measure: A process for doing web-based registration

  will be ready for implementation on 1/21/02

   Objective 14: To Implement a Scheduling Plan to be

Used in the Fall 2003/2004 Semester.

- Title: Scheduling

- Strategy 1: Examine college and state policy in regard

  to scheduling practices and required regular contact

- Strategy 2: Develop scheduling template

- Strategy 3: Develop process that faculty and staff will use to publish a semester schedule of topics

- Measure: Course schedule will be published using the new system prior to the Fall 2003/2004 semester

Objective 15: To Develop a Tracking System that Tracks Completion and Progress of Enrolled Students.

- Title: Tracking System

- Strategy 1: Determine reporting requirements of tracking system

- Measure: A process for tracking student progress will be ready for implementation on 1/30/02

Objective 16: To Develop a Method to Calculate Faculty Workload Before Courses Begin in the Fall 2003/2004 Semester.

- Title: Faculty Workload

- Strategy 1: Examine college and state policy regarding faculty workload

- Strategy 2: Develop new workload plan

- Measure: Faculty workload agreement to be signed by administration on 6/4/03

Objective 17: To Offer Curriculum Taught by Qualified
Faculty by Requiring Specific Standards, Offering
Competitive Pay for Part Time Faculty, and Unique
Scheduling.

- Title: Obtaining Qualified Faculty

- Strategy 1: Determine minimum qualifications for
  instruction in the programs

- Strategy 2: Develop a unique pay structure for a
  combination of contract and credit education

- Strategy 3: Use scheduling system to fit qualified
  faculty with the correct topics

- Measure: Minimum qualification, equivalencies, and
  contract pay structure will be submitted for approval
  on 6/4/03

Objective 18: To Integrate the Ability to Offer
Contract Education Courses Through Scheduling and Faculty
Assignments.

- Title: Contract Education

- Strategy 1: Research needs and training issues for
  local businesses

- Strategy 2: Develop contract education marketing plan

- Strategy 3: Take advantage of scheduling by offering contract programs

- Measure: The first contract education course will be held on 8/18/03

Objective 19: To Plan for Methods to Improve Retention so that Advanced Courses Maintain Enrollment.

- Title: Retention

- Strategy 1: Determine issues that affect retention in programs

- Strategy 2: Implement methods to improve retention

- Measure: A report on program retention will be prepared after the Spring 2002 semester

Goal 4: To Develop an Affordable Technology Plan That Facilitates Both the Instructional Plan and Methods

Objective 20: To Develop a Web Application that
Provides Students' Access to an Online Learning Community,
Registration, Enrollment, Progress Tracking and
Examinations.

- Title: Web Application

- Strategy 1: Plan the necessary infrastructure and required for a web based application

- Strategy 2: Research necessary systems integration requirements for web based registration and enrollment

- Strategy 3: Hire outside consultants to develop software for web based registration and enrollment

- Strategy 4: Faculty will develop online testing software for delivery of examinations

- Strategy 5: Faculty and staff will develop a tracking system

- Strategy 6: Faculty and staff will develop an integrated online learning community

- Measure: A complete web application product will be ready for deployment on 7/28/03

Objective 21: To Develop a Classroom Facility Capable
of Providing Instruction in Information Technology Programs
Before Courses Begin in 2003/2004.

- Title: Classroom Facility

- Strategy 1: A physical plan for classroom facility
  will be developed

- Strategy 2: Research the technology requirements of
  the new facility

- Measure: A plan for the classroom facility will be
  ready for approval on 4/5/02

Objective 22: To Develop a Video System that will be
Used to Deliver Lectures and Panel Discussions Online.

- Title: Video

- Strategy 1: Research the video system requirements for
  delivering streaming and on demand video

- Measure: A video system will be recommended for
  purchase on 4/8/02

Objective 23: To Develop an Audio System that will be Used to Deliver Lectures and Panel Discussions Online.

- Title: Audio

- Strategy 1: Research the audio system requirements for delivering streaming and on demand video

- Measure: An audio system will be recommended for purchase on 4/12/02

Objective 24: To Provide a Detailed Budget that Identifies Initial Equipment Costs, Software Licensing, Staffing, Maintenance and Upgrades Before the End of the 2001/2002 School Year.

- Title: Budget

- Strategy 1: Develop an initial rollout budget

- Strategy 2: Develop an annual maintenance budget

- Measure: A budget will be provided on 4/12/02

Limitations and Delimitations

The focus of this report is to provide a detailed plan for integrating distance learning technologies with traditional classroom instruction. This has been accomplished by creating an instructional model for

curriculum development and a plan for integrating required technologies. This model was then applied to the Information Technology program at Mt. San Jacinto College. The intention of this effort is to propose a unique method for positioning the college as a principal in the economic and workforce development of the region. By implementing such a strategy the college will be able to answer the needs of employers, students, and businesses in the area, which is for flexible, affordable, and current training.

Limitations

One of the major issues encountered in this proposal was the lack of evidence supporting training demands in the regions supported by Mt. San Jacinto College. This is a particular area that this project does not address, which exposes a considerable issue. A question still remains as to the efficacy of providing the specific certification programs mentioned in the project proposal. A better approach would be to perform an extensive market research and survey that identifies the key areas of training skill sets required by employers. This would provide an essential starting point for determining successful programs to run in Information Technology. Unfortunately, time and resource constraints made this task impossible.

A second flaw in the design of this project, which is related to the first, is the need for participation from local community sponsors. This would be essential for actual proposal implementation for several reasons. First, community sponsors could provide and excellent source for funding, marketing, and staffing. Second, establishing community sponsorship would guarantee the success of the program as a key player in the economic development of the region.

A third area that was not addressed in this proposal was that of job placement, an important objective from the perspective of students and employers. The proposal uses the potential of employability of industry certification. A better approach would be to establish an internship program, and develop skill sets based on the employer requirements. With this approach employers would be more likely to employ students from the program. As mentioned in Husing's (1998) report, a key element to economic success of this region is the development of an Information Technology talent pool from which employers can hire. As already stated, time and resource constraints made this difficult.

Delimitations

Due to the implications stated in the limitations, this project was deliberately narrowed down in order to produce a complete product. Although potentially this project could be applied to various distance learning technologies at multiple different types of institutions it was decided to focus on specific technologies ready for implementation at Mt. San Jacinto College. These technologies primary included video technology, due to the fact that this is the most expensive and difficult to implement. In addition, this project was narrowed to focus specifically on the Information Technology courses in the Computer Information Science department at Mt. San Jacinto College.

Assumptions

The following assumptions apply for this project:

- Working adults would prefer or even desire to take courses in a distance learning format.
- Employers view vendor certification programs as a valuable qualification for employment.

- Distance learning courses provide a format that will help more students take classes and more effectively be prepared for employment.

- Distance learning is an effective means of education.

- Employers in southwest Riverside County need employees with skills in Information Technology.

- Local businesses are seeking for new ways to obtain Information Technology training.

- The proliferation and availability of high speed Internet access will continue to increase.

- Students learn technology related material through a combination of hands on training and classroom style lectures.

- There will be adequate funding for this project

Definitions of Terms

The following terms are defined as they apply to the project:

- Information Technology (IT)

  Information technology is a term that describes a wide range of technologies. These technologies generally deal with communication, networking, and software.

- Streaming Video

  Video that is delivered over the Internet through a
  constant high-speed connection. This requires special
  software at both ends of the video delivery process.

- On Demand Video

  Video that is stored or archived so that students can
  retrieve the video at any time. This would require a
  specific type of video player on the students'
  computer.

- Vendor Certification

  A program that a corporation has implemented as a
  method to verify knowledge and skills using the
  corporations' products. Many employers consider vendor
  certification to be a benchmark for success.

- Technology Infrastructure

  All of the equipment required for getting a specific
  type of technology to work.

- Microsoft

  A software company.

- Cisco

  A company that produces networking equipment.

- IETF (Internet Engineering Task Force)

  An organization that establishes rules and regulations
  that governs the protocols that are used on the
  Internet.

- MBONE

  A technology that allows the Internet to deliver live
  content through multicast technologies

- ATM

  A high-speed technology used as the backbone for
  multimedia applications and on the worldwide Internet.

- Gigabit Ethernet

  A high-speed technology typically used as a backbone
  for multimedia applications

- Codecs

  A term referring to the compression of video.

- MPEG

  A type of video compression.

- Real Networks

  A company that produces video and audio software for
  the Internet.

- Unicast

  A method of delivering data on a network. Unicasts are always between two machines.

- Multicast

  A method of delivering data on a network. Mulitcasts are between one machine and several others at the same time.

- LAN (Local Area Network)

  A high-speed architecture for network communication between personal computers

- WANs

  A technology for interconnecting LANs

- ALNs (Asynchronous Learning Networks)

  A distance learning terminology for communicating between people at different times and places.

- MUDs

  A role playing game played on the Internet.

- Prometric

  A company that offers certification testing for vendors.

- VUE

  A company that offers certification testing for vendors.

- Beta

  A term used frequently for testing. Used in the computer industry.

- Carnegie Unit

  A method of referring to a unit of instruction. One Carnegie unit is equivalent to 16 hours.

- Computer Adaptive Testing

  A testing process that uses computer based testing and a special algorithm for determining the level of a student's knowledge.

- VPN (virtual private network)

  A lower cost alternative to providing remote access over the Internet.

- Contract Education

  An educational agreement between a college and a local business.

- 3-tier Technology

  A term that refers to the Application, Business, and Data layers of software development.

- Compaq

  A company that sells computer equipment.

- DISA (Distributed Internet Architecture)

  Architecture designed for Microsoft Server products.

- Communication Racks

  Standard shelves that hold computer equipment and
  wiring.

- Switches

  Special devices used in LANs to enable communication.

- Routers

  Devices that connect networks together.

- Layer Three

  Refers to the Network Layer of the OSI model. A Layer
  Three device is capable of routing.

- UNIX

  A server operating system.

- LINUX

  A server operating system.

- Novell

  A company that sells networking software.

- RAID (Redundant Array of Inexpensive Disks)

  A method of combining multiple disks together to

  increase storage capability and protect data.

- Terminal Server

  A special server that allows users to run sessions. A

  terminal server allows users to run applications and

  software from a remote location.

- CITRIX

  A company that sells terminal server software.

- KVM (Keyboard, Video, Mouse)

  A method to combine all three device signals onto one

  channel. Used to remote control computers.

- Symantec

  A software company

- Sony

  A company that produces small electronics

- GB

  Gigabyte. One gigabyte is equivalent of 1024 MB.

- MB

  Megabyte. One megabyte is the equivalent of 1024 KB.

- T3

  A T3 connection is a communication circuit established

by a telephone company to an Internet Service
Provider. A T3 is capable of bandwidths of up to
45Mbps.

- Shure

  A company that sells audio equipment.

- Certification Track

  A program of study. A certification track is the
  series of units requires ot complete a program.

- Program of Study

  A certification track. A certification track is the
  series of units required to complete a program.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The Need for a Practical
Approach

Current literature in education does not lack in

research dealing with the nature and feasibility of

distance education programs. However there is a definite

lack of emphasis on practical application. A faculty member

or local administrator at a higher education institution

would have difficult time finding relevant material in

developing a distance education program. Galassi, White,

Vesilind, and Bryan (2001) note that:

> Two long-standing criticisms of educational
>
> research as conducted by university researchers
>
> over the years have been that it is not relevant
>
> to practice and that it is not accessible to
>
> practitioners.(p. 75)

This research focused on the curriculum demands of

professional development schools, however, the application

to career education programs is not difficult. Galassi et

al. emphasize that in professional development schools

research is successful when applied by teachers and

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educational researchers focusing on school based questions. As this research indicates there is a need for educational research that provides recommendations, models, and implementations techniques for important questions regarding the successful implementation of distance learning.

<div align="center">

Workforce Development and
Industry Certification at
Community Colleges
</div>

Another area that the literature in the educational field does not specifically address is the application of specific vendor certification programs in higher education. However, there is a great deal of attention directed toward the recent rise of vocational education and corporate involvement in providing curriculum support, funding, and technology. A majority of the research studies that have been published focus on the area of vocational education, which seems developing a more specific career centered focus (Nesbit, 1999, p. 266). Other terminology that seems to address concerns in the technical training and certification arena is termed as customized or contract training. This type of training deals primarily with community colleges attempts to hold private noncredit

training courses aimed at meeting the specific demands of a business or businesses. Although, this focus is in a non-credit format the research that has been done can be helpful in determining the course of action in implementation in a credit program at a college that has a similar emphasis. Several other areas that have produced research helpful to this study are in the areas of tech-prep, school to career, and adult education efforts.

Studies on partnership programming indicates that the success and vitality of a training program is linked directly with the need to establish key partnerships. Sorgunro (2000) argues:

> Evidence abounds that programming partnership engenders a vision for successful training programs. It is a powerful tool for survival that could serve the test of time. Therefore, as educators, extensionists, researchers, trainers, programmers, or experts, we must strive to be pro-active partners in development. (p. 54)

In each of these vocational efforts there is an understated phenomena that many community college districts are relying on vendor specific or industry driven certification programs to satisfy their tech-prep or

school-to-career initiatives. The following sections focus

on the major issues in each of these vocational efforts.

Business Schools

A great deal of research has been dedicated to the

efforts of many community colleges in implementing   .

curricula that emphasizes a hands on or real-world

approach. The conclusion of this research is that this type

of learning engages the student and better prepares them

for the immediate working world. Many of these studies use

practical math skills as an example of how mathematical

concepts applied to a real scenario produces positive

results. In a study by Pharr, Morris, Stover, Byers, and

Reyes (1998), about the integration of business principles

in core curriculum, the conclusion is reached that even

though organizations are employing techniques to respond to

a rapidly changing environment, "most undergraduate

business programs continue to follow a pedagogical model

adopted several decades ago" (p. 166). This certainly

applies to corporate involvement with technical training

programs. Private organizations are realizing a failure of

modern education to prepare an adequate hiring pool so

their efforts have turned to providing assistance in this

effort. Pharr et al. confirms that, "businesses require

students with skills and abilities suited to the current business environment" (p. 167).

In a study on inequality in classrooms, Maxwell (2000) discusses the increasing disparity being created by technology in U.S Schools. However, if technology is implemented with the disadvantaged population in mind then correct solutions can be found. Among these solutions is to establish successful relationships with local business. In the research, Maxwell indicates that partnering with corporations and local business can provide significant benefits for schools. These benefits include funding and equipment (p. 52). This study, as many others, conclude that business schools, especially, must alter educational practice to reflect changes in industry. Further evidence of this growing concern can be noted in the recent rise of charter schools and vouchers that represent a growing dissatisfaction with education preparing individuals for the workforce.

Adult Education

Although applicable primarily to business schools, community college education seems to be assuming this role of second chance or adult education and providing the focus mentioned in the research by Pharr et al. (1998). Many

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educators in the adult education field have began to

realize the growing importance of providing secondary

education to individuals seeking either to switch careers

or update their current training. Nesbit (1999), from the

Centre for Labor Studies argues:

> One major trend underscores this crucial and
>
> developing role for adult education: the
>
> recognition that education for young people alone
>
> is not enough to prepare them to meet adequately
>
> the challenges of the new century. (p. 266)

Nesbit (1999) reinforces the idea that education is

becoming a life long pursuit, coupled with the increasing

need for human resource training. Of particular importance

are the factors that Nesbit, lists as being challenges to

adult education. First, is that "training of adult

educators has become both more systematic and complex" (p.

267). Increasingly, adult educators are being required to

obtain credentials or certifications to qualify as

professionals. Education needs to recognize this paramount

need in adult education programs. Although not clearly

specified in the research by Nesbit, this concept directly

applies to community and technical colleges that seek to

provide adults with professional training and

certification. Often times the certifying agency demands

that the instructor qualifies by being certified in what is

being taught. Second, Nesbit claims that the field of adult

education is coming under a great deal of scrutiny as

evidenced by the review of several recent works on adult

education. Underlying this research is an inherent goal

that adult education should be the equal participation of

individuals if society is going to meet new challenges

(Nesbit, p. 267).

Vocational Education

The challenges of providing relevant education in

community colleges are at the forefront of research at the

National Center for Research in Vocational Education.

Grubb, W. N., director for the center has been involved in

numerous studies that have indicated significant challenges

to implementing relevant career education in our community

colleges. As presented at the League for Innovation in the

Community College, Grubb, Badway, Bell, Bragg, and Russman

(1998) discuss issues related to the development of the

entrepreneurial college. Their work serves as a review of

the current issues surrounding the focus of community

colleges attempts to integrate into their curricula an

emphasis on workforce and economic development. The

research by Grubb et al. clearly defines workforce development as a form of education that "provides training for employees of particular firms" (p. v). Economic development is referred to an emphasis "in which colleges act in various ways (other than providing courses) to stabilize or increase employment in their communities" (p. v). Grubb et al. defines the term entrepreneurial college as a:

> . . . term designed to capture its
> entrepreneurial spirit, market-oriented drive,
> and responsiveness to external organizations. (p.
> vi)

As an example, the study presents a college that emphasizes workforce development and occupational goals of local business over that of the traditional academic or transfer goals of what is termed a "regular college" (p. v).

Significant to this research by Grubb et al. (1998) was the use of seven community colleges that emphasized technical curriculum and created an advisory board in which questions and interviews could be garnered. This study required the interview of several key participants including educators, coordinators, and deliverers of the

instruction. Noteworthy was the ability for the researchers to gain valuable insights to the challenges of implementing vocational education programs, but more importantly the ingredients required for successful implementation. Grubb et al. mentions in the executive summary:

> Among influences within the colleges, the most important have been the relative emphasis of colleges on occupational rather than academic or transfer missions; the aggressiveness of administrators; the presence of faculty with connections to employers; the stability of support for entrepreneurial activities; the effects of faculty senates and unions on the rigidity of the regular college (which has sometimes forced colleges to undertake new activities outside the regular college); and demographic factors. (p. vi)

The research by Grubb et al. (1998) was also able to determine causal factors such as trustee members having close ties with local businesses, legal requirements of governing bodies, and aggressive funding supporting workforce development. This study emphasizes the need for "careful assessment of community needs and strategic

planning" (p. vi). The conclusions from this study emphasize barriers to implementation as well as successful techniques to overcoming those barriers. The findings are summarized in the following key points:

Entrepreneurial Colleges Can Offer a Great Potential for Serving the Unmet Needs of a Particular Community. In light of most community college goals as outlined by state laws and requirements, the emphasis on integrating a business emphasis cannot only improve the education for students, but the economic and workforce development goals of the college.

Regular and Entrepreneurial College Must be Integrated. Grubb et al. (1998) conclude with several key considerations when integrating these vocational efforts with traditional credit programs:

> Several mechanisms can enhance the connection
> between the traditional and emerging college
> programs, including sharing faculties;
> eliminating the differential funding between
> credit and noncredit courses; creating joint
> student services, joint advisory committees, and
> joint instructional centers to improve the

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quality of teaching; and integrating their

administration and physical locations. (p. vii)

Grubb et al. also conclude that integrating credit and

non-credit efforts could also work to "share the costs of

expensive equipment and facilities" (p. 48).

Funding Practices Need to be Changed. Grubb et al.

(1998) also warn against funding only programs that draw

more apportionment:

> States wishing to support the entrepreneurial
>
> college need to reconsider their funding and
>
> regulatory policies, since these have powerful
>
> effects on the entrepreneurial college. (p. 49)

Colleges Must Engage in Appropriate and Adequate

Planning Procedures. Even from the most sophisticated

colleges interviewed, Grubb et al. (1998) determined that:

> Such basic issues as the magnitude of the
>
> entrepreneurial college, its effects on
>
> employment and business productivity, the quality
>
> of instruction in nontraditional settings, and
>
> the most appropriate mechanisms of planning and
>
> evaluation for entrepreneurial activities have
>
> received almost no attention. Research in these
>
> areas is needed to help colleges and state policy

makers improve the effectiveness of the

entrepreneurial college. (p. vii)

Grubb et al. (1998) indicate that a key ingredient to

success is the development of careful planning processes to

decide what educational activities to pursue. Also

emphasized was the need to conduct frequent environmental

scans and do market research to determine the direction of

labor force and community needs and then decide how to fill

those needs. However, the research seemed to indicate more

than just meeting the needs of the community:

> Often, the college creates a demand for services
>
> rather than simply responding to the needs of
>
> students, employers, and community groups. In
>
> some cases, these new roles have been performed
>
> within the traditional credit structure of the
>
> college. In other cases, new functions have
>
> created a separate entity within the college,
>
> operating within a new culture and new rules and
>
> regulations-an institution sometimes referred to
>
> as the "shadow college," because its activities
>
> have not always been recognized when citizens
>
> think of the community college, and because it

has been in the shadow of more conventional

programs. (p. ix)

Implementing Creative Use of College Faculty. One of

the biggest issues is providing an adequate salary scale

for non-credit courses and part-time faculty. By being

flexible and integrating the colleges credit and non-credit

efforts compromises can be reached that benefit the faculty

and the development process. Grubb et al. (1998) discuss

the concept of faculty recruiting:

> Faculty recruiting methods can also contribute to
>
> bridging the regular and entrepreneurial college.
>
> Individuals who have come from business and
>
> industry-as most occupational instructors have-
>
> and who have maintained their contact with the
>
> field, are more likely to participate in
>
> workforce development.(p. 45)

One college interviewed by Grubb et al. (1998)

proposed an option where faculty members are:

> . . . responsible for a 40-hour work week rather
>
> than a fixed number of courses. Within this time
>
> commitment, faculty can allocate their time more
>
> flexibly and carry out a range of tasks that are
>
> typically not a specific part of their current

job descriptions, maintaining relationships with

employers, for example, or counseling students,

or doing placement (p. 47).

Eliminating the Credit / Noncredit Differential. Due

in large part to funding issues or faculty member, the

difference between credit and noncredit programs should be

erased both physically and within the management of the

college.

Educating Community Leaders. A big concern about

efforts to focus on the more entrepreneurial goals of a

college is to reconcile the public's impression of the

people's college with that of workforce development and

economic partnership.

Significant State Policies that Effect Community

College Integration. Colleges are often required to

implement programs that help disadvantaged or welfare

students get back into the labor force. Funding issues are

sometimes tied directly to these issues. As a solution,

Grubb et al. (1998) offers:

Develop programs moving nontraditional students,

including job training and welfare clients, into

employment with companies that are committed to

continued training, so that the community college

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could complete through customized training what

they start in the regular college.(p. 47)

Career Education

As indicated by Grubb et al. (1998) the community

colleges have an increasing role in workforce development

and career preparation. Research in vocational education

indicates the increasing need for guidelines for colleges

attempting to make this transition into what Grubb et al.

terms a entrepreneurial college. Other research proposed by

the National Center for Research in Vocational Education

focuses on the role of the college in career education. One

study provides a tool that can be used by colleges in this

attempt, *A Sourcebook for Reshaping the Community College:*
Curriculum Integration and the Multiple Domains of Career
Preparation. In this research, Badway and Grubb (1997),

provide an illustration of several case studies that offer

conclusions as to a framework for offering career

preparation courses. Defined in this research are several

areas of competency:

> Foundation academic competencies - reading,
>
> writing, calculation, and science competencies
>
> learned in the way in which they are applied in
>
> everyday practice.

