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Establishing Cisco Academy at San Bernardino High School

La Mont Alfredo Carroll

ESTABLISHING CISCO ACADEMY AT SAN BERNARDINO HIGH SCHOOL

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Career and Technical Education

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by

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Approved by:

[redacted]

Joseph A. Scarcella, Ph.D., First Reader — Date 5/6/02

[redacted]

Ronald K. Pendleton, Ph.D., Second Reader

ABSTRACT

The purpose of this project was to establish a CISCO program at San Bernardino High School. This program facilitates students matriculating with the program being taught at San Bernardino Valley College. Students earn certification as a Cisco Certified Networking Associate (CCNA) at the high school level and can continue at community college to earn the Cisco Certified Networking Professional (CCNP) certification. Establishing this program would reduce the amount of truancies and high school dropouts. This program has shown substantial results at reducing students' dropout and lethargy

Computer Networking Professional and Technicians are projecting a shortage of trained IT professional. San Bernardino County Schools Superintendent Dr. Herbert Fischer and local government official intend to fill this void by training students in the Inland Empire along with Cisco Systems, Inc.

Establishing a Cisco Academy at San Bernardino High School would provide industry certification and help increase some students' self-esteem. Modification to the required curriculum was necessary to ensure successful completion rates.

Vocational education programs have resulted in the reduction in the dropout rate and documented evidence is available by researcher such as Grassco and Shea. Cisco training meets all of the needs of SCANS, language arts and Math standards. These programs were positive solution to reducing students' dropping out and funding for these programs should not be curtailed. Although much of the research is dated, further research on this topic was vehemently recommended.

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Cisco System, Inc.

DEDICATION

I dedicate this thesis to my mother Mary Ellen Carroll who has insisted on my completing this degree program while supporting me with caring love.

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CHAPTER ONE

BACKGROUND

Introduction

This project was developed in order to establish a CISCO academy at San Bernardino High School. The program implementation was designed for students seeking an entry-level computer networking employment within the computer industry. Chapter one was an overview of this project. The context of the problem was synthesized from similar studies, significant of the project, and assumptions. Subsequently, the limitation and delimitation that affect this project were discussed.

Context of the Problem

There will be a significant shortage of trained networking technicians over the next decade. This group was expected to grow 44.5 percent by 2005, about 23,000 jobs (Local Area Networking-Related, 2001). CISCO Systems, Inc. discovered there were insufficient amounts of trained technicians and decided to develop a training program in concert with the educational system.

Research suggests that CISCO Corporation established programs with educational institutions to fill the void of limited number of certified networking technicians. It can

only be an asset for the enrichment of educational training at San Bernardino High School.

Networking employment was expected to grow significantly over the next decade. This group was expected to grow 22.5 percent by 2005, about 6,700 jobs (Local area network-related, 2001). This shortage was caused by large organizations decentralizing their computer networks and increasing the number of in workstations. The proliferation in computer networks has exacerbated the lack of trained networking technicians. Employer's demand was somewhat greater than supply of qualified applicants. Employers may have some difficulty finding qualified applicants at times and applicants may find little competition in their job search (Computer Support Specialists, 2002).

One of the driving forces in education environments was to teach across the curriculum. Cisco acclaimed academy curriculum correlated to national math and science standards; developed by educational and networking experts.

The lack of credentialed employees has caused many to enter the field from non-related areas. Many information technologists learned their trade from trial and error with little or no formal training in computer networking.

Teaching high school students about information technology has become a complicated issue. Students suffer from apathy and limited attention span. Academy programs such as CISCO academy has established a reputation of reducing delinquency, dropouts, and motivating apathetic students.

Purpose of the Project

The purpose of this project was to establish a CISCO program at San Bernardino High School. This program facilitates students matriculating with the program being taught at San Bernardino Valley College. Students earn certification as a Cisco Certified Networking Associate (CCNA) at the high school level and can continue at community college to earn the Cisco Certified Networking Professional (CCNP) certification. Establishing this program would reduce the amount of truancies and high school dropouts. This program has shown substantial results at reducing students' dropout and lethargy.

> Porter Collegiate Institute, located in a suburb east of Toronto, used to be better known as Last Chance High. A decade ago, it was the place other schools sent their "problem kids," the ones who skipped classes, got bad grades and generally caused trouble for their teachers. But peek into Anant Sukhrams' classroom on a typical weekday morning these days, and you'll see no signs of the school's old rep. (Robin, 2001, p. 2)

Significance of the Project

The state has not established guidelines for this program. However, Cisco System, Inc. has developed a standardized curriculum for students to matriculate to San Bernardino Valley College. These students have an advantage over students who lack formalized training in computer networking. Students trained at high school may stand alone as excellent preparation for gaining entry into the information technology field or the student may continue education at the locate community college.