Education for citizenship education – the

economic, political, and social aspects of work

Job specific/technical skills – the technical and

production skills required for a particular

occupation.

Career exploration – the match between self-

knowledge and labor markets.

Systems utilization skills – understanding

the big picture of how diverse personnel, time,

capital, material, and facilities interact to

shape an organization's performance.

Generic technical skills – tools for

designing and analyzing organizational systems,

including software applications, recordkeeping

procedures, interpretation of visual data

representations, quality assurance techniques,

and occupational and public safety standards.

Workplace organizational experience – the

commonalties between all other domains and an

actual work setting. (p. iv)

The research conducted by Badway and Grubb (1997)

gathered specific examples from several institutions and

compiled them under section headers that emphasized each of

these domains. Particularly helpful is the discussion on job specific technical skills. An attractive option, when relating to the difficulties in obtaining these areas, is using developed curricula by vendor programs that have prepared sequencing, curriculum, job placement activities, and a cohesion that sometimes college programs lack. On the subject of helping students determine an appropriate career path Badway and Grubb (1997) conclude:

> Career exploration is the least frequent domain formally addressed by community colleges, a particular worrisome finding since many students use the college to experiment with the options available to them, "milling around" in unfocused courses of study until they find an area of interest that matches their personal attributes. Colleges have been slow to publish retention, graduation, and placement outcomes for each course of study so that students can understand the employment outcomes they might expect from a certificate or degree; we found only one college that did so. (p. v)

This is what makes industry sponsored certificate programs so attractive in Information Technology and

related fields. Students often enter a program fully aware

of the demand for jobs and success of others in obtaining

their certificates. As employers begin to rely on vendor

programs as a bench mark for effectiveness the role of

academic institutions providing this type of curricula will

be necessary. The main value of research in the career

education field is the emphasis on what colleges have found

as successful for workforce development reform. Hansen

(1993) emphasizes that community colleges are:

> The one educational institution simultaneously
>
> providing initial preparation for work, upgrade
>
> training to those needing additional skills,
>
> retraining for displaced workers and others who
>
> want to change careers, and second -chance
>
> training for individuals who need some
>
> combination of basic (or remedial) academic
>
> education an technical skills. (p. 1).

Tech-Prep

A logical extension of the need to help students

determine an appropriate career path or helping adults

determine their career options is the recent emphasis on

tech-prep initiatives throughout the country. Tech-prep

seeks to help establish a clear path for students in high

school programs to transfer to college and eventually to valuable employment. Many technical certification programs being offered by a variety of vendors including 3Com and Cisco Systems offer some two plus two format attractive to community college tech-prep programs.

Another study by Grubb (1996), *Community College Innovations in the Workforce Preparation: Curriculum Integration and Tech-Prep,* offers valuable insight into the course development process of tech-prep programs. Using a qualitative method and a program evaluation of several institutions, Grubb concludes there are two major issues that concern the issues surrounding tech-prep initiatives.

Integrating Academic and Occupational Education. A real value to any tech-prep program is an instructor with an occupational background. As Grubb (1996) concludes, these instructors "infuse some academic content into an existing occupational course, often quickly and informally" (p. vi). In addition to finding experienced educators this study indicates several techniques for implementing career-focused curriculum. These include the writing across the curriculum technique, development of applied academics courses, multidisciplinary courses applied to technical developments, emphasizing the nature of work and other

employment related issues, and using clustered courses or learning communities (p. vi).

Linking Community Colleges With High School Programs. Grubb (1996) indicates that often times high schools are willing to participate in programs but college faculty that are entrenched in old pedagogy struggle. Grubb offers analysis that can prove to be helpful in determining a solution:

> The willingness of faculty to make changes in pedagogical methods developed long ago, and honored by years of experience, may be considerably limited unless adequate time, monetary incentives, and essential staff development are made available. (p. 21)

Grubb (1996) concludes by offering several factors that limit change in community colleges. These can be applied to many vocational programs, not just tech-prep initiatives. These factors are in summary:

> Resistance of faculty to change curriculum
>
> Faculty members are not supported with release time or adequate compensation
>
> Uneven support of administrators

Lack of funding from the institution other than
grant initiatives

Inability to track and define students (primarily
because the information systems necessary to
track the students are not yet in place)

Lack of counseling and specific definition of
programs such as tech-prep. (p. 21)

In addition to these factors, Grubb (1996) suggests
several requirements for future success of tech-prep
programs in community colleges. These suggestions include
changing the culture, having an institutional commitment,
and having stability in administrative leadership.
Important are the general conclusions that about how these
changes must be implemented:

Extended beyond the smaller numbers of trail-
blazing teachers, coordinators, district
administrators, volunteers, and enthusiasts who
have participated in the initial stages. In turn,
this will require stability in both the funding
and the climate of reform that has led to these
reforms. Administrative leadership is a final
requirement, since few changes can be carried out
by individual faculty; only administrators can

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provide the coordination among faculty and the
institutional commitment necessary for these
reforms. But the rewards can be substantial in
helping community colleges fulfill their promise
as innovative, teaching-oriented, learning
centered, nontraditional institutions responding
to their multiple missions with flexibility and
foresight. (p. vii)

School-to-Work

Natural extensions of the tech-prep initiatives are
the many reform proposals being termed frequently as
school-to-work. Many of the same conclusions reached in the
tech-prep research parallel that of issues dealt with when
attempting to implement school-to-work programs. Rogers
(1995), from the National Institute for Work and Learning,
delivered a research paper entitled *Learning from
Experience: A Cross-Case Comparison of School-To-Work
Transition Reform Initiatives to the Academy for
Educational Development*. This research used a method that
first determined criteria elements for successful programs
and then compared several institutions that implemented
those criteria. The elements used in the research were:

Leadership from executives of educational systems

Leadership from program deliverers

Professional development for teachers and other
staff

Cross-sector collaboration

Student self-determination

School-based curriculum and instruction

Work-based learning strategies

Integrated career information and guidance system

Progressive system that starts before grade
eleven

Articulation with postsecondary institutions

Creative financing

Application of research. (Rogers, 1995, p. 2)

Many of the conclusions reached by Rogers (1995) apply
directly to concerns with implementing Information
Technology training at community colleges. Several of the
areas, such a professional development for faculty, suggest
that the current methods used at colleges will not suffice
for the increasing technological demands of the present.

An Analysis of the Community
College Role in the
Information Technology Labor
Shortage

One of the greatest demands of this technological age

is providing employers with a qualified labor force. Many

businesses are beginning to discover the lack of skills

being provided for individuals leaving public education

institutions. This shortage, termed the Information

Technology labor shortage, is an indicator of the

increasing demand for community colleges to provide

relevant industry training for individuals. Mitchell,

Carnes, and Mandosa (1998), in a report for the Office of

Technology Policy, indicate that the:

> United States has much at stake in ensuring an
>
> adequate supply of Information Technology
>
> workers; severe shortages would compromise
>
> organizational productivity and the Nation's
>
> ability to develop leading-edge products and
>
> services, as well as the growth and global
>
> competitiveness of important U.S. industries. (p.
>
> 3)

The research by Mitchell et al. (1998) into the

Information Technology labor shortage compiled statistics

from recent Department of Labor surveys of employers to

determine the scope of this challenging problem. This study

also indicates that the required number of positions per

year of computer scientists far exceeds the number being

graduated by current four-year Universities (p. 2). In

response, Mitchell et al. indicates efforts by community

colleges as a primarily vehicle for meeting the demand of

this shortage. This includes two-year associate degree

patterns "which provide grounding in applications as well

as basic theory, and vocational technical education

programs" (p. 16). The research by Mitchell et al. (1998)

documents:

> Special university / community college one-year
>
> programs designed to upgrade the skills of
>
> Information Technology workers already in the
>
> workforce (new applications) or those with
>
> background in other technical fields who are
>
> looking for a fast track entry into the
>
> Information Technology profession. (p. 16)

Important to note is the research that indicates

factors that affect the supply of technology workers and

the response by industry. Maxwell (2000) indicates that many local businesses seek to sponsor school programs specifically to prepare a future Information Technology workforce. There needs to be, as the research concludes, more partnerships between academia and the Information Technology industry.

The need for providing a solution for this labor shortage and the traditional role of the community college demands an emphasis on career education. With funding issues and strains on faculty members, industry partnerships should be a welcome solution. There is certainly a demand for research in this area and the development of a framework that can be used by college administrators when attempting to integrate Information Technology training and vendor certification programs. Overall, the research that has been done on vocational and career education does not address the recent rise in industry marketing community colleges to deliver vendor specific certification programs. The literature that does exist are mainly commentaries that express fears that too much corporate involvement will result in a reduction of the overall quality of education at the two year level. However, there is a significant need to address the

continuing efforts of companies like Microsoft, Novell,

Cisco, and 3Com to market educational programs to community

colleges and high school districts.

The Use of Video in Distance Education

Emphasis in distance education, particularly in

synchronous online education emphasizes the need for live

interactive content. Included in this literature review is

an analysis of the issues between interactive and informal

video and videoconference systems that are used for more

formal and non-interactive video. The literature available

on this subject suggests some inter-disciplinary theories

that emphasize possible solutions to the perceived problems

discussed in the following sections on interactive and non-

interactive video. In addition, the last section will

conclude with unresolved issues that relate to using video

as an educational tool.

Interactive Video

Most of the literature on the subject of using video

in education focuses on the need to replicate the live

interactivity of the classroom environment. This places

demands on the delivery of instruction and the technologies

that make that possible. Patrick (1998) explains that the interactive forms of video use are "often personal, oral, brief, and spontaneous" (p. 18). Video sessions with this type of characteristic influence classroom management in interesting and challenging ways. For example, Patrick describes:

> One technique for improving interactivity was to have a student facilitator at each remote site who was familiar with the equipment encourage and assist the students to be interactive. (p. 18)

Other literature supports the emphasis of changing classroom management techniques. To emphasize the same example that Patrick (1998) used, Mazur (2000) noted in an observation of an instructor who had demonstrated successful interactive video:

> . . . the requirement of student participation and responsibility for operating the communication tools engages the remote locations and enlists their assistance in creating communication and contact as a collaborative effort. (p. 7)

Even with the use of expensive video conferencing software many researchers have discussed the questions of

whether or not distance learning can provide adequate

levels of interactivity. Although several studies cast

serious doubts on interactivity levels for distance

education, Roblyer and Ekhaml (2000) emphasize that the

lack of interactivity is based on student perceptions and

not on reality. As Roblyer and Ekhaml discover in their

review of pertinent studies:

> With proper instructional design, distance
>
> courses can actually be more interactive than
>
> traditional ones, providing more personal and
>
> timely feedback to meet students' needs than is
>
> possible in large, face-to-face courses. (p. 1)

Roblyer and Ekhaml (2000) also realize the necessity

to raise student perception and provide criteria for

evaluating the interactivity levels. They offer a rubric

that when applied can help test interactive qualities of

distance education. Interesting to note is that in order

for a distance education course to score at the highest

levels in the rubric it is necessary to employ the use of

interactive video. The following is an excerpt from the

highest level of the third element of the rubric:

> In addition to technologies to allow two-way
>
> exchanges of text information, visual

technologies such as two-way video or

videoconferencing technologies allow synchronous

voice & visual communications between instructor

and students and among students. (p. 3)

Educational concepts, such as Roblyer & Ekhaml's

(2000) rubric, continuously emphasize the need for two-way

interactive video in distance education. However, the

literature seems to lack real solutions to many of the

problems that have risen in recent years as institutions

have tried to implement these costly solutions. Mazur

(2000) emphasizes in a review of some recent studies,

"despite the proliferation of distributed, interactive

video systems for instruction, students consistently

complain about the qualitative experience in their courses"

(p. 2). In addition, Mazur defines several boundaries to

effective use of this technology centering on instructor

experience and skill level.

One major problem emphasized in the literature was the

reluctance of learners' to engage the instructor with

questions during an interactive session. Although many

researchers have noted that this is usually faulted to the

methodology employed by the instructor or a limitation of

the technology being used. Mazur (2000), emphasizes in an

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analysis of an instructor, each student must be encouraged

to interrupt the instructor whether in the instructor's

presence or across a video link. This way there is no

difference in responses between local students raising

hands and remote student interrupting. This impacts the

typical classroom Socratic method of teaching and requires

instructors to become familiar enough with the technology

to become effective classroom managers. Mazur even suggests

that in the modern video age that instructors should be

more willing to allow other staff to be responsible for

classroom management, and relieve the instructor of the

potential burden inherent in learning new modalities.

   With the advent of the Internet, conceptual visions of

how instruction is delivered are changing. Interestingly

enough, researchers in distance education strategies are

not limited to live video but rather virtual environments.

As technology improves and concerns grow over issues that

affect the classroom such as racial issues, the thought of

two dimensional environments are gaining momentum.

Originally spawned from Internet games such as graphical

Multi-User Dungeons (MUDs), the virtual reality cyber space

is starting to be experimented on in the classroom.

Duplicating the classroom is not the only idea either, some

educational theorists have described meeting in exchanges

that duplicate a real environment that would be to costly

or even to dangerous to have students there in real life.

Communications scholars, Krikorian, Lee and Chock (2000)

provide research on communication issues in a 2-D

environment. These authors make the point that:

> . . .spatial orientation can no longer be
> ignored; it has come of age. Virtual environments
> reflect a new medium of online communication
> because they offer a new channel of nonverbal
> communication, that of spatial distance. (p. 3)

This is echoed in research by Patrick (1998) who

affirms that virtual environments will be the solution to

high bandwidth interaction sought after in today's video

conferencing software.

One of the issues preventing the widespread use of new

technologies, like the virtual reality or interactive video

is the lack of commercially available software. Many

researchers have provided analysis of some of the packages

currently available. Among them, Patrick (1998),

categorizes most software that duplicates video

conferencing over the Internet into tools that offer voice,

video, and a shared workspace such as a white board. The

discussion in this review focuses on the modality and delivery of these systems.

The most common method for delivering an interactive video session is using a video conferencing system over a circuit-based connection or a packet-based connection. The latter offers the biggest break on price and ease of use and therefore is the most attractive to developers. However, closed-circuit video conferencing systems with dedicated high-speed bandwidth are still popular on many campuses today (Patrick, 1998).

The use of video in education has developed along with the telecommunication industry's use of video conferencing hardware and software. Many schools and businesses have rooms dedicated to the use of expensive and difficult to use video conferencing systems. These schools are becoming more prepared to take advantage of new technologies on the horizon such as the Internet multicast backbone (Mbone). As Patrick (1998) emphasizes:

> . . . by examining how videoconferencing systems
> are used and not used, and how the technology
> impacts the people who use it, we can learn
> valuable lessons that may help to make the Mbone
> more useful and valuable. (p. 2)

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Non-Interactive Video

As Patrick (1998) describes a large majority of video conferencing systems have either "by design or by usage" (p. 18), become nothing more than non-interactive broadcasting systems. As systems become more expensive, it becomes increasingly important to determine the level of interactivity that is required. The literature indicates that there are clear differences in the requirements for interactive and non-interactive video sessions (Patrick, 1998). For example, delay in either voice or video tends to be intolerable for users in an interactive environment, however, in a broadcast or non-interactive mode the delay may be acceptable within limits. Recently, software companies such as Cisco Systems (formerly Precept Software) and ICAST have developed Internet based video conferencing systems with the concept of removing interaction completely, and thus, improving the efficacy of their products.

In a white paper titled *A Distributed Video Server Architecture for Flexible Enterprise-wide Video Delivery* (1998), Cisco Systems offers detail on a recent product called IPTV. In this document, Cisco explores the key differences with this approach with that of extensive

systems offered by Oracle and Silicon Graphics with that of

popular web video products being provided in Microsoft's

Netshow and Real Networks' RealVideo. According to Cisco,

this product utilizes multicasting techniques so that,

"commonly-requested content is replicated and dispatched to

local workgroup servers… this localizes network bandwidth

consumption-minimizing the amount of video traffic" (p. 2).

The requirements of interactive sessions, when

evaluated based on participants, is more demanding than

more formal non-interactive settings. Patrick (1998)

describes these formal sessions as having, "a fixed agenda

and specific roles for participants, while informal

sessions are more free form and personal" (p. 18). Meetings

that are organized with agendas, speaking impromptu and

asking questions tend to require different methodologies

and different technologies.

Video Conferencing software that takes advantage of

Internet technologies currently utilizes either broadcast

or multicast technologies. Broadcast technologies are used

primarily on Local Area Networks (LANs). Unicast

technologies found in popular software programs such as

Real Audio and Real Video, and Pointcast use unicast

technology. Unicast sends directed packets of information

directly to clients, which can be extremely bandwidth

intensive do to the redundancy in data transmission. Recent

developments in multicast technologies may prove to be more

effective because data transmission is sent to groups of

users rather then being unicast (Patrick, 1998). However,

implementing multicast technologies on the Internet has

proven to be difficult. Multicast technology requires

specific hardware support from Internet devices such as

routers and switches. In addition network providers need

incentive to provide the infrastructure support required to

carry multicast technology. Currently, the Internet

Engineering Taskforce (IETF) and other organizations have

made strong recommendation for support of such

technologies. This support is found in the development in

the next generation Internet Protocol (IP) development

called IPv6. This new protocol will include support for

multicasting and as Patrick (1998) states, "will likely be

an important component when building network applications

for the future" (p. 4).

Recent developments in Internet technologies have led

to the expectation that video streaming a conferencing

application will become more mainstream. Patrick (1998)

indicates that two of these enhancements include:

An advance in multimedia codecs that allows audio

and video to be encoded and compressed,

transferred over the Internet and uncompressed

and decoded on standard desktop computers. The

second is a new Internet technology for

transferring multimedia data efficiently. (p. 2)

The future of streaming video strategies will most

likely involve the further development of specific Internet

technologies. The Internet provides a common vehicle

utilizing standardized protocols and communication methods.

In addition, the Internet provides a method for reducing

expensive leased lines. In education circles, the Internet

provides a vehicle for reaching remote learners. Patrick

(1998) discusses the development of portion of the Internet

that utilizes a technique of distributing communication

called multicasting. This new development has been termed

Mbone. The Mbone infrastructure supports the ability to

efficiently send video, voice, and data transmissions to a

group of selected users.

The development of Mbone will be dependent on product

support and development of readily available commercial

products. Important to note is the emphasis that large

companies in the networking industry such as Microsoft and

Cisco have started to make appeals to Internet standards in the development of their products. Referencing the Cisco Systems (1998) white paper on IPTV, the new product development emphasizes industry standard technologies and interoperability with Mbone and IETF protocols.

Further industry support for standards and new product development will only increase as Internet backbone providers increase the bandwidth capabilities of their networks. In addition, recent development in Asynchronous Transfer Mode (ATM) technologies, and Gigabit Ethernet technologies has made Wide Area Network (WAN) congestion seem less daunting then yesterday.

The rate of development and use of advanced Internet technologies such as Mbone have been slow at best due to several factors. As discussed by Patrick (1998):

> There are a number of factors that are contributing to the rate that the MBone is being deployed. First, implementing the MBone is a difficult technical task that requires advanced knowledge of Internet protocols and routers. Second, support for the MBone protocols must be provided in the network itself and cannot be installed by end users. Third, the MBone

technologies have developed gradually and have been relatively unstable and unpredictable in the past, making many potential users hesitant. Fourth, the end user applications developed for the MBone are still immature and difficult to use especially in comparison to more highly developed multimedia applications. Fifth, the Internet is often congested and this leads to unacceptable audio and video quality. Sixth, there is little compelling content available on the MBone and too few people to support personal communications and too little high quality production material to support a mass audience. Seventh, the content that is available on the MBone is usually badly produced, often created by pointing a camera at the front of a classroom, making the service pale in comparison to television or films. (p. 2)

The literature on video technologies in education emphasizes the need to develop technologies and instructional methodologies for overcoming these areas discussed.

Theories Relating to the Use
of Video

Some of the more unique methods of overcoming issues
related to interactive video come from a multi-disciplinary
effort. One method discussed by Mazur (2000) is to borrow
concepts from cinematography and film in order to prescribe
solutions to the classroom environment that adopts video
instruction. Mazur (2000) argues that the use of video in
the classroom has not received satisfactory results because
education has been ignoring the sound theories that have
been develop over the years in film. Using a modification
of Bellour's model, Mazur (2000) is able determine the
sense of motion and interaction in video sequence. This
helps to cure the difficult but obvious problem of a
motionless camera resting on a lecturer. Mazur (2000)
concludes with several techniques drawn from the film
industry designed to improve the perceptions and response
of the audience. Among these include, close-ups, long shots
with pans, changing frames with zooming techniques,
juxtaposing graphics and text, rotation of multiple
cameras, and unique shots of group discussions.

Another discipline that is borrowed from frequently in
the discussion of video usage in distance education is in

communications. Krikorian, Lee and Chock (2000) for example, draw on several communication theories to discuss spatial distance. These include: uncertainty reduction theory, expectancy violations, and equilibrium theory. The interaction between participants is an important concern. From the perspective of communication scholars, this is the ingredient that turns boring still video into an interactive experience in which the learners' perceptions are won by the enriching experience.

One issue brought up by researchers, including Mazur (2000), is the issues surrounding the acceptance of instructors and students of the new technology. Not only the willingness to participate, but actually use effectively the new technology. Instructors, especially new instructors, seem to have a reluctance to introduce new technologies in their classrooms. A noted communications scholar, Rogers (1983), details several criteria that must be maintained in order to introduce a new technology or innovation to a group of people. These criteria have been labeled as the diffusion of innovations theory. As a communication theorist, Rodgers has explored these issues in relation to introducing a new product or enhancement to a consumer group or culture. This theory can be broken down

into five key elements. The first is the concept of
relative advantage. When someone is presented with a new
design or idea their first impulse is to question whether
or not the innovation is beneficial to them. The second
idea is that of compatibility. The new innovation must show
compatibility with current practices and systems. The
alternative is disposal of the current system and adopting
the foreign idea as a replacement. The third element is
that of complexity. If a new concept is to complex then
people will simply not use it. The last two stages of
diffusion theory are trial and observe ability. In order
for a group or society to implement a new technology they
must have the ability to test and observe results from the
new technology. These well-defined requirements provide an
excellent means for determining the inability of certain
educators in effectively implementing technology in their
classrooms. Adjusting Rodgers diffusion theory to apply to
education only requires some adjustment in terminology.

Unresolved Issues in Using
  Video as an Educational
  Tool

Studies have been done to determine the effectiveness
of utilizing video as a tool in education. Most of these
studies, however, emphasize the goals and objectives of

traditional classroom models. Distance education is, therefore, being compared to traditional environments based on the same assumed objective. Wegner, Holloway, and Garton (1999) indicate, in a study on a distance education course that did not use video, that distance education can sometimes have unintended enhancements. Their research "substantiated a relationship between the use of technology-based delivery systems and the cultivation of group processing skills" (p. 104). These researchers agree with the other research that there is a significant difference between students' perceived level of interaction and the actual experience. Research in education does not emphasize the impact or benefits of video on the education experience. Mazur (2000) even openly questions the possibility of benefits in net meetings, group interaction and cinematic techniques that the individual learner controls.

Another area that the current literature does not address is the impact that video could have on Asynchronous Learning Networks (ALNs). A significant amount of research has been applied to learning asynchronously rather than synchronously. However, the use of video storage and retrieval techniques could help to provide unique methods

for students to review lectures, catch up on missed material, and provide an excellent medium for future online material. The primary reason for this inattention has been expense, however, with the cost of storage dropping and bandwidth problems being resolved a solution seems eminent.

Other research in ALN environments indicates concerns in faculty workload, development, and training. Hartman, Dziuban, and Moskal (2000) in satisfaction surveys of both teachers and students in asynchronous environments found that "faculty using the ALN environment indicate that their workload increases along with the amount and quality of the interaction with and between students" (p. 23). This finding deals with web chats and online content, it can only be assumed, and there is no research to corroborate, that this would be even more significant in interactive video environments. Mazur (2000) confirms that training is necessary to improve an instructor's level of understanding and competency and, by so doing, remove some of the factors that attribute to dissatisfaction among students.

Carswell, Thomas, Petre, Price, and Richards (1999), in research involving distance education at Open University, determine that effective distance education not

only considers instructors, but students as electronic

learners. As concluded by the research:

> . . . we argue here that in order to provide an
>
> improved Internet-based system, an analysis of
>
> the system from the students perspective, is
>
> required. (p. 16)

The literature on this subject does not seem to

emphasize the technological barriers that students may have

in accessing online instruction. This is especially

important when considering interactive video sessions.

Issues of inclusion and or exclusion will undoubtedly

surface. However, with the rise in availability in high

bandwidth connections, this issue may only be temporary.

As Carswell et al. (1999) suggest, the biggest issue

with video conferencing on the web is that of bandwidth.

This is not for just video, but also sound. Most video

conferencing software packages multiplex video and sound

together in one packet stream that is sent to a receiving

device or software component that disassembles the packet

stream and represents the video and sound to the end users.

However, as Patrick (1998) explains the bandwidth demands

for video and audio can be overwhelming to the modern

Internet. For example, even with modern encoding methods

audio transmissions are typically 71 Kb/s and poor quality video over small resolution requires at least 128 Kb/s. Contrast this with slow modem speeds of only 56Kb/s and it is not difficult to understand the reluctance of providers to allow support for certain multicast technologies.

As new technologies provide solutions to bandwidth issues, the educational research is years behind the market forces that currently drive the video on demand industry. Examining industry articles provide some insight into the future of this and other emerging technologies. For example, Tristram (1998) in an article in Network Magazine defined key issues relating to use of video systems on the Internet. This article references and reviews product that have yet to be tested or discussed in education circles. An important need for research in using educational video products is an emphasis on current technology.

The technology concerns can be overwhelming, which is why many researchers shy from the daunting task of grappling complex new technologies. Most researchers today compromise by offering techniques and strategies designed to promote the use of the appropriate technology with the right level of interaction. Most of these considerations fall into the category of human interaction.

Patrick (1998) defines several human factors:

. . . involved in designing tools for remote

communications and in conduction the [video

conferencing] sessions. The tools must be

intuitive and easy to use. The communication must

be understandable and effective. The tasks being

undertaken must be completed. (p. 5)

The solutions to providing adequate interaction in

distance education in the literature are centered on live

video. The successful implementation of this technology

will only be achieved by taking into consideration both the

human factors involved and the technological advancements.

By compiling research in both of these areas, and utilizing

theories from other disciplines, solutions can be developed

that will work under today's conditions and budgets as well

as tomorrows.

Recommendations for Distance
Education Methodologies

Instructional Methods

Significant trends in Distance Education research is

extending beyond the novelty of teaching courses using

technology and begin to discover methods for delivering

effective instruction in new formats. Although, distance courses have been widely adopted by colleges and universities, not all programs have success, due in large part, to poorly developed instructional methodologies. As many researchers point out, running courses in a distance format does not free the institution from the need to deliver effective education. In a phrase, poor education in a distance learning format is still poor education. Secker (2002) provides an excellent justification for effective teaching practices in the classroom. Using a variety of instructional methods, this research emphasized the need for an alteration of instructional teaching style to produce better achievement scores in science students. However, the research does indicate that these findings may not work among all groups of students. Therefore, Secker suggests:

> Investments in classroom conditions that facilitate multimodal methods of inquiry and accommodate differences in individual learning styles and backgrounds are most likely to pay dividends in terms of academic excellence and equity. (p. 151)

The idea of providing different modes of instruction to garner student interest and to facilitate learning styles is further validated in similar studies. Jewitt, Kress, Ogborn, and Tsatsarelis (2001) focus on using other techniques of instruction and evaluation besides the traditional "classroom talk and written texts" (p. 5). They use the term multimodal to include other methods of instruction including visual and action orientated participation. Jewitt et al. concludes that offering multiple methods of instruction:

> . . . highlights the need to attend consciously to all modes of communication, both in terms of the resources available for teachers and those made available to pupils. (p. 17)

The idea of multimodal methods of instruction needs to be applied to distance learning. If distance learning becomes a major method of instruction in colleges and universities then care must be taken to ensure effective instructional design and methodologies. This includes the need to provide students with multiple methods of instruction. Another reason this is important it because educational research has shown that distance learning programs tend to be exclusionary. This is due in large part

to technology requirements and economic status. Selwyn and Gorard (2001) evaluate the assertion that technology will overcome the exclusionary nature of some educational practices. Instructors in the distance learning camps frequently argue that distance learning methods will be able to reach more people and provide education for economically disadvantaged population. This research discusses the barriers that students face when technology is used as an educational tool. The research concludes with the opposite of the expected result, in that increased use of technology in distance learning programs can lead to a greater disparity between those who can afford the technology and those who cannot.

Important to the implementation of a distance learning program is to evaluate the current research on the effectiveness of these types of programs. Modifications to instructional methodology should be made to adjust to the results from such findings. The areas listed below are several of the topics analyzed in recent literature on distance education.

Instructor Interaction

In a study of an online course using blackboard.com, Beard and Harper (2002) find that the lack of instructional

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interaction inherent to distance learning is problematic.
The findings of the study were that although many of the
students responded that they would continue to take online
courses had many complaints. Those included the "lack of
instructor interaction and the inability to interact with
other students" (p. 660). There is a need to provide a
format for instruction that gives students the opportunity
for distance learning, but also provides the required level
of interaction that the student requires.

Another paper focusing on the role of the instructor
in distance learning programs indicates that among the many
impacts of distance learning on education will be the
decrease role of the instructor. Notar, Wilson, Restauri,
and Friery (2002) discuss the change of focus that distance
learning will have on education. Education will move from
an instructor-centered environment to a learner-centered
environment. Notor et al. indicate that the primary role of
the instructor is to help the student to become an active
learner thus adopting the role of facilitator.

Office Hours

Another important consideration regarding instructor
interaction is in the approachability factor in relations
to students. Traditionally this has been in the form of

office hours and after class meetings. Denzine (2000) emphasizes that the requirement for individual access to faculty should not be disregarded. Admittedly, Denzine does not apply the findings on faculty approachability during office hours to the distance education environment. However, the findings do emphasize the need to develop unique ways to encourage faculty-student contact. Although, students' may not contact the faculty member due to behavioral issues, the research does point out the significant need to address the issue of approachability during office hours.

Examinations

One particular study by Jensen, Johnson, and Johnson (2002) emphasizes the need to focus on other areas in education besides that of instructor involvement. This was in the area of examinations. Jensen et al. determined that effective computerized quizzes delivered correctly could form the basis for motivating students to learn and participate in online programs. This research focuses on the positive impact having frequent examinations, which require the students' group effort to achieve, produce more involvement and quality participation in online courses. Important to this research was the finding about how to

offer these frequent examinations to online students.
Jensen et al. suggests the following:

>(a) a predefined list of objectives is developed,
>
>(b) the list of objectives is initially short and
>
>becomes longer and more challenging as the course
>
>progresses, (c) the importance of the grades is
>
>relatively low, (d) the assignment focuses on
>
>learning terms and procedures, (e) individual
>
>examinations are given to ensure that all group
>
>members are learning, and (f) the overall course
>
>grading is conducted under a criteria-referenced
>
>system. (p. 165)

Self-Study

Besides examinations, another inherent aspect of
distance learning is the concept of self-instruction. As
mentioned previously, as an instructor transitions from a
traditional role to that of facilitator it becomes
necessary to design efficient methods for students to
engage subject material. Bergen (2002) suggests that use of
self-instructional modules could be an alternative to
traditional methods (p. 33). In addition, Bergen concludes
that providing self-instructional modules is an alternative
strategy that college administrators could use to adapt

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curriculum to the "needs, resources, and socio-cultural

conditions" (p. 33), of distance learners.

<center>Success Factors for Learning
Environments</center>

Physical Classrooms

Although a seemingly obvious concept, one of the major

success factors attributing to learning is the physical

space that learning takes place in. Douglas and Gifford

(2001) provide insight into facility planning that takes

into considerations factors often times ignored by site

planners. Douglas and Gifford provide an interesting

perspective on developing classroom facilities. The

research finds that facility planning can take into account

both student and faculty input. Importantly, the Douglas

and Gifford find that "students and faculty prefer rooms

that have a sociopetal setting, a view to the outdoors, and

comfortable seats" (p. 308).

Web Presence

In the distance learning environment, the classroom

environment becomes the tools used to communicate. The same

considerations for facility planning should be considered,

but in a more electronic sense. For distance learners, the

usability of the online learning environment is an

important factor for success. A well developed web presence can also provide a tool for gaining public awareness and marketing the online services. Mechitov, Moshkovich, Underwood, and Taylor (2001) emphasize the importance for colleges and universities to have web interfaces that have specific information, that are helpful, and easy to use (p. 657).

Successful Distance Learning
  Programs

Understanding current educational research can help college and university administrators set realistic goals in regard to distance learning programs. Stone (2001) indicates that distance learning programs do not significantly improve enrollment numbers:

> Institutions that invest heavily in costly
> distance learning technology, with the
> expectation of recouping their costs through
> increased enrollment revenue, may want to
> reconsider their position. (p. 7)

Stone (2001) also indicates that implementing a distance learning program does not automatically mean attracting non-traditional working students into a program. Stone suggests several factors including lack of awareness,

challenges with technology, and the preference for
interaction. An important use of this research is the
suggestion to implement courses that combine the use of
distance learning and traditional learning styles thus
helping to overcome some of these barriers.

The conclusions reached by Stone (2001) also suggest
other factors that lead toward successful distance learning
programs. One suggestion is that distance learning programs
offered by local departments are more successful than
distance learning programs offered by a centralized
department. A local department is more successful due to
the ability to address specific concerns that might
otherwise prevent course from being successful. Among these
concerns, Stone emphasizes the need for addressing such
issues as:

> . . . workload issues, student contact needs,
> compensation issues, handling student
> disabilities, fairness of traditional teaching
> evaluations in a non traditional environment, and
> the disparate effect of academic major courses on
> student and organizational performance. (p. 9)

Another important area of consideration in successful
distance learning programs is the emphasis on an

appropriate audience. Waldman and Lange (2002) found that business students in a distance learning program were attracted primarily to the vocational nature of the course. For business students, this study suggests that curriculum be designed in a practical method that focuses on specific employable skills (p. 22). Waldman and Lange indicate that a significant percentage of business students in distance learning programs value the vocational nature of the course. This indicates that among students taking distance education a significant percentage of them study courses through a distance learning program for vocational reasons. It would be important then to provide more opportunities for working adults to attend vocational type courses in a non-traditional environment.

The research by Waldman and Lange (2002) also shows that among the business students surveyed more students felt that learning things relevant for work and improving promotion prospects were more important than other factors (p. 21). This would indicate that as the novelty factor of distance learning reduces, real application would apply to students that require the format to deliver specific needs. Waldman and Lange indicate successful distance learning programs will emphasize these employable skills.

Nelson and Restauri (2002) confirm that targeting

distance learning to specific populations can be

advantageous. Their research indicates that the needs of

older employed students are not being met by traditional

education (p. 664). Other factors that this research

considers important to program success is to progress

through the development of a distance program in stages and

at a speed that can be managed by the institution. Nelson

and Restauri conclude that an important consideration of

launching a distance learning program is to establish

goals, develop distance learning formats, and establish a

good evaluation process (p. 665).

Successful Implementation of
    Video in Distance Learning

Implementing distance learning programs that use

synchronous or asynchronous video can be a greater

challenge. Due to the large expense incurred and the

demands for bandwidth administrators are faced with a

daunting challenge. Salvati (2002), an administrator for a

high school program that uses synchronous video, expresses

the tremendous advantage of video but also expresses deep

concerns over the budgeting process of video education (p.

277). Salvati also expresses that video can be used to

bring in experts, and more importunately take advantage of the collaborative use of faculty (p. 278).

Motamedi (2002), in an article discussing the advantages and disadvantages of using videoconferencing technologies in the educational field, explains several factors influencing the success of video in education:

> Factors which influence the successful use of videoconferencing include number of sites, number of students at each site, instructor's teaching styles and degree of interactivity used, motivation of students, organization of the course, positive attitude of the participants, and preparation of the instructor. (p. 390)

Motamedi (2002) also warns administrators considering the use of video conferencing to be careful of bad video quality, reduced interaction quality with increased numbers of students, inadequate teacher training, boring talking heads, and high start up costs. Quality is an important consideration. Many colleges and universities rely on instructors with poor quality equipment and inability to produce production quality material. As Motamedi concludes, "the future of videoconferencing looks bright as we continue to refine both the technologies and our approaches

to their use" (p. 393). Recent expansion of technology including high-speed access, new compression techniques, and new Internet technologies will make videoconferencing more of a reality in the near future.

CHAPTER THREE

PROJECT REPORT

Introduction

The following report details specific instructions for
meeting the stated program plan goals and objectives. This
report focuses on specific strategies for implementing an
Information Technology program that meets the needs of
employers (Pharr et al., 1998) and a potential Information
Technology workforce. By integrating distance learning
technologies with traditional classroom instruction (Stone,
2001), this project presents an instructional model and a
technology plan that will facilitate a unique, flexible,
and outcome focused curriculum.

Educational Objectives

A key component to a successful educational program is
to identify an objective that students will set as their
ultimate goal or end result. This proves to be a motivating
factor that maintains the focus of the students' attendance
to the program. Nesbit (1999) confirms that in order for
adult education to be successful, the programs must be
targeted to specific, attainable industry targeted goals.

Successful implementations of distance learning programs

carefully assess the needs of the students and community

(Grubb et al., 1998) prior to establishing specific goals.

The objective should then be developed in a close balance

between state directed goals and industry targeted

outcomes. Examples of programmatic objectives might be:

- Obtain a degree or certificate

- Transfer to a four-year program

- Obtain a job with local industry partners

- Obtain an industry-recognized certification

Regardless of the key programmatic objectives, it is

important for the objectives to be clear, easily

identifiable, and measurable. Nelson and Restauri (2002)

emphasize that successful distance learning programs define

clear goals. The success of the program can then be easily

gauged by an evaluation of clearly measurable results. In

addition, the program can be targeted to the correct group

of students (Mariani, 2001). Waldman and Lange (2002)

determined that the most successful distance learning

programs are vocational in nature. This project proposes to

use industry partnerships and certification programs to

establish appropriate goals distance learning

implementation. This is consistent with the findings of Sogunro (2000), which emphasize the need for developing programs in key partnerships in order to guarantee the success of training programs. By linking program objectives with industry certification, a college can gain significant benefits from universally accepted and industry recognized education patterns and many other benefits (Maxwell, 2000), which a partnership with industry brings.

Students that have a clear objective, and a clear path to obtain that objective will be much more likely to be retained and ultimately fulfill the objective. When a student accomplishes a programmatic objective then that student should obtain credit for the program. Grubb (1996) suggests when departments monitor progress based on definable outcomes then one of the common failures of vocational education to track students successfully can be avoided. These outcomes would constitute a series of skill based competencies (Waldman & Lange, 2002) that lead toward the ultimate goal or objective. Success of the program can be determined on successful retention and completion of programmatic objectives by enrolled students.

Linking programs to vendor certification can provide a solution for meeting the common needs of technical schools.

Vendor certification programs also provide proven marketing

materials, and curriculum already designed to meet the

needs of many businesses. Therefore, a key partnership with

a vendor certification program can assist the department in

performing the needs assessment suggested by Grubb et al.

(1998). Although the Information Technology field is

growing rapidly, the areas of software development, systems

management, network management, and web site management are

the most popular (Mitchell et al, 1998). As suggested by

Pharr, S. et al. (1998) a solution similar to this is

necessary for vocational schools to maintain relevancy in

such a rapidly developing field. Although there are many

certification programs available it is important to

identify programs that are reliable, easily recognized by

employers, and that has well defined curricula. Once a

certification program has been identified a typical

requirement is usually to establish a partnership or

agreement with the sponsoring vendor or association.

Finding certification programs with partnerships or

agreements that benefit the college is an important recipe

for success. These agreements often include software,

equipment, training and other valuable resources. Maxwell

(2000) suggests several benefits that can come from a

relationship established with businesses. Table 2

illustrates recommended certification programs, the

sponsoring vendor or association, and the name of the

required partnership or membership program (see Table 2).

These are suggestions for the development of an industry

driven curriculum plan at Mt. San Jacinto College.

Table 2.

Recommended Certification Programs

Certification	IT Area	Partnership
Microsoft Certified Systems Administrator (MCSA)	Systems Management	Microsoft IT Academy
Microsoft Certified Database Administrator (MCDBA)	Systems Management, Web Site Management	Microsoft IT Academy
Microsoft Certified Systems Engineer (MCSE)	Systems Management, Web Site Management, Network Management	Microsoft IT Academy
Microsoft Certified Solutions Developer (MCSD)	Software Development, Web Site Management	Microsoft IT Academy
Cisco Certified Network Associate	Network Management	Cisco Academy Program

(CCNA)

Cisco Certified Network Professional (CCNP)	Network Management	Cisco Academy Program
Certified Internet Web Master Associate (CIW Associate)	Software Development, Web Site Management	CIW Authorized Academic Partner
Certified Internet Web Master Associate (CIW Designer)	Web Site Management	CIW Authorized Academic Partner

Program objectives can be easily defined by

associating the program with the requirements of the vendor

or association. Usually these requirements involve

successfully completing a computer-based examination

offered via a national testing organization. Two of the

more popular testing organizations at this time are

Prometric and Virtual University Enterprises (VUE). As long

as the program remain a local non-transferable curriculum

associating program completion with outside examination

agencies is acceptable. However, if applying for state

approval as a state certificate or degree program the

examination would be optional. In both situations, program

completion should be based on satisfactory completion of

specific course and unit requirements. A strategy such as
this can help to avoid one of the more common barriers to
distance learning programs, which is the inability to get
authorization during the curriculum approval process (NCES,
1997). Table 3 illustrates the recommended certifications
and the respective examinations (see Table 3; see Appendix
A for a more detailed description of these certification
tracks).

Table 3.

Exam Objectives for Certification Programs

Certification	Exam Objectives
MCSA	Exam 70-210,Exam 70-215,Exam 70-218;Exam 70-216
MCDBA	Exam 70-228,Exam 70-229,Exam 70-215,Exam 70-216
MCSE	Exam 70-210,Exam 70-215,Exam 70-216,Exam 70-217
	Exam 70-219,Exam 70-220,Exam 70-221
MCAD	Exam 70-305,Exam 70-306
	Exam 70-310,Exam 70-229
CCNA	Exam 640-607 CCNA
CCNP	Exam 640-607 CCNA, Exam 640-503 Routing, Exam
	640-504 Switching,Exam 640-505 Remote Access,
	Exam 640-506 Support
CIW Associate	CIW Foundations (1D0-410)
CIW Designer	CIW Foundations (1D0-410)

Site Designer (1D0-420)

E-Commerce Designer

(1D0-425 or 1D0-380)

Note. Exam objective listed are only recommendations. Many
certification programs provide multiple options for completion

Model Program

The simplest program to use as a model program is the
CCNA (Cisco Certified Network Associate) certification,
which only has one exam objective. Defining a model program
is the first major obstacle in the curriculum development
process. Grubb (1996) explains that colleges traditionally
have difficulty in adapting to new models of education. The
CCNA certification is a well-defined curriculum, which is
convenient in using as a model and can provide a reasonable
foundation for easing the curriculum approval process. The
following is the curriculum track for the CCNA
certification.

Exam Objective(s)

- Exam 640-607 CCNA

Description

The CCNA certification (Cisco Certified Network
Associate) indicates a foundation in and apprentice
knowledge of networking for the small office/home office

(SOHO) market. CCNA certified professionals can install,

configure, and operate LAN, WAN, and dial access services

for small networks (100 nodes or fewer), including but not

limited to use of these protocols: IP, IGRP, IPX, Serial,

AppleTalk, Frame Relay, IP RIP, VLANs, RIP, Ethernet,

Access Lists.

Exam Objective Notes

The Cisco Certified Network Associate exam (CCNA) is

the only exam required to achieve a CCNA Routing and

Switching certification.

Local Requirements

Obtain local certificate in CCNA technologies by

successfully passing all one half unit topics in the exam

objectives

By using a curriculum model, the curriculum can be

developed in successful stages, which is a major

recommendation of Nelson and Restauri (2002). Each

certification track is made up of exam objectives. These

serve as a unique programmatic objective for student

accomplishment. However, the programmatic objectives should

be broken down into sequential, clustered courses that

serve as the basis for the required skill based

competencies. This project recommends that courses be

established so that students work toward achievement of the exam objectives by accomplishing a series of one half unit topics. The advantage gained in breaking objectives into smaller sections is flexibility. Students are able to take these topics at their own pace and skill level. Both Mitchell et al. (1998) and Badway and Grubb (1997) emphasize the importance of having courses that allow for students to finish quickly, and to have proper sequencing. This achieves the necessary flexibility to promote a program that can be taken in a variety of formats, including traditional classroom instruction and online delivery.

These topics are taken for credit and require a total of eight hours of instruction divided up according to Table 4 (see Table 4). Each of the instructional methods will be defined in the following section.

Table 4.

Hourly Requirements for One Half Unit Topics

Instructional Methods	Hours Required
Lecture	2
Guided Activity	4
Panel Discussions	1
Exams	1
Total Hours	8

Students obtain credit of the topics by completing an examination at the conclusion of their studies. Requiring students to complete smaller courses with frequent examinations can provide students with greater opportunities for success, which is a key finding in the research by Jensen (2002). Topics should cover selected components to be covered on the certification exam. Students, who fulfill each of the topics, by passing all of the exams, should be prepared for taking the objective exam. In this way, courses could be taking in a variety of sequencing and provide students with multiple entry points into the program (Mitchell et al., 1998). Each certification track should divide the topics into a suggested course of study with recommended prerequisites;

however no prerequisites should be enforced to maintain flexibility.