Assumptions

The following assumptions were made regarding the project:

1. It was assumed this program would provide high school graduates with significant marketable skills upon high school graduation.
2. It was assumed CCNA certification will be the predominate requirement for employment within the computer networking field.
3. It was assumed there would be enough opportunities within the Inland Empire for CCNA graduates.

4. It was assumed San Bernardino High School through program modification could make significant improvement in the program to produce a better student.

Limitations and Delimitations

During the development of the project, a number of limitations and delimitations were noted. These limitations and delimitations are presented in the next section.

Limitations

The following limitations apply to the project:

1. This project was designed and implemented entirely for San Bernardino High School.
2. CISCO Systems has a strict guideline that hinders program modification necessary to serves student special needs.

Delimitations

The following delimitations apply to the project:

1. This program can be used by any school through-out the world.
2. Modification in the curriculum to service special needs can be implemented in other programs.

Definition of Terms

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

Academy - An inclusive vocational development program that encompasses a variety of interrelated subject matters (Neufeldt & Guralnik, 1998).

Advance Organizer - Use of an "ideational scaffold" to teach the interrelationships within an organized body of knowledge (Orlich, Harder, Callahan, & Gibson, 1998).

Binary - A numbering system characterized by ones and zeros [1 = on; 0 = off] (Cisco, 2000).

Cognitive Academic Language Learning Approach (CALLA) - An instructional model that we developed to meet the academic needs of students learning English as a second language in American schools (Chamot, 1994).

Classless Inter-Domain Routing (CIDR) - A technique supported by BGP and based on route aggregation. CIDR allows routers to group routes together in order to cut down on the quantity of routing information carried by the core routers. With CIDR, several IP networks appear to networks outside the group as single, larger entity (Cisco, 2000).

Cisco Certified Network Associate (CCNA) - CCNA indicates a foundation in and apprentice knowledge of networking for the small office/home (SOHO) market (Career Certifications, 2001).

Cisco Networking Academy - A program implemented over the past two years, Cisco has instituted an online learning systems approach that integrates the multimedia delivery of a networking curriculum with testing, performance-based skills assessment, evaluation, and reporting through a Web interface (Cisco, 2000).

Concept Analysis - Sequencing of concept characteristics or examples that relate to the concept or to a concept hierarchy (Orlich et al., 1998).

Context Analysis - Is a powerful aid to vocabulary expansion because students can often discern word meanings from the c0ntext in which they occur (Roe, Stoodt, & Burns, 1998).

Cross-Curricular Instruction - The integration of one subject matter into one or more other subject matter (California Department of Education, 1996).

Curriculum - Curriculum may be defined as the sum of the learning activities and experiences that a student

has under the auspices or direction of the school (Finch & Crunkilton, 1999).

Data Link Layer - Layer 2 of the OSI reference model. Provides transit of data across a physical link. The data link layer is concerned with physical addressing, network topology, line discipline, error notification, ordered delivery of frames, and flow control. The IEEE divided this layer into two sub layers: the MAC sub layer and the LLCC sub layer. Sometimes it is simply called link layer. Roughly corresponds to the data link control layer of the SNA model (Cisco, 2000).

Directed Reading Thinking Activity (DRTA) - The directed reading-thinking activity is a framework for instruction that parallels the active reading process by providing a scaffold of how proficient readers ask question of a text and predict what will happen next (Strategic Teaching and Learning, 2000).

Empirically - Based on practical, real-life experience (Orlich et al., 1998).

Electrostatic Discharge (ESD) - Another name for static electricity, which can damage chips and destroy system boards, even though it might not be felt or seen with the naked eye (Andrews, 2001).

Graphic Organizer - They are graphic arrangements of terms that apply to the important concepts in a reading selection (Roe et al., 1998).

Institute of Electrical and Electronic Engineers IEEE - It is professional organizations whose activities include the development of communications and network standards. IEEE LAN standards are the predominant standards today (Cisco, 2000).

Information Technology - It is the broad subject concerned with all aspects of managing and processing information, especially within a large organization or company. Because computers are central to information management, computer departments within companies and universities are often called IT departments. Some companies refer to this department as IS [Information Services] or MIS [Management Information Services] (Computer Terms, 2002).