The exam objective for the CCNA exam requires a total of 22 topics. This would require that students enroll in a total of 11 units in order to prepare for the CCNA exam objective (Refer to Appendix B for a complete list of one half unit topics and the recommended sequencing).

In addition to providing a list of suggested courses, it is also important to provide a model outline of record for a sample topic. This is of particular importance due to the emphasis that state has placed on local curriculum committees deciding on the relevance of distance education (Refer to Appendix C for appropriate guidelines on submitting topics for approval). Of particular mention are the methods of instruction, and the definition of regular instructor contact which according the California State Academic Senate office (1999) is crucial for success. A distance learning addendum would also be required to submit with each topic in order to establish that the educational objectives of each topic can be achieved using a variety of instructional methods (see Appendix D). As the Academic Senate (1997) discusses the curriculum committee at an individual college must decide on the validity of using

technology to mediate communication. This project details

the methods of instruction referred to in the course

outline and the technology required. The addendum seeks to

reinforce the content of this project in the approval

process.

<center>Model Program Beta</center>

After approval is obtained for the one half unit

topics (or courses in the traditional sense) then the CCNA

program should be tested on a trial basis. Developing the

program in this manner has a greater chance of success

(Nelson & Restauri, 2002). This beta process will be used

to gather important information regarding the potential

success of the program. Particular emphasis should be

placed on the ability of students to follow the appropriate

sequencing, and transition form traditional modes of

registration and enrollment to this new concept of one half

unit topics. After the process an evaluation should be

performed and adjustments made to the program itself, or in

the way it is explained, marketed, or delivered (see

evaluation section).

Redesign Current Curriculum

After implementing changes in the beta process, the first goal should be to redesign the current Information Technology curriculum at Mt. San Jacinto College. Currently the college runs certification programs in MCDBA, MCSE, and CCNA. After successful implementation of the CCNA program, the college will be ready for successful implementation of the rest of the programs. Using the CCNA program as a model the faculty will redefine the current courses into specific curriculum tracks and necessary topics. This should be a local development process, in which faculty are the major decision makers. Stone (2001) strongly encourages colleges to establish distance learning programs through each local department rather then a centralized office. Once these topic areas have been defined they will then have to be submitted through a separate approval process.

Develop New Curriculum

This same process will be required for new programs of study. As discussed previously certification to be added are MCSA, MCAD, CCNP, CIW Associate and CIW Designer. After these programs have been submitted for approval, further evaluation and research will be required for any additional

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certification tracks to be added. In addition, curriculum

tracks should not be submitted for approval as programs of

study until after an evaluation process has determined the

necessary staffing and technology requirements of new

programs (see Appendix A for a complete list off curriculum

tracks to be developed).

Instructional Methods

Lectures

In addition to the curriculum development process, the

second goal of this project is to define specific

guidelines for the methods of instruction referred to in

the course outline of record and distance learning

addendum. The first instructional method is that of

lectures. Inherent to the ability of a student to obtain an

adequate understanding of difficult concepts is the

traditional classroom lecture format. This format provides

the student with an invaluable resource for gaining

knowledge by having direct interaction with faculty (Beard

& Harper, 2002). Most research indicates that interaction

with the instructor is a key component to success (Beard &

Harper, 2002; Denzine, 2002; Stone, 2001). By providing

this format in a live setting or in a distance format can

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certain population transition to the use of technology

(Selwyn & Gorard, 2001). Lectures should be held in a

traditional computer classroom, with seats available for

students that wish to attend in person. This would not only

allow for students that still prefer traditional

instruction formats but also help in reducing any feared

disparity problems for those populations without the

required technology (Stone, 2001).

A unique ability of the lecture format using one half

unit topics is that various instructors and not necessarily

the same instructor deliver these lectures. This provides

students with a wide range of backgrounds and personalities

in which to draw from. This would serve as an additional

enhancement to the variety of instruction methods discussed

by Secker (2002). Exactly how this is accomplished will be

discussed in the scheduling section. This format also

prevents duplication in educational efforts. For example,

if a college were offering two identical courses it would

be entirely possible that the instructors could be giving

lectures on the same topics throughout the semester. Using

unique scheduling available with the one half unit topics

any student enrolled in a topic has the potential to a

lecture by any faculty member. This could help reduce

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duplication, or more importantly give students more then one opportunity to hear a lecture on a specific topic. More importantly, this model provides the faculty with the opportunity to deliver instruction on topics that students want to learn. This will also provide a better opportunity to alleviate some of the concerns with faculty workload that a distance learning program would introduce (Hartman et al., 2000). In traditional lecture classrooms, especially in technology classes, the instructor teaches every topic to every student regardless of the skill level of the participants. With the arrangement of specific topics as requirements instead of traditional courses the teaching is more specifically targeted to the group of students who are at the same level in their progression towards the educational objective.

This model not only delivers education based on the knowledge level of the students, the potential of solving the physical location needs of the student is also realized. In addition to live attendance, all lectures should be multicast using streaming video technologies to students' homes or businesses. These students will be required to meet specific technology requirements. The intention being to attract the non-traditional student,

which according to Mariani (2002), can deliver education to more groups of people that the traditional environment does not serve. A web site and chat engine will accompany the video so that students can post questions and view lecture handouts and materials. By providing archived video and using web tools along with an interactive video classroom, the bandwidth (Mazur, 2000) and low quality issues can be reduced (Patrick, 1998). This can also server to solve some of the concerns that educational research has pointed to with regards to the potential for disparity due to low bandwidth of certain populations (Maxwell, 2002). This will present an online forum so that students can participate in listening and responding to education in real time via the Internet.

These lectures will also be recorded and stored on a digital video storage unit for a period of two weeks, so that a student can retrieve and listen to the multicast asynchronously. The purpose being so that students can view the any lectures missed over the past few weeks or review important lectures. Any specifically noteworthy lectures or guest lectures flagged by a faculty member will not be deleted but archived permanently. These archived sessions can be reviewed by students, evaluators of the program or

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in the place of live lectures for courses with low
enrollment.

Panel Discussions

Although lectures are an important method for students
to receive instruction directly from experts, another
important instructional method is a panel discussion. A
panel discussion essentially provides the ability for
students to ask questions to a group of faculty members
and/or outside experts. This collaborative (Salvati, 2002)
effort provides students with a significant resource in
both distance or in person formats. If students are truly
progressing at their own pace through the instructional
program (certification track) then a panel discussion will
provide them with the ability to gain valuable instruction.

This forum will give an opportunity for students to
participate in a discussion on a specific technology
involving multiple faculty members and any guest experts on
the subject material. These can be either planned
discussions on individual topics or open forums. Specifics
on scheduling times for these events will be discussed
later. These panel discussions will occur in a live forum
at the school and simultaneously over the Internet via
streaming video technologies similar to the methods used in

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delivering lectures. For users that do not meet specific
technology requirements a toll free number will be
established so that audio from the live panel discussion
can be delivered at low cost. For home users that meet
technology requirements, the sessions will be delivered
with video and audio. In addition, software will be used
that allows both students and faculty using either media
(live, phone, Internet) will be able to participate
equally. This software will be integrated into a web portal
referred to as a learning community (Grubb, 1996).

Learning Community

         The learning community is an essential component to
providing quality instruction to individuals using distance
technologies. This will serve as the classroom presence for
students (Mechitov, 2001) engaged in online learning as
well as an effective information resource for current and
prospective students. The learning community is actually a
collection of web tools in a centralized location for the
purposes of facilitating interaction or receiving
instruction. Convenient to the development process is the
benefit to affiliation with vendor programs that produce
curriculum designed for web-based instruction. All students
registered in the program will have several communication

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vehicles so that they can gain the most from their learning by communicating with faculty, staff, and other students. An email system will be available including the ability to disseminate information to specific mailing lists. A newsgroup for each topic will be defined along with a general information post. A web site will also be available for programmatic information (Mechitov et al., 2001), technical support, and as on online learning resource. This web presence will also include the ability to register, enroll, receive progress reports and take examinations.

Exams

The key component to successful instruction are examinations (Jensen, 2002) that challenges students to both apply the skills the learned and prove their understanding of concepts. This will be achieved in two ways. First, every program of study is derived the certification tracks authored by independent vendors. These all require certifications exams as the chief validation of knowledge and ability. By basing objectives on certification, students are required ultimately to validate the their education by passing certification exams. Second, credit for each topic taken will be granted after each

student successfully completes a computer adaptive test and a skill-based examination.

A faculty member will administer both of these exams and attendance by the students is required, this is not a component students can participate in remotely. Discussed later in the scheduling section, there will be open times available for students to register on a first come first serve basis to take the required topic examinations. The computer adaptive test will be delivered over a private intranet and the skill-based examination will be performed in the classroom. The students will be asked to demonstrate the skills the learned in the guided activities. This is intended to produce an action orientated learning environment (Jewitt et al., 2001). An important consideration is that every exam must be created prior to enrollment in topics. This is because students can register for an examination at any time after a topic is enrolled. Another important consideration is to maintain privacy and security with each examination. Refer to Appendix E: Sample Questions for Adaptive Testing and Appendix F: Sample Skill-Based Examination for practical examples of these examinations (see Appendix E and Appendix F).

Guided Activities

The requirement of students to pass a skill-based examination increases the importance of students participating in guided activities that strength the student's ability to work with the technology being learned. Each topic will emphasize this by committing a significant percentage of instruction to hands on learning. In this process the student will learn to become and active learner (Notar et al., 2002). Guided activities are different then lectures, in that there is no scheduled activity topic. Students will be asked to register on a first come first serve basis in selected time periods reserved for this purpose. A faculty member will be in attendance to guide the student (Notar et al., 2002) through the specific technology that the student is working on. It is intended for these guided activities to be opportunities for students to work with pre-prepared scenarios developed either by the faculty member or the participating vendor. Students will also be able to, on a limited basis, participate in guided activities through a Virtual Private Network (VPN). Communication with the instructor will be arranged through software bundled with the learning community.

<u>Self-Guided Activities</u>

As an alternative to in-person activities students can decide to arrange for doing these activities at home or at work or otherwise termed as self-instruction (Bergen, 2002). This option will be reserved for students with demonstrated advanced ability and specific technology requirements. These students must receive recommendation from the instruction prior to selecting this option. In addition, the students must purchase, or validate possession of, an equipment list for home study. The learning community will serve as a basis for assistance and troubleshooting regarding the self-paced activities. Students enrolling in this option are asked to take advantage of instructor office hours for technical support (see Appendix G for a sample self-guided activity equipment requirements list).

Office Hours

Office hours are typically a resource that is not used frequently by students. However, it is suggested that office hours become an integral part (Denzine, 2000) of the instruction process. This can be achieved by arranging students to meet with instructors for counseling on

specific requirements of the program. Each instructor will be assigned a group of students in a certification track to mentor. Office hours will also be integrated into the learning community, so that students can reach instructors online through a variety of methods. Due to the increased access to the instructor, and the expanded role an instructor is going to play in mentoring, and courseware development it is recommended that the office hours be extended. Refer to the section on faculty workload for a discussion on required hours of instruction.

Web Based Registration

The third goal of the proposal is to develop an instructional plan that will integrate (Grubb, 1998) the methods of instruction discussed above with current college policy. Policy at the college is usually rooted in two factors: state regulations and technological infrastructure. The most difficult hurdle to overcome regarding both of these factors is with that of registration and enrollment. Therefore, it is proposed that enrollment in any topics, or courses in the traditional sense, be limited to students that have registered in the program via an online registration tool. The purposes for

this is to limit the number of exceptions have to be created in the current college policy and open the potential for greater flexibility in the enrollment process. Online kiosks should be made available at key locations for students who do not have Internet access at home to be able to register. This serves as another tool to help avoid any disparity due to technology requirements (Stone, 2001). By requiring students to register for entrance to the program, greater controls can be implemented. These controls include the ability to apply prerequisite knowledge requirements of courses, pre-testing, and creating priority for enrollments. The proposed registration process is illustrated in Figure 1 (see Figure 1).
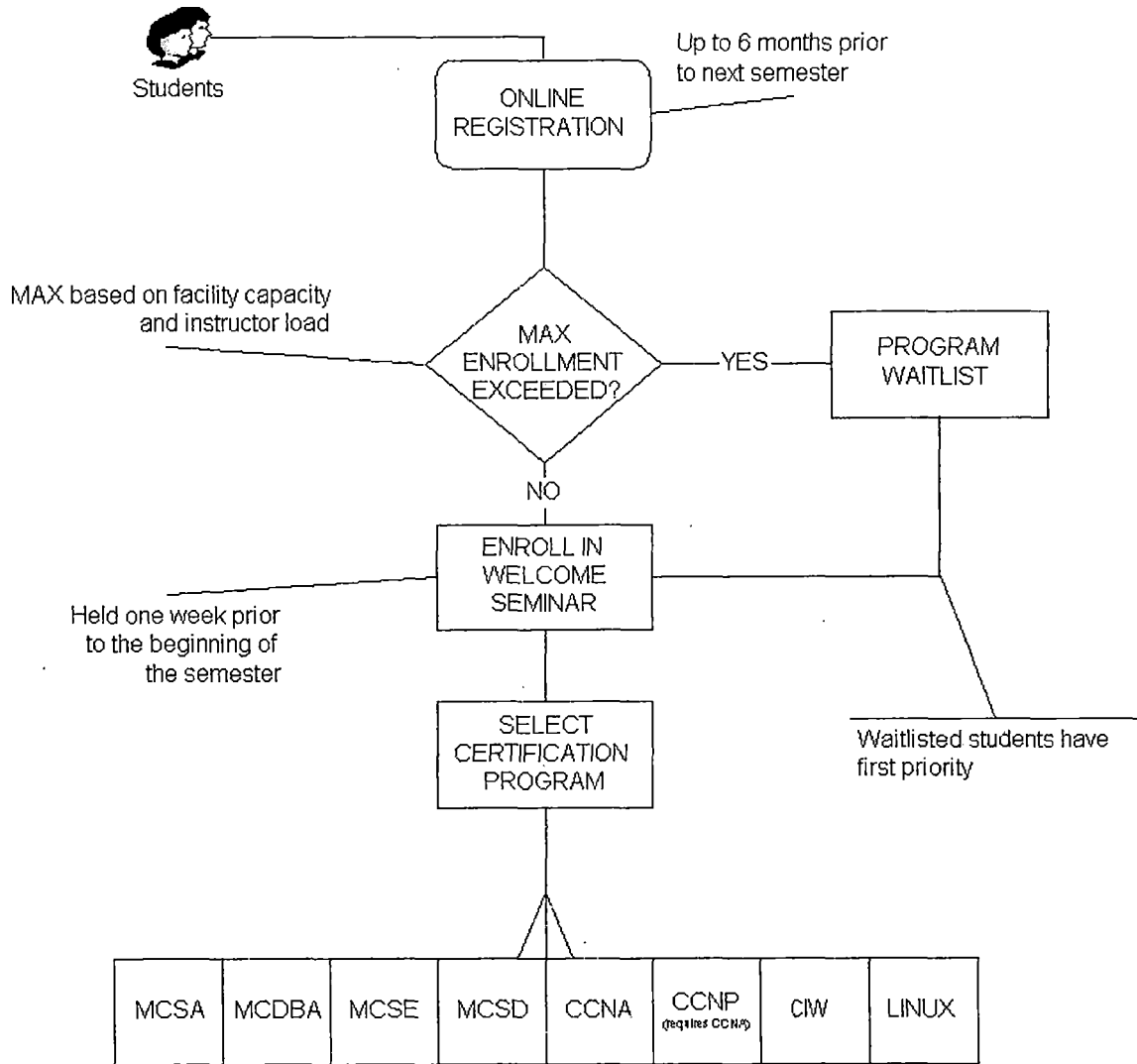
Figure 1. A Flow Diagram of the New Student Registration Process.

As outlined in Figure 1, the online registration process should begin at least six months prior to the beginning of the next semester. Students will be able to register for the program and be automatically enrolled in a

welcome seminar. The welcome seminar will be a one half

unit course that will be eight hours and held one week

prior to the beginning of the semester. All of the full

time faculty should be in attendance at this seminar.

Introductions can be made and the mentoring process can

begin. The purpose of this seminar will be to:

- Provide instructions on how to access the online
  learning community

- Introduce the certification tracks and the required
  objectives

- Help students select a program of study or
  certification track

- Explain the enrollment and scheduling process

- Explain the examination process

This seminar is crucial for success. Students need to

be clear about what to enroll for and how to get help

regarding their progress. Through these types of effort the

populations, that might ordinarily be difficult to reach

(Stone, 2001), will be able to gain valuable information

about how the distance learning options available can apply

to them.

The registration process also provides a method to place a ceiling on the maximum students in the program and to create a waiting list in order to maintain maximum enrollment numbers. After some analysis, a determination must be made as to the capacity for students in the program. Based on an average student taking the equivalent of six Carnegie units, or 12 one half unit topics, an estimation can be made as to the number of contact hours required. In addition this must be factored in with the space available in the facility as well as the workload placed on the faculty. If the average student enrolled in 6 units, then this program could support, with one classroom, approximately 400 students. This would equate to roughly 800 enrollments. This is not too far off, considering the average enrollment for these programs in the traditional model has been roughly 300 per semester. This number does not completely factor in the potential of online access, therefore, it is important to include in the evaluation process of this program a method for increasing or decreasing the maximum student count for the entire program. Faculty should be involved in this process to assist in developing the alternative methods of faculty load discussed by Grubb et al.(1998) and Stone (2001).

When the maximum student count is reached, students can be placed on a waiting list. These students will gain first priority for the registration for the next semester. So as students successfully obtain objectives and/or leave the program new students can be constantly filled in those positions. Important policies will need to be established including a minimum enrollment for each semester. Students are encouraged to work at their own pace, however, a practical amount of units must be set so that students who are not progressing will not prevent others form enrolling. Research indicates that students in a distance learning environment prefer a faster paced schedule (Mitchell et al., 1998), and the ability to customize the sequencing. The recommended minimum is three units, or six one half unit topics. A second restriction might also be required, and that is to require students to re-register for every certification track or program of study. This will provide more opportunities for students to gain access to the program and improve the entry points (Mitchell et al., 1998) into the program.

Also to be discussed in the scheduling section is that it will not matter the number of students who select a particular curriculum track. In this example, all programs

and the corresponding one half unit topics will be

available for enrollment every semester. Because of this

reason, no restrictions are necessary as to the

registration in specific certification tracks.

Scheduling

Once a student has registered for the program and

chosen their desired certification track, they will be

responsible for using the online system to enroll in one

half unit topics each semester. Figure 1 provides a

flowchart of this process (see Figure 1).
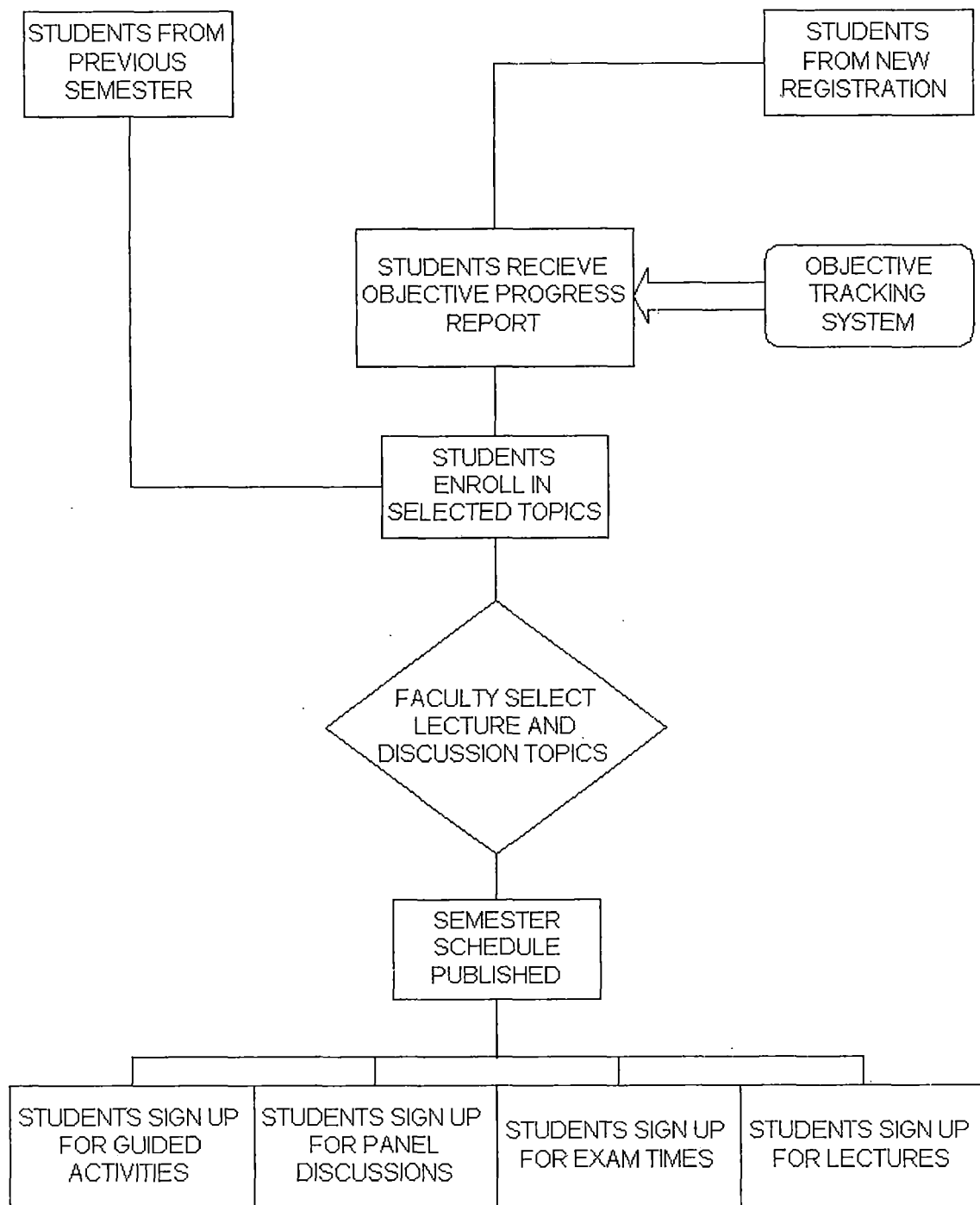
Figure 2. A Flow Diagram of the Semester Enrollment and

Scheduling Process.

A key component to be discussed in the next section is that students will receive at the beginning of each semester a progress report that includes a recommended program of study. This will be a list of suggested one half unit topics and the recommended sequencing. From this list students will select the topics that they wish to register for.

There will be no minimum or maximum limit to the number of students that can register for a particular topic. As enrollments in a topic increase so will the resources committed to the instruction of that topic. Conversely, fewer enrollments in a topic will result in smaller amounts of instruction. However, this is a delicate issue. Both Grubb (1996) and Stone (2001) strongly encourage colleges to aggressively seek for creative methods to solve these types of issues. Grubb (1996) indicates that one of the primary reasons for failure in a distance learning program is the unwillingness of administration to be flexible. Funding for the college is based on instructor contact. Therefore a student enrolled in a one half unit course must receive eight hours of instructor contact. This contact, however, can take many forms and is defined by the curriculum process. Certain

forms of contact will always remain constant. Guided activities and examinations will be open enrollment. This means that once students enroll in a topic they will be able to select from a list available times for these activities. In the example of a one half unit topic, a student would be able to select four hours of guided activity and one hour of examination (see Table 4 for a breakdown of the hours).

The panel discussions, and lecture activities are more expensive in terms of scheduling and resources. Faculty will schedule live lectures and panel discussions after the enrollment process in complete. This will provide an opportunity for faculty to determine qualitatively what particular topics are in more demand or require specific addressing. A guideline for making this decision is presented in Table 5 (see Table 5). Students in topics with low enrollment will be required to obtain lecture material from previously recorded lectures or online material. Students can gain the learning provided in the panel discussions by using the learning community to guide their studies. This adjustment in instructor contact, based on enrollment, is why it is necessary to develop these topics as online courses.

Table 5.

Lecture Selection Criteria for One Half Unit Topics

Number of Enrollments	Lecture Selection
0 – 5	No Lectures Scheduled. Previous lecture on video or online curriculum only
6 – 10	1 Lecture Scheduled
11+	2+ Lectures Scheduled (depending on demand and evening / day preference

Students will not be able to select time slots for instructional activities until after the schedule has been produced for the entire semester. Successful enrollment in a topic is a two-step process. First, the students must enroll in the topic and second the must select when they want to participate in lectures, panel discussions, guided activities, and examinations. Once the faculty have made scheduling decisions regarding topics for lectures and panel discussions a schedule will be offered for enrollment. This will be on a first come basis, however, priority should be given to students with the highest accomplished unit amount. This scheduling process will occur every semester. Ideally the system would work in a three-semester system with an extended summer. Figure 3 details a recommended schedule that distributes time for

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activities based on the emphasis in the program (see Figure

3).

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8 - 9 AM	LECTURE	GUIDED ACTIVITY	GUIDED ACTIVITY	GUIDED ACTIVITY	EXAM	LECTURE	PANEL
9 - 10 AM					EXAM		PANEL
10 - 11 AM	LECTURE				EXAM	LECTURE	PANEL
11 - 12 PM					EXAM		PANEL
12 - 1 PM	BREAK						
1 - 2 PM	CONTRACT	CONTRACT	CONTRACT	CONTRACT	CONTRACT	PANEL	EXAM
2 - 3 PM						PANEL	EXAM
3 - 4 PM						PANEL	EXAM
4 - 5 PM						PANEL	EXAM
5 - 6 PM	BREAK						
6 - 7 PM	LECTURE	GUIDED ACTIVITY	GUIDED ACTIVITY	GUIDED ACTIVITY	EXAM	GUIDED ACTIVITY	GUIDED ACTIVITY
7 - 8 PM					EXAM		
8 - 9 PM	LECTURE				EXAM		
9 - 10 PM					EXAM		

Figure 3. Template for Weekly Classroom Schedule.

Note that more time slots are given to guided

activities. Also, the time slots are spread evenly across

day, weekend, and evenings. This particular schedule also

reserves time for contract education. Table 6 indicates the

distribution of hours per instructional activity.

Table 6.

Hourly Division of Instructional Methods Per Week

Instructional Methods	Hours per Week
Lectures (2 hours each)	12
Guided Activity (4 hours each)	32
Panel Discussions (1 hours each)	8

Exams (1 hour each)	12
Contract Education	20
Total Hours	84

The enrollment process needs to be carefully monitored to prevent a significant drop off in enrollments. Patterns should be watched carefully to aid in the next scheduling process. Students need to be encouraged to maintain enrollment and to schedule for examinations.

Tracking System

Grubb (1996) indicated that in these types of vocational efforts one of the greatest failures is the lack of student tracking and counseling. The main purpose of a tracking system should be to encourage students to continue in their progress and to make suggestions as to a particular course of study. The tracking system can also serve as a method for faculty and administration to determine the success of the program. This data can be used to make future decision regarding funding, hiring, and expansion. In addition, several grants seek for outcome-orientated solutions, in which this system would certainly provide evidence. The tracking system should analyze each

student's progress and produce a report each semester. Students should receive this report via email and also online.

Faculty Workload

Distance learning courses always concern significant amounts of instructor workload (Hartman et al., 2000); this is due in large part to the greater audience that can be served. The argument is that distance learning courses requires greater effort and that quality can become jeopardize with an increase in the numbers that faculty are responsible for teaching. This issue has been solved, in part, due to the set number of students that are allowed to register in the program at once. Of course, as more facilities and faculty are devoted to this process the number of concurrently enrolled students can increase. Secondly, an instructor is not responsible for teaching any one course. The instructor is not even responsible for grading students due to the examination structure that has already been discussed.

This flexibility targeted toward placing the correct faculty member in an instructional setting will require some unique handling of load (Stone, 2001). At Mt. San

Jacinto College a typical full time load for faculty is 15

Carnegie units per semester. This does not include office

hours or committee assignments. This equates to fifteen

hours of instruction per week, with five additional hours

for office hours. Table 7 illustrates a proposal to base

full time load exclusively on hours per week rather than

courses or units (see Table 7).

Table 7.

Load Calculation for Full Time Faculty

Activity	Hours per Week
Instruction (Lectures, Panel Discussions, Guided Activities, and Exams)	12
Online Instruction	3
Office Hours	5
Total	20

This particular model allows the flexibility of

placing instructors in different settings. For example if

one particular instructor was knowledgeable in a particular

concept then that instructor might perform the lecture for

that topic during the semester. Note that this plan devotes three hours of instruction to online work; this is to provide the instructor with some time to work with students who are working from home, in courses with low enrollment, or are having particular difficulty. This calculation is based on a ratio of one hour for online instruction for every 4 hours in the classroom. Table 8 shows how this ratio could help in calculating overload assignments for full time faculty members (see Table 8).

Table 8.

Overload Calculation for Full Time Faculty

Activity	Hours per Week
Instruction (Lectures, Panel Discussions, Guided Activities, and Exams)	4
Online Instruction	1
Total	5

The ratio will have to be different for part time faculty members. Part time faculty will not be required to mentor students, however they will be occasionally required to engage students in the online learning community. Table

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9 illustrates a maximum load for a part time faculty member (see Table 9).

Note that the part time faculty is only able to teach nine hours per week, with a ratio of eight hours in the classroom to one hour of online instruction. The reason for this limitation is a state law requiring that part time faculty not be allowed to teach more than a 60% load over the course of a year. Table 10 shows how many hours three full time faculty members and two part time faculty members would provide during a week (see Table 10).

Table 9.

Maximum Load for Part Time Faculty

Activity	Hours per Week
Instruction (Lectures, Panel Discussions, Guided Activities, and Exams)	8
Online Instruction	1
Total	9

Table 10.

Sample Hourly Workload for Weekly Schedule

Instructor Hours	Hours per Week
Instruction Hours for 3 Full Time Faculty	36
Overload Hours for 2 Full Time Faculty	10
Instruction Hours for 2 Part Time Faculty	18
Total Weekly Hours of Instruction	64

This particular calculation was determined to meet the 64 hours of required instruction during the week for one classroom facility (see Diagram 3). Based on the above example, it would take three full time faculty, working overload, and two part time faculty to deliver a full schedule of instruction for one classroom. This does not include any hours devoted to contract education (as displayed in Diagram 3). This should serve as a basis for adding more facilities and staffing.

Obtain Qualified Faculty

As mentioned previously one of the greatest difficulties in offering technical education is finding qualified part time faculty (Grubb et al., 1998). This is due to a significant labor shortage in Information Technology but more significantly low pay rates that are

mandated by the state. To increase the potential of finding

more part time faculty the college should engage in

partnerships with many local businesses. These business

partners often times become a source for new part time

faculty. In addition, the college needs to be creative in

finding ways to attract highly qualified faculty members.

The best way, and the most obvious are with higher pay

rates and more hours. This cannot be done under the present

system; however, by running contract education courses the

college could offer additional courses to part time faculty

with more pay. Grubb et al. (1998) offers that successful

vocational programs use a creative mix of credit and

contract courses to assist in sharing expenses. Grubb et

al. (1998) also suggests that workload be spread over both

types of courses.

The new scheduling system also promotes the particular

skills of part time faculty. In this way, part time faculty

can be placed in specialized areas of expertise rather then

teaching an entire course. This is important, because in

traditional settings faculty are asked to engage in

significant amounts of preparation time without

compensation. Rogers (1995) indicates that colleges need to

be concerned with staff development issues. An expert from

the field could deliver an impressive lecture on a

particular topic, or participate in a panel discussion.

This expert might not be as willing to handle issues such

as examinations, activities, and grading. The college also

should consider the minimum qualifications for part time

teaching positions to reflect that of the industry. Instead

of relying on degrees in unrelated fields, a good

suggestion is to require certification or demonstrated

experience in an area of expertise. This is a common and

excepted practice among many vocational programs (Nesbit,

1999).

Contract Education

Offering contract education courses provides the

college with the flexibility to provide instruction outside

of the policies that govern credit courses. However, most

local businesses that take advantage of the ability to

create customized courses will target objectives other than

certification. The advantage of the one half unit topics is

the ability to modularize instruction into customized

courses to help businesses develop the technical skills of

employees. Pharr et al. (1998) indicates that most

businesses require different models for education then

traditional colleges offer. In addition, new topics can be researched and developed specifically to be offered in the contract environment.

Specialized courses can be delivered onsite during reserved times or delivered onsite depending on resources available (both instructor and equipment). A significant advantage to offering contract education, as a companion to current credit offerings, is the ability to direct funds towards maintaining the classroom facility. This becomes an important mechanism for supplementing current funds for the program and learning to adopt aggressive funding tactics (Grubb et al., 1998) to support distance learning. Maxwell (2000) suggests that businesses are often willing to engage in partnerships with local colleges specifically for this reason. Contract education should be offered as a valuable resource to the community, and the college must provide significant support in marketing these services. Marketed correctly and this program could become a significant value to local businesses looking for an economical way to obtain Information Technology training.

Retention

By providing extra hours for online instruction and providing students with frequent progress reports significant gains will be made in retention. However, one of the primary concerns at the college currently is the need to maintain enrollment in advanced level courses. Although this will be alleviated by the ability to schedule one half unit topics with low enrollment, a key evidence of success is high enrollment in advanced level topics. The goal of the registration, enrollment, and mentoring, and tracking systems needs to be to encourage students to continue in the program and ultimately finish. A major component of the evaluation process needs to be the outcomes of the program, specifically completion percentages.

Web Application

The fourth goal of the project is to develop technology plan for the implementation of this instructional design. The fist major objective is the creation of a web application that functions as the engine for a learning community, registration and enrollment process, progress tracking and testing. This web

application will also server as the center point in marketing efforts (Mechitov et al., 2001), outreach to students and employers, and counseling and faculty advisement. Figure 4 illustrates the overall vision of this online learning community (see Figure 4).
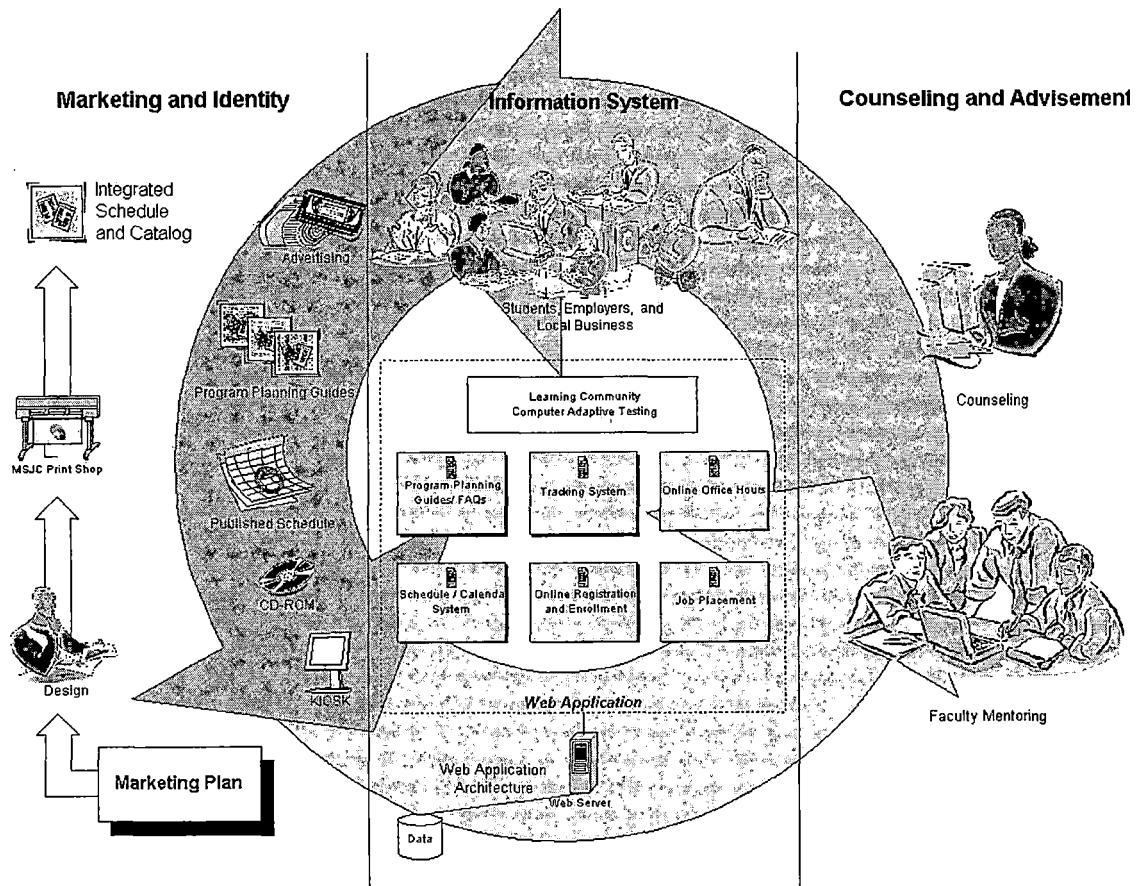
Figure 4. Web Application and Online Learning Community

As explained in the instructional methods, the web application will become a major source of student contact. The web application needs to be based on an architecture that can grow with the program and handle the potential load of multiple students accessing the site for a variety of reasons. This web application architecture should be based on a 3-tier technology. This approach separates the application front end (presentation layer) from the application itself (business layer). The third layer is responsible for storing data (data layer) (see Appendix 3 for a diagram that details a sample 3-tier architecture. This layered architecture produces the ability to cluster computers together to distribute the application in an environment that can withstand significant loads. With more than one server functioning in a particular role, this clustering feature provides a method to increase the scalability of the application. This effect can be produced at all three layers of the architecture.

A recommended approach to implementing this architecture is to find sponsors (Maxwell, 2000) or companies that offer products that support a distributed environment. Microsoft Corporation produces this type of server product, for example. Compaq has partnered with

Microsoft in order to produce a hardware platform suited for the clustering available in Microsoft's products. This architecture produced by Compaq is called Distributed Internet Architecture (DISA). The advantage of using vendors such as Compaq and Microsoft are the educational discounts and the development of these systems has already been accomplished. This reduces the amount of work and planning required implementing the physical hardware for the web application.

Classroom Facility

The web application will be hosted in the classroom facility. Facility planning is an important component to any educational endeavor (Douglas & Gifford, 2001). Placing equipment and networking technology within view of the students is part of an overall philosophy that involves the students with technology. The classroom facility needs to be a place that provides an open and manageable environment for working with a variety of technologies. As mentioned earlier students in guided activities will be working on different projects, so maximum flexibility is absolutely required. The classroom facility is capable of handling fifty students. Forty students will be provided

workstations in a typical classroom structure with four

rows of ten each. A limit of ten students will be allowed

to participate in classroom guided activities through a

dedicated VPN connection. Figure 5 provides an overall view

of the proposed facility and the essential components (see

Figure 5).
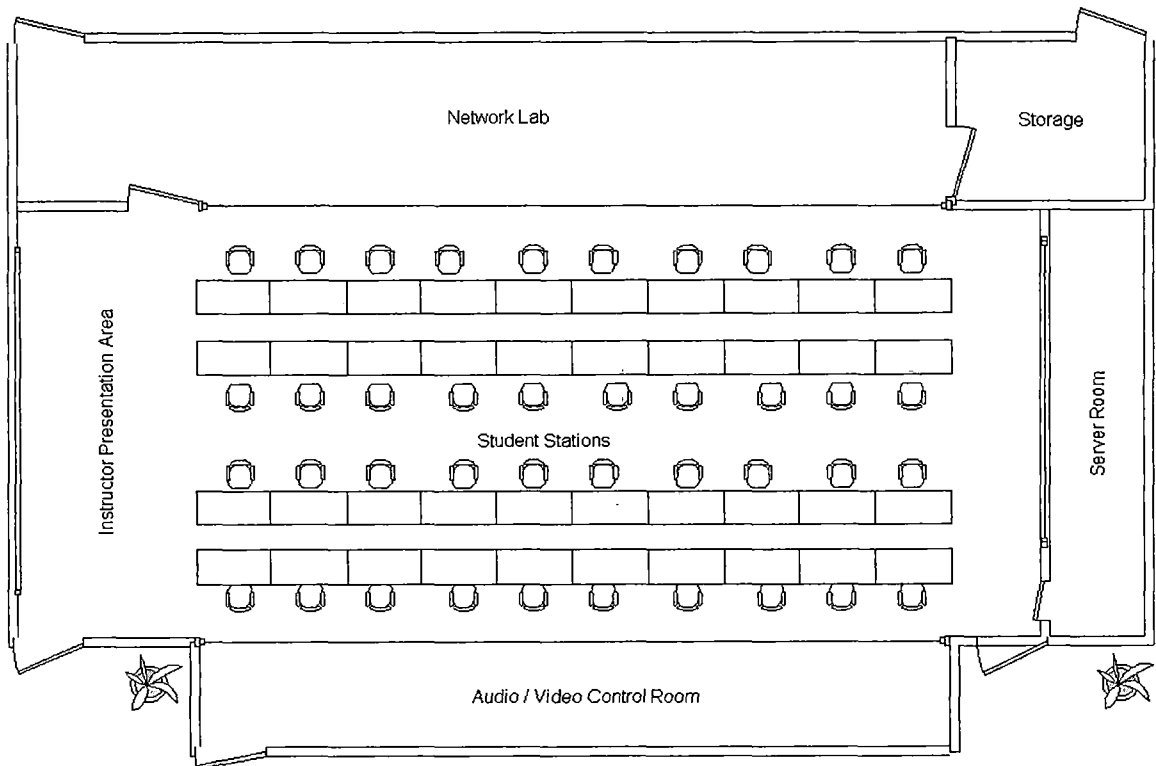
Figure 5. Plan for Classroom Layout.

Instructor Presentation Area

This area of the classroom facility should be equipment with a white board, and an overhead projector mounted to the ceiling. The projector should be connected to a workstation intended for instruction use. In addition, video-splicing equipment should be provided so that instructors are able to connect laptops to the projector. Demonstration software should also be installed to facilitate the ability of the instructor to control the machine remotely. Several companies, including Mimio Inc., provide software and hardware designed for this purpose. In addition, remote connections should be made available to servers in the server room and network equipment in the network lab so that the instructor can make necessary changes and perform demonstrations.

Network Lab

The network lab is a separate facility from the classroom with a large window so that the instructor and students can view the equipment. The network lab will have cabling and connections provided so that students can remote control all of the equipment from the classroom. In addition, all wiring for the classroom will come to a center location is this lab and organized though 19″

industry standard communication racks. This wiring will be

transported through cable management ladders that will be

distributed in key locations throughout the classroom,

network lab, and server room.

Various infrastructure components will be required to

make this lab feasible. This will include several LAN

switches, and a firewall capable of VPN support. In

addition, wiring patch panels, communication racks, and

devices for electrical connections. The network lab will

have a variety of network equipment to support various

networking courses including the MCSE, CCNA, and CCNP

programs. The minimum amount of equipment will be specified

for each row of computers. The VPN connections students are

also considered to be a row of students. That equipment

should be:

- 2 sets of 6 routers per row

- 6 10/100 switches per row

- 6 10/100 hubs per row

There should also be provided in the network lab the

necessary equipment and tools required for cable

installation, and wire management. A false drywall unit

should be in place for students to practice performing

cable installation. Advanced Cisco topics require specialized equipment including layer three switches, remote access equipment, frame relay and ISDN simulations, and some specialized routing equipment. Each of these requirements should be detailed with the submission of curriculum for the individual topics.

Server Room

The advanced MCSE topics require specialized servers including UNIX and /or LINUX servers, Novell Netware servers, and several Microsoft servers configured in a variety of roles. All of these machines need to be placed in communication racks in the server room. The server room will be viewable from inside the classroom. This server room should supply all necessary power infrastructures including a Uninterruptible Power Supply (UPS) for servers.

The server room will also contain all of the servers required in the web application architecture. This will require several web servers and database servers each configured in a clustered environment. A suggested technology is to use Microsoft clustering on Compaq DISA architecture. The server room will need to contain all the servers required for the video solution mentioned in the next section. Finally, the server room will contain the

required computers for the students' workstations. This includes a server computer configures with a Redundant Array of Inexpensive Disks (RAID) configuration and a client machine. Each of these should be based on an Intel platform. Secondly, the student workstations will connect to a PC on a card with an integrated IDE chip. These cards will be configured in a back plane configuration. They will be exclusively configured to be terminal services clients. A terminal server will be required to support the client connections. Software from Microsoft or Citrix is required to support this configuration.

Student Stations

The student stations will require a KVM (keyboard, video, mouse) connection to the server room to establish a connection to the server, client, and terminal services machine. The terminal services machine acting as a machine dedicated for Internet Access and Office Applications. The client and server will be configurable depending on a variety of environments required in the guided activities. The students will each have a 19" flat screen monitor configure with a control arm. This monitor will be connected to the KVM, so that students can switch between each of the three machines. The VPN students will establish

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connections to the client and server through software that
allows users to control the desktop remotely. Several
software packages are available for this purpose, including
packages available from Microsoft and Symantec. Figure 6
provides a graphical representation of this layout (see
Figure 6).
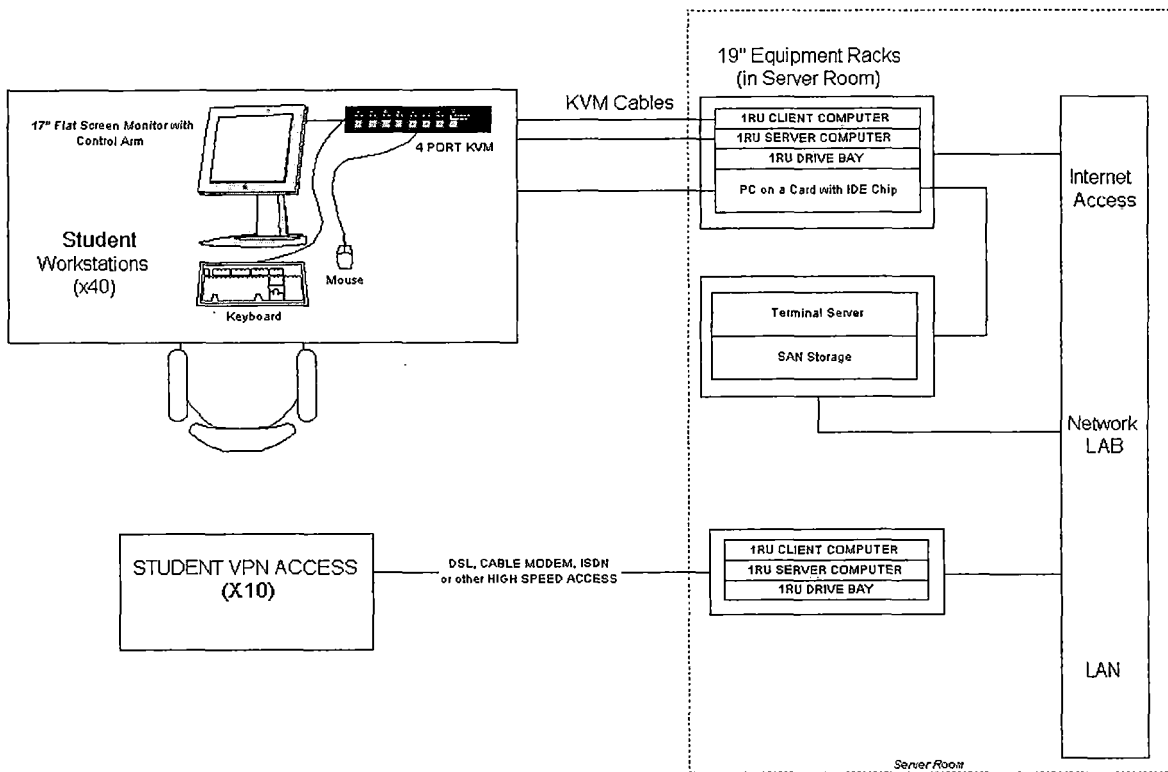
Figure 6. Student Workstation Layout.

Audio/Video Control Room

This room is dedicated to the control of audio and visual for the purposes of streaming content or archiving content. This room will also be used as a multimedia staging area for developing content for the web. A recommendation made by Patrick (1998), Mazur (2000), and Motamedi (2002) is that a separate technical support staff be hired to control, edit, and mange all video and sound equipment. This would include a part time person to be available during the recording times for lectures and panel discussions. Also, not having the appropriate equipment for video and sound editing is one of the major reasons for failure in using interactive video (Motamedi, 2002).

Video

The video system will be setup so that this person could manage all camera equipment and audio equipment and view what is going on in the classroom at the same time. A window between the two rooms will be provided. The best video solution for this environment would be to use a Pan/Tilt/Zoom camera with remote control ability. With this equipment the camera could maintain video images of the instructor with a 360-degree radius assuming the camera is

attached to the ceiling. Figure 7 shows this layout (see

Figure 7). This system provides for remote control and

other special features including the camera ability to lock

on to an instructor and follow. It is important in this

type of environment to use equipment and techniques leaned

in the cinematography industry and not to ignore lessons

for the world of video editing (Mazur, 2000).
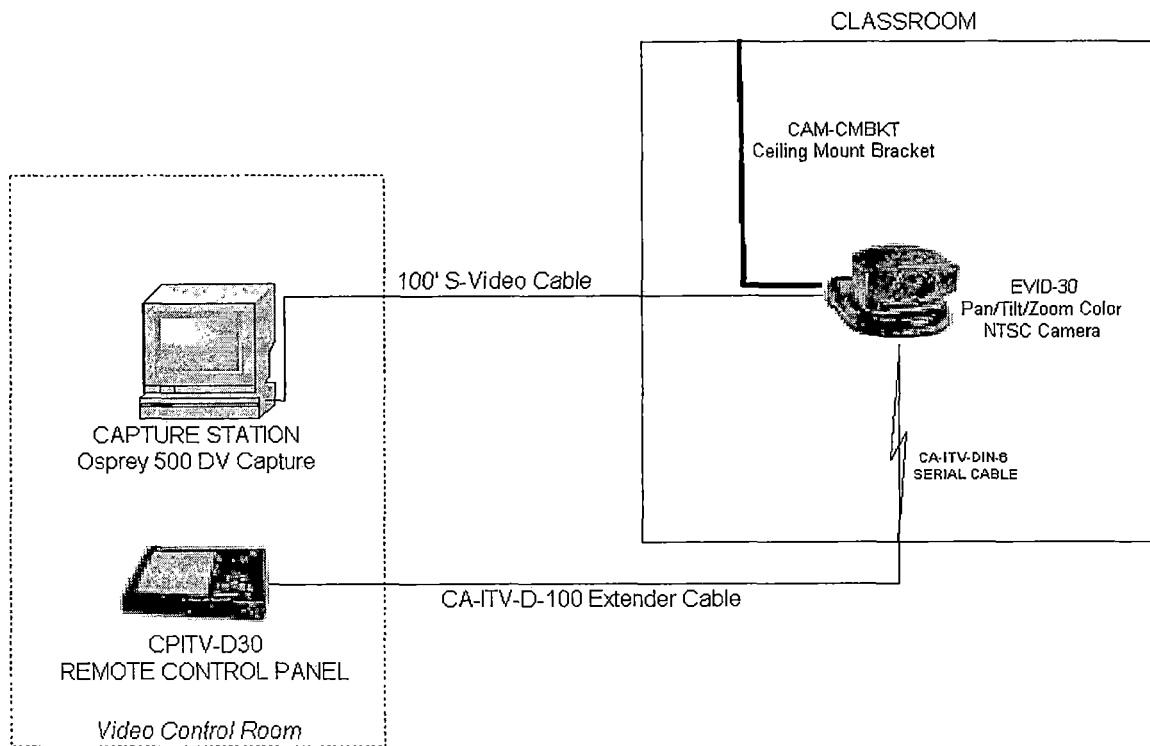
Figure 7. Sony Pan/Tilt/Zoom Camera System.

The other component to the video system is the

software and hardware setup required to implement a

solution for video streaming and archive. One of the best

solutions for education is a series of products from Real

Networks. This includes a high-end multimedia station with

a good video capture card. This system captures video input

from the Sony Camera and prepares the video for

transmission. This capture station would be equipped with

Real Presenter software which allows the integration of

PowerPoint slides and other technologies with the streaming

video. Once the video is prepared for transmission, the

video would be streamed to a Real Server +. This server is

capable of handling multiple connections and can also

archive the video and store the video for on demand

requests. All of these servers should be configures on a

high-speed Gigabit Ethernet backbone. This video server

would have to store the video on a system such as a Storage

Area Network (SAN). This storage system has the potential

storage capability large enough to handle several hours of

video and audio. This project proposes storing at least two

weeks of lectures and panel discussions. This equates to

roughly 20 hours of audio and video per week. A rough

estimate would be 4.5GB / Hour with Real Software

compression (this number changes depending on the download rate) would estimate the storage for this project to be at least 200 GB of storage. Of course the demand on these servers needs to be considered when choosing the correct server architecture. Hardware vendors have developed several solutions for video storage and streaming that should be considered. Another component that requires consideration is the establishment of an Internet connection that can handle the load potential of video applications. It is expected that the Internet connection for VPNs and web browsing will be handled by existing district access, however, video technology requires significant amounts of bandwidth. Initially, this project proposes a burstable T3 connection. This type of connection allows for a specific amount of data transfer at a regular sustained rate. Connections are still allowed to burst to the maximum data transmission, which in this case would be 45MBPS. Figure 8 illustrates the Real Networks System (see Figure 8).

STORAGE AREA NETWORK

Router

INTERNET

1000 MBPS ETHERNET

VIDEO   AUDIO

SERVER
REAL SERVER +
(60 CONNECTIONS)

CAPTURE STATION
REAL PRESENTER SOFTWARE
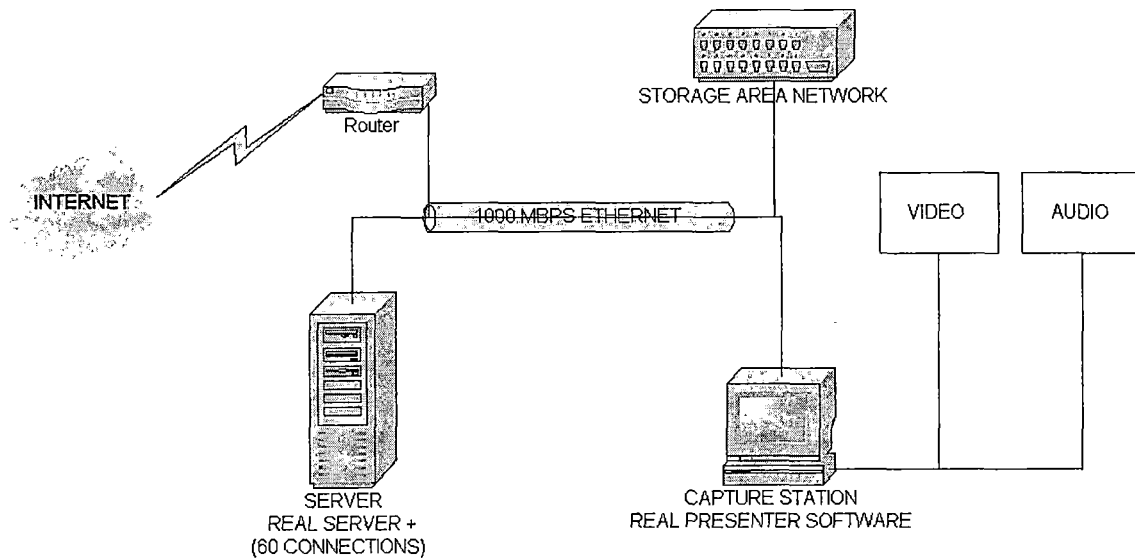
Figure 8. Real Networks Architecture.

Audio

The Real Networks system also supports streaming and

storing audio with the video system. However, a microphone

system needs to be setup in the classroom to support his

proposal. A wireless microphone system should be setup for

the instructor, while typical conference microphones should

be used in case students want to ask questions or

contribute to the discussion. Acoustically, the sound

system will be difficult, so a microphone amplifier system

with built in quality controls should be used prior to

inputting the audio into the capture system. Figure 9

details the necessary arrangement of equipment (see Figure

9). Shure is a leading audio retailer.
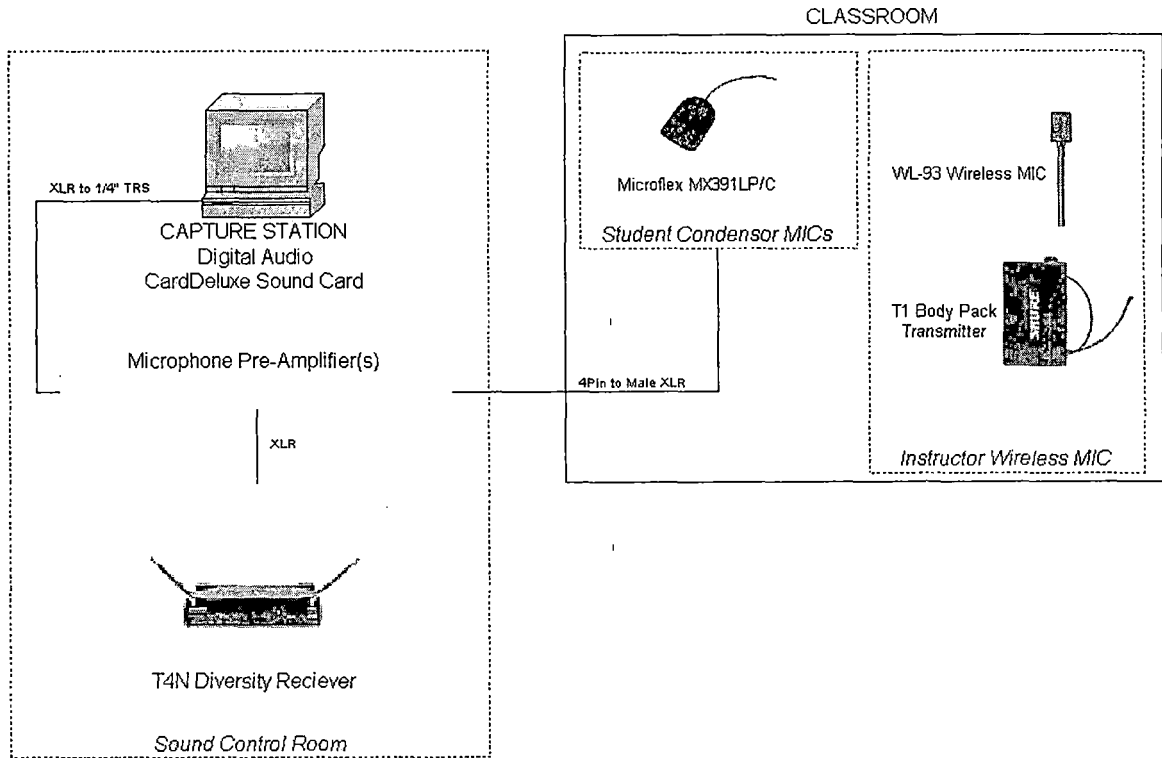
Figure 9. Shure Wireless Microphone Sound System.

CHAPTER FOUR

PROGRAM IMPLEMENTATION

Budget

Table 11 details the estimated first year expenses for the project (see Table 11).

Table 11.

Budget

Estimated Start-Costs	Amount
Development Costs	
350 Hours of Curriculum Development	$ 9,800.00
2800 Hours of Web Application Development	$ 75,000.00
Outside Software Consulting	$ 25,000.00
Vendor Certification Dues and Subscriptions	$ 7,500.00
Classroom Facility	
1st year of a burstable T3 connection (3MBPS average)	$ 28,000.00
Furniture, Tables, Chairs, etc… (use partial existing)	$ 75,000.00
Cabling Infrastructure	$ 25,000.00
Switches (partially existing)	$ 75,000.00
Routers and advanced Cisco Equipment (partially existing)	$ 75,000.00
Firewall with VPN support and unlimited	$ 20,000.00

connections

Laboratory Tools and Equipment	$	10,000.00

Audio and Video System		
Video Server	$	10,000.00
SAN Storage Unit	$	35,000.00
1000 Gigabit Infrastructure	$	10,000.00
Pan/Tilt/Zoom Color NTSC Camera	$	1,220.00
Telemetrics Control Panel	$	900.00
Cabling	$	400.00
Mounting Bracket (Ceiling)	$	100.00
Wireless MIC system	$	500.00
Audio Capture Card	$	595.00
Video Capture Card	$	900.00
2 Microphone Preamplifiers	$	4,000.00
12 Boundary Microphones	$	2,400.00
Cabling	$	500.00
Real System + (60 Users)	$	1,200.00
Real Presenter	$	200.00

Student Stations		
KVM Solution	$	16,000.00
KVM Cables	$	25,000.00
19" Monitors with Control Arms	$	24,000.00
40 Client Systems	$	80,000.00
40 Server Systems	$	120,000.00
Terminal Server / Licensing	$	14,000.00
Backplane / 40 PC on a Card CPUs	$	40,000.00

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Server Room		
4 UPS Systems	$	20,000.00
Compaq DISA System		
2 Clustered Web Servers	$	14,000.00
2 Clustered Data Servers	$	20,000.00
Software Licensing	$	25,000.00
6 other Servers (for MCSE Lab)	$	12,000.00
Total Estimated Start-up Costs	$	903,215.00
Estimated Annual Costs		
T3 Connection	$	28,000.00
Software upgrade / renewal	$	10,000.00
Subscriptions / Dues and Fees	$	10,000.00
Part – Time Tech Support	$	25,000.00
Part-Time Video Tech	$	25,000.00
Total Estimated Annual Costs	$	98,000.00

Calendar

Figure 10 displays a Gantt chart of the expected calendar for accomplishing the specific objectives specified in the program plan (see Figure 10).

Figure 10. Page One of Gantt Chart Using Specific
Objectives in the Program Plan.

ID	Task Name
34	Guided Activities
35	Develop Guidelines
36	Self-Guided Activities
37	Develop Guidelines
38	Other Equipment Package
39	Office Hours
40	Develop New Methods
41	Integrate Online
42	Submit Plan
43	Web-Based Registration
44	Examine College and State Policy
45	Develop Registration Process
46	Submit Process
47	Scheduling
48	Examine College and State Policy
49	Develop Template
50	Develop Publishing Process
51	Tracking System
52	Determine Reporting Requirements
53	Faculty Workload
54	Examine College and State Policy
55	Develop New Plan
56	New Plan Signed
57	Obtaining Qualified Faculty
58	Determine Minimum Qualifications
59	Develop Unique Pay Structure
60	Submit for Approval
61	Use Scheduling System
62	Contract Education
63	Research Training Needs
64	Develop Marketing
65	Schedule Contract Training
66	Run First Course

Project: Calendar

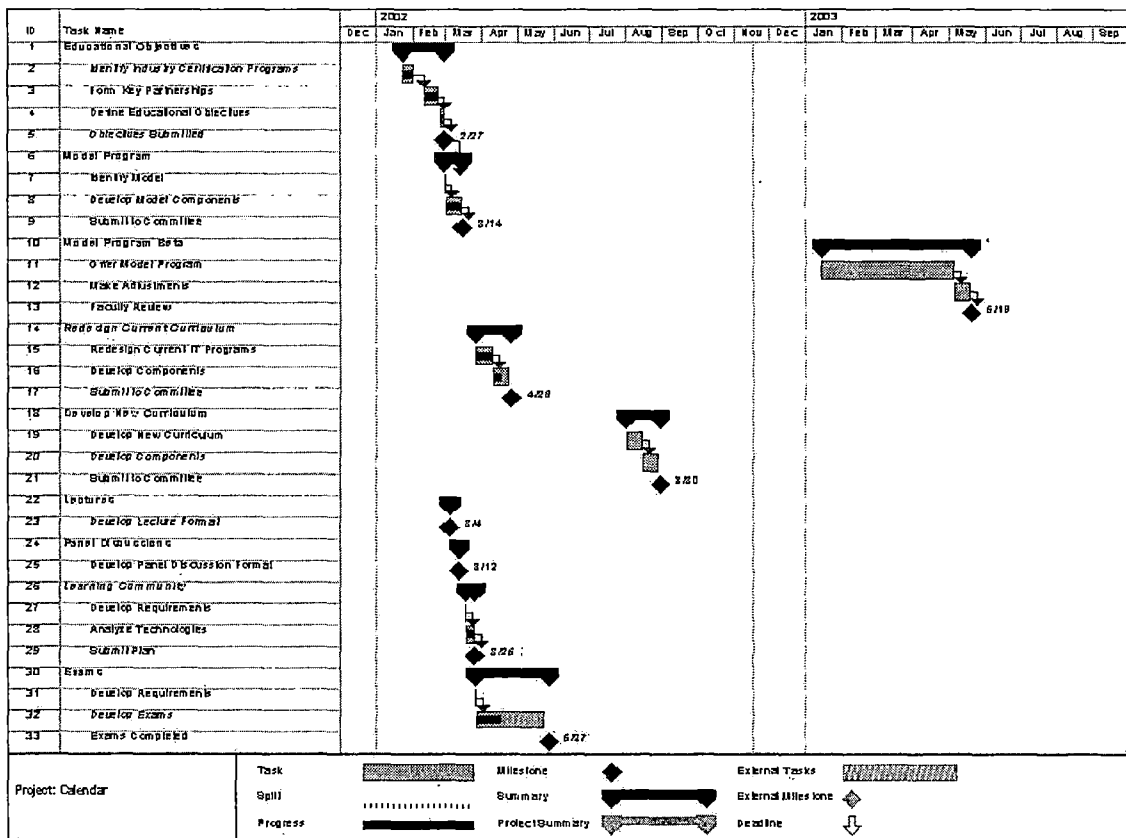|		Milestone	◆	External Tasks	
Task					
Split		Summary		External Milestone	◇
Progress		Project Summary		Deadline	⇩

Figure 11. Page Two of Gantt Chart Using Specific
Objectives in the Program Plan.

Figure 12. Page Three of Gantt Chart Using Specific Objectives in the Program Plan.

Program Evaluation

Nelson and Restauri (2002) indicate that in order for distance learning programs to be successful they must establish a plan for evaluating success. This project proposes an evaluation method that will primarily use a model based on evaluability assessment. This is primarily because the faculty and staff directly will be directly

involved in the development and implementation of the project program plan. Success of the program will be determined and a formative evaluation process that will include 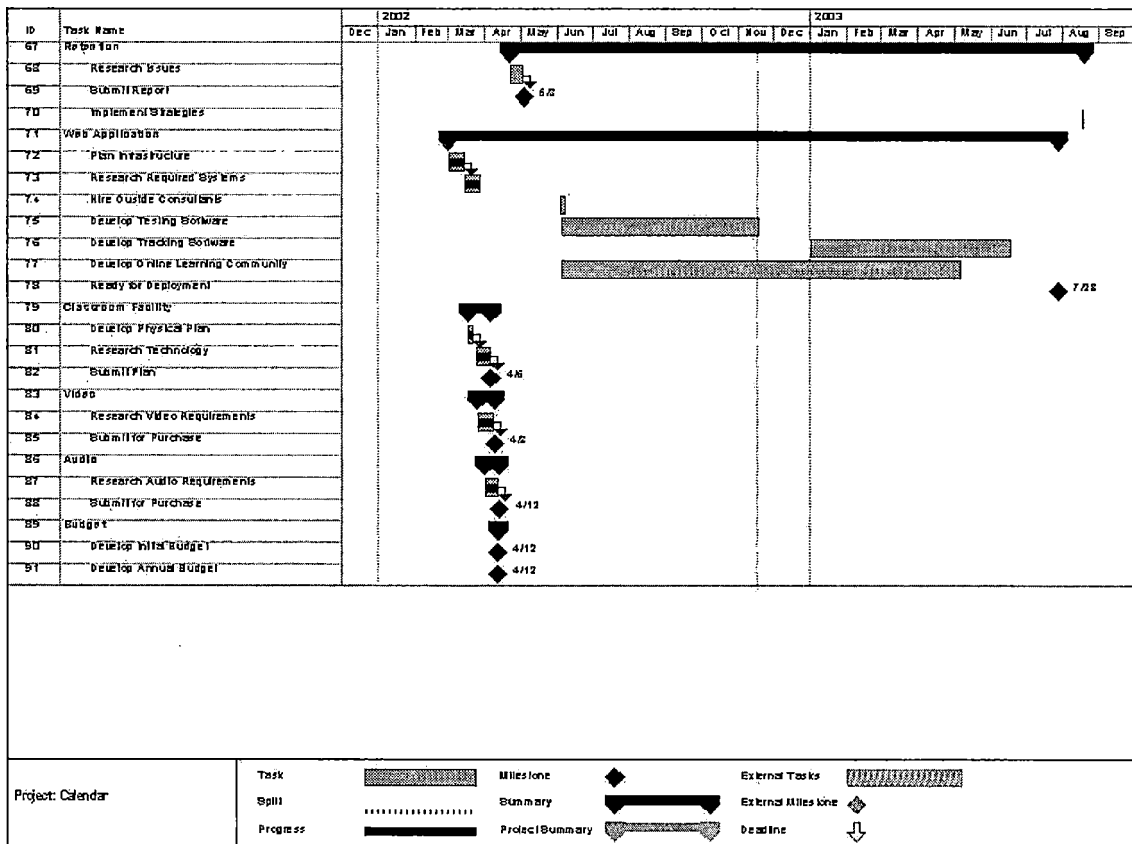participants from the Information Technology program at Mt. San Jacinto College will make suggestion for improvement. In addition, at the end of the first year the project an outside committee made up of local business partners from the Career Education Advisory Committee will measure goals for success. Grubb et al. (1998) argues for an advisory board as a participate in any educational evaluation process. The focus of this committee will be a summative evaluation that seeks to determine if this new program is helping to position the college as a source of Information Technology training in the region.

Formative Evaluation

Advisory Board Participants. The following members will participate on the evaluation committee:

- Dean of Career Education
- Department Chair of Computer Information Science
- Coordinator of Microsoft IT Academy Program, Cisco Academy, and other partnerships

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- All full time faculty in the Computer Information Science Department

- Instructional Technology Coordinator

- Distance learning Coordinator

Advisory Board Responsibilities. The following is a list of responsibilities of the committee:

- Review Objectives developed from vendor certifications and make suggestions for review by the Career Education Advisory Committee

- Review Model Program prior to submission to curriculum committee

- Evaluate results of Model Program Beta

- Review all curriculum developed for the program

- Evaluate guidelines created for each instructional method

- Review web registration process

- Review course scheduling process

- Review faculty workload solutions developed

- Discuss progress of contract education efforts

- Review completed software for online learning community

- Review technology plan and budget prior to submission for approval

This formative evaluation team will meet every first and third Friday of the month beginning on 1/1/02. This team will review all current progress, get an update on progress and make assignments as necessary. This team will be responsible for following the program plan. Once courses begin on 8/18/02, the team will meet once a quarter to review any technical issues, student progress and review results of tracking program for student success. This evaluation team will also be responsible for deciding on maximum program enrollment, new certification programs to add, and to review and create the schedule for lectures and panel discussions.

Summative Evaluation

The Career Education Advisory Committee will perform this evaluation. This is an already existing committee with members made up of the local business community. The evaluation from this committee will occur at annual intervals beginning with the end of the spring semester in 2004. This evaluation will include:

- An open discussion by members about the goals of the program. This committee will consider the goals and consider any changes in program direction

- The committee will review the results of a phone survey administered two weeks prior to the committee meeting date. This survey will include human resource and other business mangers in the local community.

- The committee will review any new market research and make suggestions for necessary changes in the program curriculum or delivery methods.

- The committee will make recommendations to the college.

CHAPTER FIVE

CONCLUSIONS AND

RECOMMENDATIONS

Conclusion

This project has developed a plan for making several

changes to the Information Technology program at Mt. San

Jacinto College. These changes have been recommended to

prepare the college for delivering quality technical

training to the community. To accomplish this the training

had to be evaluated for the ability to overcome several

barriers that prevent students and employers from taking

advantage of courses offered at the college. This project

proposes integrating distance learning technologies with

the current instructional model to introduce alternatives

for delivering necessary skills training to the future

Information Technology workforce in the region.

However, the current instructional model does not

support the flexibility required for students to

participate in this learning through distance technologies.

Consequently, this project proposes several changes in

instructional methodologies, technologies, and evaluation

methods in order to make this integration possible. A model

program is used as a tool in redesigning existing curriculum and creating new curriculum. The existing approach of linking educational objectives to vendor certification was retained, because of significant advantages. These included an already recognizable industry objective and benefits from partnerships established with vendors. This model is based on offering one half unit topics as preparation for fulfilling clear objectives tied to these certifications.

This project also proposes changes to the current instructional plan in order to facilitate new methodologies. These new methods of instruction include, streaming and on demand video, panel discussions, guided activities, and a unique two part examination process. The instructional plan is designed to overcome specific barriers to instruction including faculty load, scheduling, registration, and retention. In addition solutions are provided for obtaining part-time faculty and developing a contract training initiative. This plan provides for offering a range of activities and differing times accompanied by a pre-schedule lecture and panel discussion schedule available for student enrollment. This allows faculty to instruct in various topics and to share course

load without adversely effecting the instruction. This is accomplished by using hours per week as the instructional goal rather than number of students or units. The instructional plan also provides a framework for an online learning community, online enrollment and registration, and the ability for instructors to mentor students through online office hours. This community also tracks student progress and makes recommendations for future enrollments.

This instructional plan requires a technology plan in order to provide the necessary infrastructures for development. This project developed a technology plan that details the various technologies required to integrate distance learning. This includes a web application that integrates all of the features of the online learning community and provides a portal for marketing strategies and counseling and advisement. Other technologies include a classroom facility that supports remote access through VPN technologies and unique student workstation setup that allows for maximum flexibility in instruction. This project also focuses on the development of audio and video technologies for streaming content and the ability to archive content so that students can review previous lectures. Finally, the project provides a preliminary

budget for the purposes of identifying start-up costs and
an expectation for yearly maintenance.

Each of these modifications to the Information
Technology program at Mt. San Jacinto College are proposed
for the purpose of assisting the college in becoming a key
participate in economic and workforce development. An
evaluation process is proposed that involves faculty,
administration, and local business partners in assessing
the overall goals and objectives of the program plan.
After, initial implementation, it is hoped that this
project will continue to evolve until the ultimate goal of
advancing the economic success of southwest Riverside
County is realized.

Although this project used the goals of the Computer
Information Science department at Mt. San Jacinto College,
the process used in this project can be applied to
university and college programs seeking to implement
distance learning technologies to fulfill educational
objectives. Specifically, this project can be used to
assist other organizations successfully implement
Information Technology training. The process is defined by
a series of recommendations summarized in Table 12.

Table 12.

Recommendations for Distance Learning

Guidelines Learned from Literature Review	Recommendations for Other Institutions
Barriers to Implementing DL	
Lack of administrative support (NCES 1997). Uneven support (Grubb, 1996).	Develop a plan that considers major barriers to programmatic success.
Inability to get necessary authorization (NCES 1997). Curriculum development difficult (Grubb, 1996).	Develop strategies that comply with state and local requirements.
Unwillingness of colleges to adapt to new models (Grubb, 1996). Diffusion Theory (Rogers, 1985).	Begin with simplified model program.

Application of Distance Learning to Populations	
Increased needs of an aging student population (Kliener, 2001). Education is a life long pursuit (Nesbit, 1999). Older employed students (Nelson & Restauri, 2002). DL may be only option for some populations to gain valuable skills (Mariani, 2001). Traditional does not meet needs (Nelson & Restauri, 2002).	Create DL methodologies that consider the needs of specific populations. Use a combination of methods. Perform accurate needs assessment.
Difficult to reach non-traditional populations (Stone, 2001).	Create methods to transition non-traditional population to avoid disparities.
Concern that DL technology will create a disparity (Maxwell, 2000), (Selwyn & Gorard (2001). Bandwidth may exclude (Carswell, 1999). (Stone, 2001).	Provide variety of methods in both distance and in person formats to help students' transition. Combining of chat rooms, web interfaces, and phone with video to reduce bandwidth requirements. Online Kiosks for registration.

Establishing Partnerships with Industry and Local Business	
MSJC positioned to provide local businesses in Temecula with low cost human resources (Husing, 1998). Colleges play a key role in economic development (Grubb et al, 1998).	Determine economic needs of the region. Focus in on paramount need of local business.
Community College plays a significant role in reducing IT labor shortage (Mitchell et al., 1998).	Focus on key information technology job training.
Need to establish key partnerships (Sogunro, 2000). Partnering provides benefits (Maxwell, 2000).	Develop relationships with industry partners offering certification-training programs.
Businesses required different models for education (Pharr et al., 1998). Businesses willing to provide partnerships (Maxwell, 2000).	Creative customized offerings or combinations of smaller credit courses.
Businesses need specific skills and abilities (Pharr et al., 1998). Need to provide training for employers (Grubb et al., 1998). College need to help fulfill skills gap (Mitchell et al., 1998).	Focus on key training areas.

Faculty Issues	
Faculty required to get outside certifications (Nesbit, 1999).	Use certification as minimum requirement for employment.
Struggle with Hiring Part-Time faculty with expertise (Grubb et al., 1998).	Establish partnerships with local business. Creative use of contract education.
Consider alternative faculty load proposals (Grubb et al., 1998), (Stone, 2001). Compensation a barrier to success (Grubb, 1996), (Stone, 2001).	Load calculation based on minimum number of contact hours/week. Lecture time based on a enrollment criteria. Online interaction considered part of workload.
Need for appropriate staff development (Rodgers, 1995).	Alter teaching requirements to include only areas of specialty.
Faculty concerns over increased workload with DL (Hartman et al., 2000).	Adjustable rates of student contact hours depending on key factors including enrollment, type of activity, and online material available. Limitations of enrollment in instructional activities.

Curriculum Issues

Important to assess needs of students and community carefully (Grubb et al., 1998). Establish appropriate goals for DL (Nelson & Restauri, 2002).	Careful goal planning process. Establish, clear measurable and attainable goals. Rely on already established analysis by industry partners.
DL should have a career centered focus (Nesbit, 1999). Need for focus outside of transfer courses (Grubb et al., 1998). DL should be vocational (Waldman & Lange, 2002).	Establish key objectives for student achievement. Design curriculum around educational objectives. Tie program to industry certification programs.
Develop skill based competencies for DL programs (Badway & Grubb, 1997), (Hansen 1993), (Waldman & Lange, 2002).	Define clear skill based competencies that lead toward educational objective.
Local departments should handle DL not centralized (Stone, 2001).	Curriculum development process begins with faculty.
DL curriculum should be developed in stages (Nelson & Restauri, 2002).	Use industry certification as a model. Begin with model program.

Scheduling	
Need for proper sequencing of courses to maintain enrollment (Badway & Grubb, 1997).	Develop unique, smaller courses to provide flexibility in scheduling and sequencing.
Create clustered courses (Grubb, 1996).	Arrange smaller courses to map tightly with programmatic objectives.
Need for fast track courses (Mitchell et al., 1998).	Every course should be available every semester to allow for convenient and flexible scheduling.
Need for programs with easy entry points (Mitchell et al., 1998).	Smaller courses with objectives that tie in with the larger programmatic objective. Reduce the number of prerequisites. Creative registration of smaller courses.

Funding Issues	
Do not base DL funding on expectation of enrollment increase (Stone, 2001), (Salvati, 2002), (Motamedi, 2002). Colleges need to use aggressive funding tactics (Grubb et al., 1998). Creative Financing (Rogers, 1995).	Use of business contracts to support expensive credit programs.
Sharing Expenses between non-credit and credit programs (Grubb et al., 1998).	Use non-credit course in combination with credit courses to provide better pay rates for part-time faculty.

Instruction	
Establish learning communities (Grubb, 1996).	Development of a integrated web portal of learning environment and program information.
Need to have a variety of instructional methods (Secker, 2002) (Jewitt et al., 2001). Combine DL with traditional (Stone, 2001).	Use of multiple faculty for tope areas. Panel Discussions.
Visual and action orientated learning (Jewitt et al., 2001).	Skill-based examinations. Guided activities.

Need for instructional interaction (Beard & Harper, 2002). One on one Interaction (Denzine, 2002), (Stone, 2001).	Provide for traditional lecture formats. Online office hours.
Instructors as facilitators (Notar et al., 2002). Need to treat remote and in person audience the same (Mazur, 2000).	Guided Activities.
Frequent examinations tied to objectives (Jensen, 2002).	Smaller courses each tied in with a pass/fail exam objective. Frequent computer based examinations.
Self-Instructional models (Bergen, 2002).	Online lab activities. Self-guided CBT.
Facilities planning (Douglas & Gifford, 2001).	Adopt a facility plan that integrate each instructional opportunity and provides with optimal setting for video and other DL tools.
Web presence important (Mechitov et al., 2001).	Informational web site. Marketing efforts. Establishment of a web portal for online tools.

Need for Support Staff (Patrick, 1998). Instructor, Student experience with product and proper support staff (Mazur, 2000), (Motamedi, 2002).	Hire support staff to be available during all video sessions.
Video Alternatives such as 2D for low bandwidth (Patrick, 1998). Use of compression (Patrick, 1998). Low Quality due to bandwidth constraints (Mazur, 2000).	Combining of chat rooms, web interfaces, and phone with video to reduce bandwidth requirements.
Different requirements for application of video (Patrick, 1998). Levels of interactivity (Motamedi, 2002).	Allow for both live and recorded video.
Borrow cinematography concepts (Mazur, 2000).	Create video and sound editing room. Use accepted industry standard video and sound equipment.
Video provides excellent collaboration ability (Salvati, 2002).	Panel Discussions.
Avoid talking head and bad video practice (Motamedi, 2002).	Separate video facility with appropriate video editing equipment. Required staffing.

Counseling	
Failure to track students is a problem (Grubb, 1996). Little or no counseling in vocational programs (Grubb, 1996).	Define clear educational objectives to track student process successfully.
Evaluation	
Need for an advisory board (Grubb et al., 1998).	Create an advisory committee with key members from the college and local business.
Good evaluation process for DL critical (Nelson & Restauri, 2002). Evaluation process must be followed (Grubb et al., 1998).	Establish evaluability assessment with formative and summative components.

Recommendations

This project developed a model of instruction to be used to implement distance learning technologies with traditional instruction to produce a flexible means for students to receive instruction in Information Technology. There are several areas that could be focused on to implement this type of program in other areas of education. Application of this project to other areas of instruction besides technology might be of value. This instructional model might be extremely useful in an environment that does not require all the technology of an Information Technology course. An English course, for example, could be implemented without the high cost of lab equipment. An important accomplishment of this project that could apply to other fields is the development of a model that successfully creates education that can be tailored to the students' skill level, pace, and needs. This could be researched to develop alternative forms of education, especially as our society begins to rely more heavily on the Internet as a means of communication. Studies could also be done on the efficacy of self-paced learning and

whether or not having resources readily available in remote format attributes to success.

This project proposes a few instructional methodologies that could be improved upon with instructional technology. New developments in simulation software could alter the equipment requirements, or perhaps change the methods that students gain hands on experience. In addition, new distance learning methods that report on student progress could be used to provide even greater flexibility as far as scheduling is concerned. Another area that has not been addressed is that of funding. Several potential grants on economic development are available, and key partnerships could be created with corporations in order to provide this type of model, while limiting the direct costs of the College.

Also, this project did not address some key areas that might be of concern on modern campuses today. Specific legal issues, although dealt with have been avoided rather then altered or proposed in a different format. Research could be provided that develops new legal models for handling faculty workload, student contact hours, and scheduling. Another issue of concern is that of intellectual property. As faculty develop new systems for

distance learning and create new online presentations, whether by video or multimedia, there needs to be more research that proposes methods to identify ownership of these creations. This project also did not address the barrier students may have with technology, thus preventing them from participating. Another project could propose a series of courses designed to prepares students for this type of environment. Finally, there also has been little consideration to the issue of technical support required for delivery of distance learning courses. Research can be done on the possible improvement of quality by having more assistance from technical support personnel.

APPENDIX A:

CERTIFICATION TRACKS

Microsoft Certified Systems Administrator (MCSA)

Exam Objective(s):

Client Operating System Exams (One Required)
- Exam 70-210 Installing Configuring and Administering Microsoft Windows 2000 Professional
- Exam 70-270 Installing Configuring and Administering Microsoft Windows XP Professional

Networking System Exams Part I (One Required)
- Exam 70-215 Installing, Configuring, and Administering Microsoft Windows 2000 Server
- Exam 70-275 Installing, Configuring, and Administering Microsoft Windows .NET Server (not yet available)

Networking System Exams Part II (One Required)
- Exam 70-218 Managing a Microsoft Windows 2000 Network Environment
- Exam 70-278 Managing a Microsoft Windows .NET Server Network Environment (not yet available)

Elective Exams (One Required)
- Exam 70-216 Implementing and Administering a Microsoft Windows 2000 Network Infrastructure
- Exam 70-228 Installing, Configuring, and Administering Microsoft SQL Server 2000 Enterprise Edition
- CompTIA A+ and CompTIA Network+

Description:

The Microsoft Certified Systems Administrator (MCSA) on Microsoft Windows 2000 certification is designed for professionals who implement, manage, and troubleshoot existing network and system environments based on the Microsoft Windows® 2000 and Windows .NET Server platforms.

Exam Objective Notes

- Other exams are available to complete the necessary requirements for this certification. For a more complete list refer to www.microsoft.com
- Courses for the CompTIA elective option are offered at the San Jacinto Campus. Successful completion of all course requirements is required for this option

Local Requirements

Obtain local certificate in MCSA technologies by successfully passing all ½ unit topics in the exam objectives

Microsoft Certified Database Administrator (MCDBA)

Exam Objective(s):

SQL Server Administration Exams (One Required)
- Exam 70-228 Installing, Configuring, and Administering Microsoft SQL Server 2000 Enterprise Edition

SQL Server Design Exams (One Required)
- Exam 70-229 Designing and Implementing Databases with Microsoft SQL Server 2000 Enterprise Edition

Network Systems Exams (One Required)
- Exam 70-215 Installing, Configuring, and Administering Microsoft Windows 2000 Server
- Exam 70-275 Installing, Configuring, and Administering Microsoft Windows .NET Server (not yet available)

Elective Exams (One Required)

- Exam 70-216 Implementing and Administering a Microsoft Windows 2000 Network Infrastructure

Description:
The Microsoft Certified Database Administrator (MCDBA) credential is the premier certification for professionals who implement and administer Microsoft SQL Server™ databases.

Exam Objective Notes
- Other exams are available to complete the necessary requirements for this certification. For a more complete list refer to www.microsoft.com

Local Requirements
Obtain local certificate in MCDBA technologies by successfully passing all ½ unit topics in the exam objectives

Microsoft Certified Systems Engineer (MCSE)
Exam Objective(s):
Client Operating System Exams (One Required)
- Exam 70-210 Installing Configuring and Administering Microsoft Windows 2000 Professional
- Exam 70-270 Installing Configuring and Administering Microsoft Windows XP Professional

Networking System Exams Part I (One Required)
- Exam 70-215 Installing, Configuring, and Administering Microsoft Windows 2000 Server
- Exam 70-275 Installing, Configuring, and Administering Microsoft Windows .NET Server (not yet available)

Networking System Exams Part II (One Required)
- Exam 70-216 Implementing and Administering a Microsoft Windows 2000 Network Infrastructure
- Exam 70-276 Implementing and Administering a Microsoft .NET Server Network Infrastructure (not yet available)

Networking System Exams Part III (One Required)
- Exam 70-217 Implementing and Administering a Microsoft Windows 2000 Directory Services Infrastructure
- Exam 70-277 Implementing and Administering a Microsoft .NET Server Directory Services Infrastructure (not yet available)

Core Design Exams (one required)
- Exam 70-219 Designing a Microsoft Windows 2000 Directory Services Infrastructure
- Exam 70-220 Designing Security for a Microsoft Windows 2000 Network
- Exam 70-221 Designing a Microsoft Windows 2000 Network Infrastructure
- Exam 70-226 Designing Highly Available Web Solutions with Microsoft Windows 2000 Server Technologies

Elective Exams (two required)
- Exam 70-229 Designing and Implementing Databases with Microsoft SQL Server 2000 Enterprise Edition
- Exam 70-228 Installing, Configuring, and Administering Microsoft SQL Server 2000 Enterprise Edition
- Exam 70-219 Designing a Microsoft Windows 2000 Directory Services Infrastructure
- Exam 70-220 Designing Security for a Microsoft Windows 2000 Network
- Exam 70-221 Designing a Microsoft Windows 2000 Network Infrastructure
- Exam 70-226 Designing Highly Available Web Solutions with Microsoft Windows 2000 Server Technologies
- Exam 70-218 Managing a Microsoft Windows 2000 Network Environment

Description:
The Microsoft Certified Systems Engineer (MCSE) credential is the premier certification for professionals who analyze the business requirements and design and implement the infrastructure for business solutions based on the Microsoft Windows® 2000 platform and Microsoft server software.

Exam Objective Notes
- Other exams are available to complete the necessary requirements for this certification. For a more complete list refer to www.microsoft.com
- Exams cannot be used twice for completion of requirements

Local Requirements
Obtain local certificate in MCSE technologies by successfully passing all ½ unit topics in the exam objectives

Microsoft Certified Applications Developer (MCAD)
Exam Objective(s):
Web Application Development (One Required)
- Exam 70-305 Developing and Implementing Web Applications with Microsoft Visual Basic .NET and Microsoft Visual Studio .NET

Windows Application Development (One Required)
- Exam 70-306 Developing and Implementing Windows-based with Microsoft Visual Basic .NET and Microsoft Visual Studio .NET

Web Services and Server Components (One Required)
- Exam 70-310 Developing XML Web Services and Server Components with Microsoft Visual Basic .NET and the Microsoft .NET Framework

Elective Exams (One Required)
- Exam 70-229 Designing and Implementing Databases with Microsoft SQL Server 2000 Enterprise Edition

Description:
The Microsoft Certified Application Developer (MCAD) for Microsoft .NET credential is for professionals who use Microsoft technologies to develop and maintain department-level applications, components, Web or desktop clients, or back-end data services

Exam Objective Notes
- Other exams are available to complete the necessary requirements for this certification. For a more complete list refer to www.microsoft.com

Local Requirements
Obtain local certificate in MCAD technologies by successfully passing all ½ unit topics in the exam objectives

Cisco Certified Network Associate (CCNA)
Exam Objective(s):
- Exam 640-607 CCNA

Description:
The CCNA certification (Cisco Certified Network Associate) indicates a foundation in and apprentice knowledge of networking for the small office/home office (SOHO) market. CCNA certified professionals can install, configure, and operate LAN, WAN, and dial access services for small networks (100 nodes or fewer), including but not limited to use of these protocols: IP, IGRP, IPX, Serial, AppleTalk, Frame Relay, IP RIP, VLANs, RIP, Ethernet, Access Lists.

Exam Objective Notes

The Cisco Certified Network Associate exam (CCNA) is the only exam required to achieve a CCNA Routing and Switching certification.

Local Requirements

Obtain local certificate in CCNA technologies by successfully passing all ½ unit topics in the exam objectives

Cisco Certified Network Professional (CCNP)

Exam Objective(s):

- Exam 640-607 CCNA
- Exam 640-503 Routing
- Exam 640-504 Switching
- Exam 640-505 Remote Access
- Exam 640-506 Support

Description:

The CCNP certification (Cisco Certified Network Professional) indicates advanced or journeyman knowledge of networks. With a CCNP, a network professional can install, configure, and operate LAN,WAN, and dial access services for organizations with networks from 100 to more than 500 nodes, including but not limited to these protocols: IP, IGRP, IPX, Async Routing, AppleTalk, Extended Access Lists, IP RIP, Route Redistribution, RIP, Route Summarization, OSPF, VLSM, BGP, Serial, Frame Relay, ISDN, ISL, X.25, DDR, PSTN, PPP, VLANs, Ethernet, Access Lists, 802.10, FDDI, Transparent and Translational Bridging.

Objective Notes

- Students may take Exam 640-900 BSCI instead of Exam 640-503 Routing
- MSJC does not offer courses for preparation of Exam 640-900 BSCI
- Students may take Exam 640-509 Foundations instead of the three exams Exam 640-503 Routing, Exam 640-504 Switching, and Exam 640-505 Remote Access

Local Requirements

Obtain local certificate in CCNP technologies by successfully passing all ½ unit topics in the exam objectives

Certified Internet Web Master Associate (CIW Associate)

Exam Objective(s):

- CIW Foundations Exam (1D0-410)
OR
- INET+ Examination from CompTIA

Description:

The CIW Associate has the basic hands-on skills and knowledge that an Internet professional is expected to understand and use. Foundations skills include basic knowledge of Internet technologies, network infrastructure, and Web authoring using HTML

Objective Notes

- Students may also qualify for the CIW Associate exam by passing the INET+ examination offered by CompTIA. Courses to prepare for the INET+ examination are available at the San Jacinto Campus

Local Requirements

Obtain local certificate in CIW Associate technologies by successfully passing all ½ unit topics in the exam objectives

Certified Internet Web Master Designer (CIW Designer)

Exam Objective(s):

CIW Associate Requirement (One Required)
- CIW Foundations Exam (1D0-410)

OR
- INET+ Examination from CompTIA

CIW Site Designer Requirement
- Exam 1D0-420

CIW E-Commerce Designer Series
- Exam 1D0-425

Description:

After completion of the CIW Associate Certificate students may obtain the designer certification by passing exams in Site Designer and E-Commerce Designer technologies

Objective Notes

- Students may also qualify for the CIW Requirement by passing the INET+ examination offered by CompTIA. Courses to prepare for the INET+ examination are available at the San Jacinto Campus
- Other exams are available to complete the necessary requirements for this certification. For a more complete list refer to www.ciwcertified.com

Local Requirements

Obtain local certificate in CIW Associate technologies by successfully passing all ½ unit topics in the exam objectives

APPENDIX B:

EXAM OBJECTIVES FOR CISCO CERTIFIED NETWORK

ASSOCIATE

Exam Objective 640-607 CCNA
Total Number of Topics Required: 22
Total Units Required to Complete: 11

List of Required ½ Unit Topics

Beginning Topics (to be completed first)

Introduction to the TCP/IP Protocol Stack

- Identify the functions of the TCP/IP network-layer protocol.
- Identify the functions performed by ICMP.

Introduction to LAN Design

- Describe full- and half-duplex Ethernet operation.
- Describe network congestion problem in Ethernet networks.
- Describe the features and benefits of Fast Ethernet.
- Describe the guidelines and distance limitations of Fast Ethernet.

Improving LAN Performance using Segmentation

- Describe the advantages of LAN segmentation.
- Describe LAN segmentation using routers.
- Describe LAN segmentation using switches.
- Describe LAN segmentation using bridges.
- Describe the benefits of network segmentation with bridges.
- Describe the benefits of network segmentation with routers.
- Describe the benefits of network segmentation with switches.

Introduction to the OSI Model

- Describe data link and network addresses and identify key differences between them.
- Define and describe the function of the MAC address.
- List the key internetworking functions for the OSI Network layer.
- Identify at least three reasons why the industry uses a layered model.
- Describe the two parts of network addressing; then identify the parts in specific protocol address examples.
- Define and explain the five conversion steps of data encapsulation.
- Describe connection-oriented network service and connectionless network service, and identify their key differences.
- Identify the parts in specific protocol address examples.

Introduction to Cisco Routers

- Examine router elements.

Core Topics (to be completed second)

Introduction to Routing

- Define flow control and describe the three basic methods used in networking.

The Basics of LAN Switching
- Name and describe two switching methods.
- Distinguish between cut-through and store-and-forward LAN switching.

Configuration of LAN Switches
- Describe the benefits of virtual LANs.

Introduction to Network addressing
- Configure IP addresses.
- Verify IP addresses.
- List the required IPX address and encapsulation type.

Managing Cisco IOS Configuration Files
- Manage configuration files from the privilege EXEC mode

Basic Cisco IOS Configuration
- Log in to a router in both user and privilege modes.
- Check an initial configuration using the setup command.
- Control router passwords, identification, and banner.
- Use the context-sensitive help facility.
- Use the command history and editing features.

Basic IP Configuration in Cisco IOS
- Prepare the initial configuration of your router and enable IP.

Managing Cisco IOS Software Images
- Prepare to backup, upgrade, and load a backup Cisco IOS software image.
- List the commands to load Cisco IOS software from: Flash memory, a TFTP server, or ROM.

Managing Cisco IOS Startup
- Identify the main Cisco IOS software commands for router startup.
- Password Recovery

Advanced Topics (to be completed last)

Configuration of Spanning Tree Protocol
- Describe the operation of the Spanning Tree Protocol and its benefits.

Subnetting
- Describe the different classes of IP addresses (and subnetting).

The RIP Protocol
- Add the RIP routing protocol to your configuration.
- List problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the   number of these problems.

The IGRP Protocol
- Add the IGRP routing protocol to your configuration.

- List problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the number of these problems.

Understanding Frame Relay

- Recognize key Frame Relay terms and features.
- List commands to configure Frame Relay LMIs, maps, and subinterfaces.
- List commands to monitor Frame Relay operation in the router.

Understanding ISDN

- State a relevant use and context for ISDN networking.
- Identify ISDN protocols, function groups, reference points, and channels.

Understanding PPP

- Identify PPP operations to encapsulate WAN data on Cisco routers.

Managing Cisco Access Lists

- Configure standard access lists to filter IP traffic.
- Configure extended access lists to filter IP traffic.
- Monitor and verify selected access list operations on the router.

APPENDIX C:

SAMPLE COURSE OUTLINE OF RECORD

Integrated Course Outline of Record

MT. SAN JACINTO COMMUNITY COLLEGE DISTRICT
1499 NORTH STATE STREET
SAN JACINTO, CA 92583

Course Title: Understanding Subnetting

Course Number: CSCO XXX

Semester Units: 0.5   Semester I   8   Week/Lecture: 0.5   Week/Lab:

Catalog Description:
The goal of this course is to provide individuals in the networking program the concepts necessary to understand how to subnet IP networks.

Need / Justification:
This course is part of an integrated series of courses designed to help students prepare for certification in the network industry.

Prerequisite/s (Requisites):
ADVISORY: Understanding of IP addressing and TCP/IP is highly recommended

Short Description for the class schedule:
This course is designed to teach students in the networking program how to subnet IP networks

Learning Objectives:
Upon the completion of the course the student will be able to do the following:
A. Examine and describe the reasons for subnetting IP networks
B. Differentiate between classful addressing and CIDR
C. Understand applications of subnet design
D. Apply subnetting concepts

Course Content:

Textbook:

Required: None
_____
(Author)

_____
(Title)

_____
(Publisher)   (Edition)

Other Reference Materials/ Supplies:
None

Methods of Instruction:
A. Lecture on concepts related to subnetting including CIDR and subnet design
B. Panel Discussion on common subnetting problems and design issues
C. Guided Activities which allow students to apply subnetting concepts
D. Evaluation

C. Guided Activities which allow students to apply subnetting concepts
D. Evaluation

Methods of Evaluation:

Grading Policy
A. Methods of Evaluation

1. Computer Adaptive Test on subnetting. This will include scenario questions ins multiple-choice format.
2. Skill Based Examination. This will be a hands on exam in which students will demonstrate their ability to subnet IP networks.

B. Frequency of Evaluation

1. Computer Adaptive Test at course completion
2. One Skill Based Exam at course completion

Example of Assignments:
See attached Computer Adaptive Test Pool and Subnetting Skill-Based Examinati

Course Number: CSCO XXX   New: 4/16/2002

APPENDIX D:

SAMPLE DISTANCE LEARNING ADDENDUM

Course Title: Understanding Subnetting

Course Number: CSCO XXX

Need / Justification:

The intentions for offering this course by distance learning is summarized in the following:

- To make the course available for students who are unable to attend course in person at regularly scheduled times

- To allow students to take the course material at their own pace

- To provide an opportunity for students with the appropriate technology to study form home or at work

Many students in the networking program are either working in the Information Technology field or are seeking to transition into a new career. Consequently students are faced with the difficultly of managing attendance to a regularly schedule course. By offering this course via distance learning technologies it is expected that students will be able to:

- Receive instruction either synchronously through streaming video or asynchronously through video on demand technologies or computerized course content

- Perform guided activities as a self paced exercise with the appropriate equipment at home or participate remotely through Virtual Private Network (VPN) technologies

- Participate in panel discussions through computer mediated communication

Methods of Instruction (Instructor – Student Contact):

Regular Contact

Students will be required to maintain regular contact with the instructor via an online learning community. This will include the following components:

- Email and ListServ

- Newsgroup

- Chatroom

- Online Office Hours

Students contact will be establish though the following forms:

1. Students must attend an examination in person at course completion. This examination will not be different then the evaluation detailed in the course outline of record. This will be a 1 hour examination.

2. Students will be required to specify a specific time to perform the guided activities as a VPN connection, OR, submit a guided activity summary if performing the activity on their own equipment. Guided activities require 4 hours.

3. Students will participate in an online panel discussion or attend in person. Panel discussions require 1 hour.

4. Students will view lectures online though video or attend in person. Students can also review online curriculum for lecture content. Lectures require 2 hours.

Total hours of instruction: 8

Students having difficulty will have opportunities to communicate with faculty through an online learning community or contact instructors during office hours. Students' progress will also be monitored through a tracking system. Students that have not reported activity or scheduled the examination will be contacted.

Assignments:

Students will be required to study material online or in a lecture in order to prepare properly for the computer adaptive examination at the end of the course. Students will also be required to study a practical application of the technology through a guided activity. This will prepare them for the skill-based examination at the end of the course.

Methods of Evaluation:

The evaluation methods are not altered form the course outline of record.

Technical Support:

Students will be provided access to an online learning community for support an typical issues students might encounter. Students are also asked to attend a seminar when they enter into the program. At the seminar, students are introduced to the technology and the faculty they will be working with.

Faculty are also being assigned instruction time specifically to work with online students.

Instructional Material and Resources:

Students will access all material through a web site. This will require Internet access.
Students electing to take this course through distance learning must also meet specific technology requirements.

Student Services:

Students will receive some counseling and advisement through online office hours and a learning community.

Other student services are available, such as counseling and DSP, by contacting the appropriate office.

Accommodations for Students with Disabilities:

Arrangements will be made with the DSP office for examinations, video lecture, and other resources.

Class Size:

Class size is limited only to the number of students in the program

APPENDIX E:

SAMPLE QUESTIONS FOR ADAPTIVE TESTING

Sample Questions for Adaptive Testing

CSCO XXX
Test Bank of TCP/IP and Subnetting Questions

Question 1
Type: Multiple Choice
Difficulty: TBD
Convert the following IP address into binary notation:
10.4.1.132
    A. 00001010.00000100.00000001.10000100
    B. 10100000.10000000.10000000.10000001
    C. 00001010.00000100.00000010.11000001
    D. 01000000.00000100.00000010.11000001
Points: 10
Answer: A

Question 2
Type: Multiple Choice
Difficulty: TBD
Convert the following binary IP address into dotted decimal notation:
10010110. 00110100.00001000. 11111100
    E. 140.52.8.252
    F. 150.52.8.252
    G. 252.8.52.150
    H. 140.252.8.52
Points: 10
Answer: B

Question 3
Type: Multiple Choice
Difficulty: TBD
The IP address 180.1.1.1 is in what address class?
    A. Class A
    B. Class B
    C. Class C
    D. Class D
Points: 10
Answer: B

Question 4
Type: Multiple Choice
Difficulty: TBD
Which of the following statements is a true when considering TCP/IP as a protocol?
    A. Every host, including each router interface must have an IP
       address.
    B. The subnet mask serves as the "gateway of last resort" for IP
       hosts trying to connect to the Internet.
    C. IPv4 addresses are 128 bit.
    D. Every host on a subnet must have a unique subnet mask.
Points: 10
Answer: A

Question 5

Type: Multiple Choice
Difficulty: TBD
What is the default subnet mask for a Class B IP address?
    A. 255.0.0.0
    B. 255.255.0.0
    C. 255.255.255.0
    D. 255.255.255.255
Points: 10
Answer: B

Question 6

Type: Multiple Choice
Difficulty: TBD
Which of the following IP addresses is valid for use on a host machine?
    A. 127.0.0.1
    B. 0.0.0.0
    C. 300.1.1.10
    D. 11.255.1.7
Points: 10
Answer: D

Question 7

Type: Multiple Choice
Difficulty: TBD
You have been assigned the network ID 204.200.1.0 /24 for your network. You require 4 valid subnets and need at least 20 hosts per network. Which subnet mask should you use? Note: The routers in your network are not configured to support addresses ranges that identify both a global network ID and a subnet ID. For example 204.200.1.0 cannot be both a network ID and a subnet ID.
    A. 255.255.255.192
    B. 255.255.255.224
    C. 255.255.255.240
    D. 255.255.255.248
Points: 10
Answer: B

Question 8

Type: Multiple Choice
Difficulty: TBD
If you are using a network ID of 192.168.1.0 with a /28, then how many subnets do you have (both valid and invalid)?
    A. 4
    B. 8
    C. 16
    D. 32
Points: 10
Answer: C

Question 9

Type: Multiple Choice
Difficulty: TBD
You are using a network ID of 192.168.1.0 with a /28, how many valid host addresses do you have per subnet?

    A. 8
    B. 16
    C. 14
    D. 30
Points: 10
Answer: C

Question 10

Type: Multiple Choice
Difficulty: TBD
You are using a network ID of 192.168.1.0 with a /28, what would be the first valid range of host IP addresses (assume nothing special is going on at the router)?

    A. 192.168.1.0 - 192.168.1.15
    B. 192.168.1.16 - 192.168.1.31
    C. 192.168.1.32 - 192.168.1.63
    D. 192.168.1.8 - 192.168.1.15
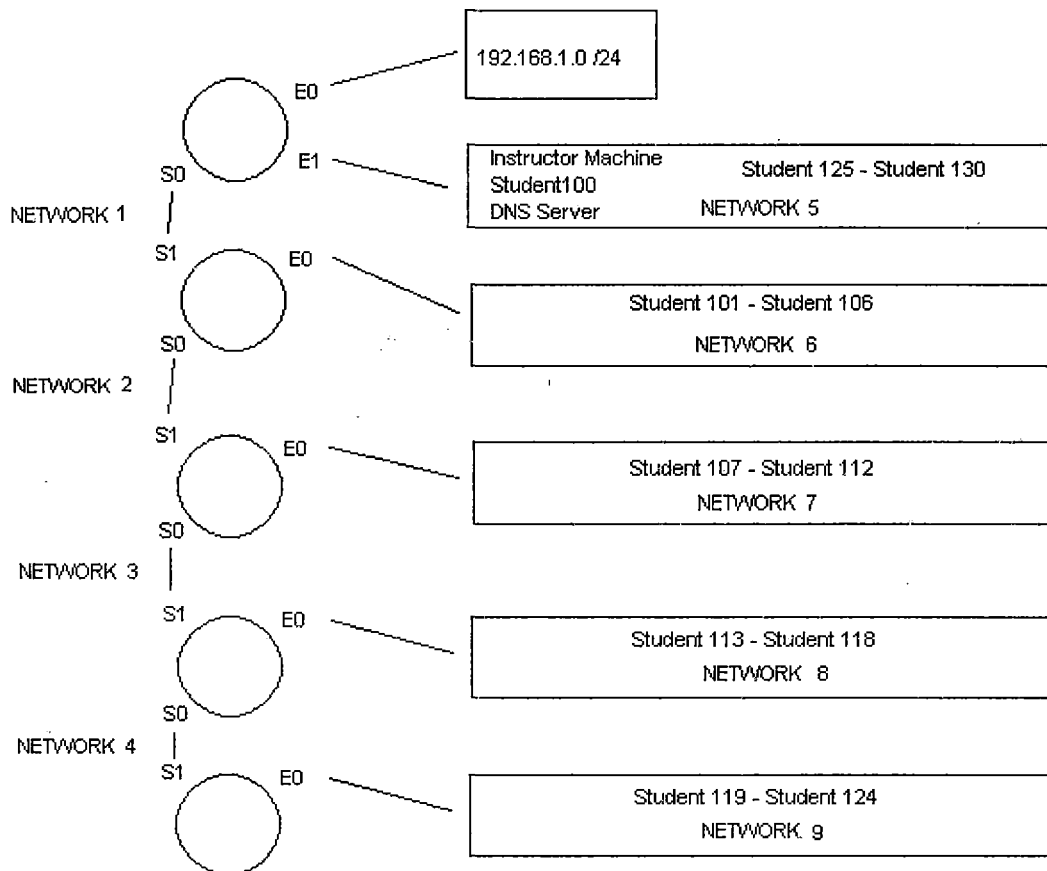Points: 10
Answer: B

APPENDIX F:

SAMPLE SKILL-BASED EXAMINATION

Sample Skill-Based Examination

CSCO XXX
Skill-Based Examination

Consult the following network diagram:

You are the network administrator for this classroom and have been asked to appropriately assign a manual IP configuration to all of the machines in this network.

You have been given the IP range of **192.168.12.0 /24**. You need to create a subnetting scheme that will fulfill the IP needs of this network. Consider the following rules:

Network 1 should be assigned the first valid subnet. Network 2 should be assigned the second valid subnet, etc…

E0 on all routers should be assigned the first available IP address in a subnet.

The lowest numbered machine receives the lowest remaining IP address in a subnet.

APPENDIX G:

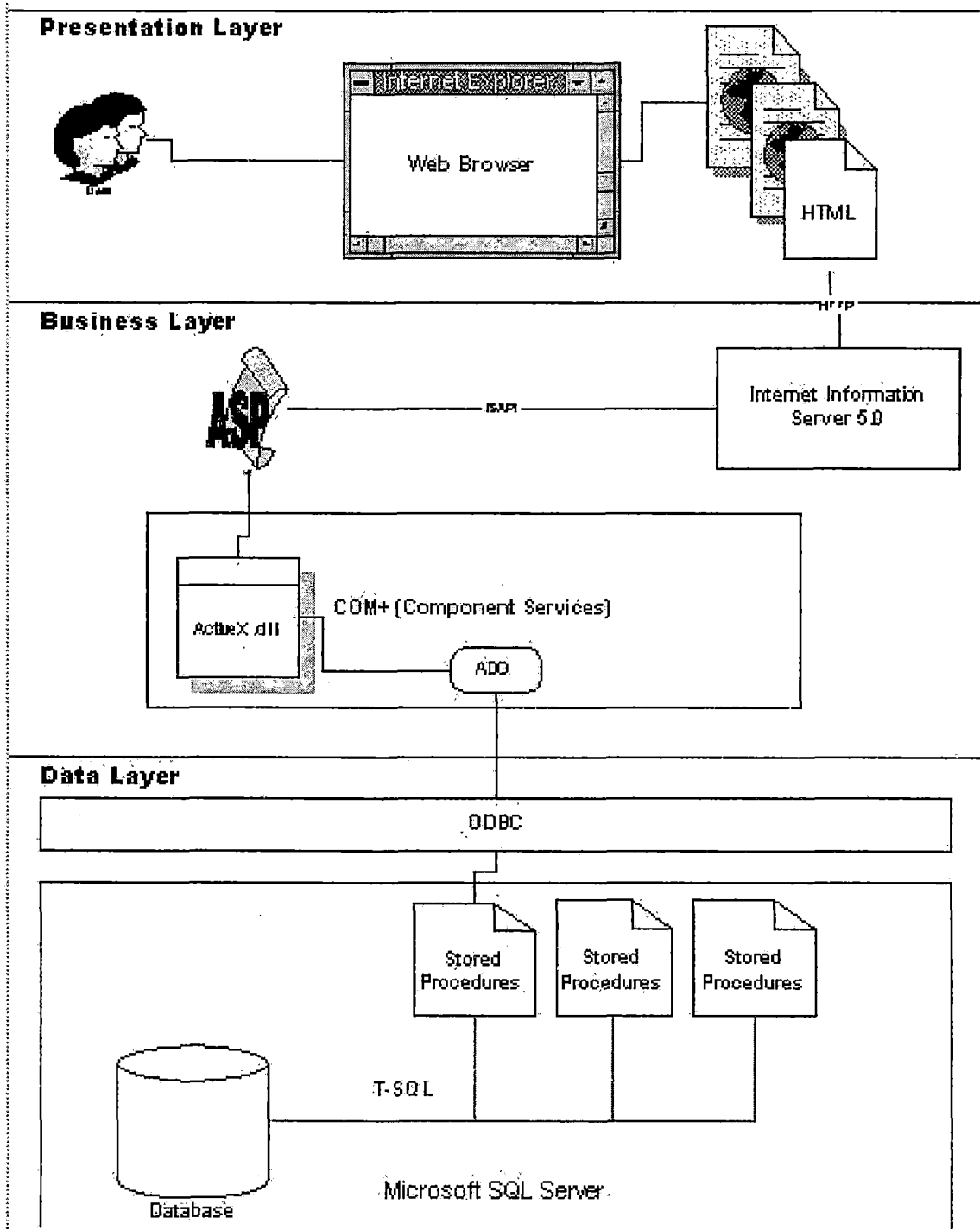SAMPLE SELF-GUIDED ACTIVITY EQUIPMENT REQUIRMENTS

Sample Self Guided Activity Equipment Requirements

Student wanted to perform guided activities from home would have different requirements depending on the certification track or program of study that they are enrolled in. The following list would be the basic requirements for most courses:

- A dedicated Internet Connection with a static IP address. The connection would need to be at least 128Kbps.

- A server with a RAID card and three SCSI drives. The server would be required to be at least a 1Ghz processor and 512MB RAM

- A client with a minimum of a 1Ghz processor and 256 MB RAM

APPENDIX H:

SAMPLE THREE TIER APPLICATION ARCHITECTURE

Presentation Layer

Web Browser

Internet Explorer

HTML

HTTP

Business Layer

ASP

ISAPI

Internet Information
Server 5.0

COM+ (Component Services)

ActiveX .dll

ADO

Data Layer

ODBC

Stored
Procedures

Stored
Procedures

Stored
Procedures

T-SQL

Database

Microsoft SQL Server

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