IP address - A 32-bit address assigned to hosts using TCP/IP. An IP address belongs to one of five classes (A, B, C, D, or E) and is written as four octets separated by periods (that is, dotted-decimal format). Each address consists of a network number, an optional sub network number, and a host number. The network and sub network numbers together are used

for routing, and the host work. A subnet mask is used to extract network and sub network information from the IP address. CIDR provides a new way of representing IP addresses and subnet masks. Also called an Internet address (Cisco, 2000).

Learning Log - A Learning log is a written record of students' perceptions of how and what they are learning as wells as a record of student growth and learning over time (California Department of Education, 2000b).

Limited English Proficient - Non-English language background students who have (or have not) clearly developed oral English language skills of comprehension and speaking and have limited reading and writing skills in English are considered LEP. This student may frequently have deceptively well developed Basic Interpersonal Communication Skills (BICS) AND LIMITED Cognitive Academic Language (L1) instruction and/or support to develop and extend CALP in the primary language and English Language Development to develop and extend CALP in the primary language (Val Verde Unified School District, Educational Services, 2001).

Local Area Network (LAN) - It is the connections of workstations, peripherals, terminals, and other devices (Cisco, 2000).

MAC Address - A standardized data link layer address that is required for every device that connects to a LAN. Other devices in the network use these addresses to locate specific devices in the network and to create and update routing tables and data structures. MAC addresses are six bytes long and are controlled by the IEEE. It is also known as a hardware address, MAC-layer address, or physical address. Compare with network address (Cisco, 2000).

Metacognitive Knowledge - Conscious awareness of one's own thinking and learning processes (Orlich et al., 1998).

Mnemonics - A strategy for remembering facts by using the first letter of each fact to make up a sentence (Orlich et al., 1998).

Networking - It is the interconnection of workstations, peripherals (such as printers, hard drives, scanners, and CD-ROMs) and other devices (Cisco, 2000).

Non-English Proficient - Non-English language background students who have no oral English skills and no reading and writing skills in English are considered

NEP. This student is in need of Primary Language (L1) instruction to develop CALP and English Language Development (ELD) to develop initially English BICS and later English CALP (Val Verde Unified School District, Educational Services, 2001).

Routing - The process of finding a path to a destination host. Routing is very complex in large networks because of the many potential intermediate destinations a packet might traverse before reaching to its destination host (Cisco, 2000).

Scaffolding - Support for learning and problem solving. The support could be clues, reminders, encouragement, breaking the problem down into steps, providing and example, or anything else that allows the student to grow in independence as a learner (Woolfolk, 1998).

Schemata - Networks of interlocking concepts, or structure our minds (Roe et al., 1998).

Task Analysis - Careful sequencing of intermediate and terminal objectives.

Technician - A person responsible for handling the technical aspects of a job or vocation (Mitchell, 1998).

Wide Area Network (WAN) - A data communication network that serves users across a broad geographic area and

often uses transmission devices provided by common carriers (Cisco, 2000).

Organization of the Thesis

This project was divided into five chapters. Chapter One encompassed an introduction to the context of the problem, the purpose of the project, and the significance of the project, limitations and delimitations, and definition of terms. Chapter Two is an analysis of literature review in support of the project. Chapter Three delves into the methodology used in the design of this project. Chapter four was an explanation of budgetary requirements. Chapter five draws conclusions and recommendation developed and implemented for this project.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Chapter Two consists of a discussion of the relevant literature. An overview of San Bernardino High School and county is discussed. The history of Cisco academies and the development of the program to increase networking technicians throughout the world are explained. Analyzes of programs at San Gorgonio High School, Porter Collegiate Institute learning strategies and standards, and what accommodation are necessary to be successful. There is a section discussing how academies are effective at reducing student apathy and dropout rates.

San Bernardino High School

San Bernardino High School was 114-year-old inner city schools located in San Bernardino within a deteriorating neighborhood abound of history and tradition. The school can accommodate digital equipment because the facilities were upgrade through a DigiTech grant. This high school has many stakeholders including distinguish graduates such as San Bernardino Mayor Judith Valles and President of Stater Brothers Jack Brown. San Bernardino High School represents a diverse socioeconomic

population and has students with a significant amount of students speaking other primary languages at home.

The ethnic diversity has the following proportions: Hispanics 54%, Whites 22%, Blacks 18%, Asians/Pacific Islanders 5%, and Native Americans 1%. Twenty-two percent of the student population was classified as Limited English Proficient (LEP) or Non-English Proficient (NEP). To be classified as LEP or NEP, English was not the primary language spoken at home, Spanish being the predominant language with Polish, Russian, and Vietnamese language spoken. There were more than 44 different languages spoken within San Bernardino City Unified School district. A graphical representation of this breakdown is presented in figure 1.

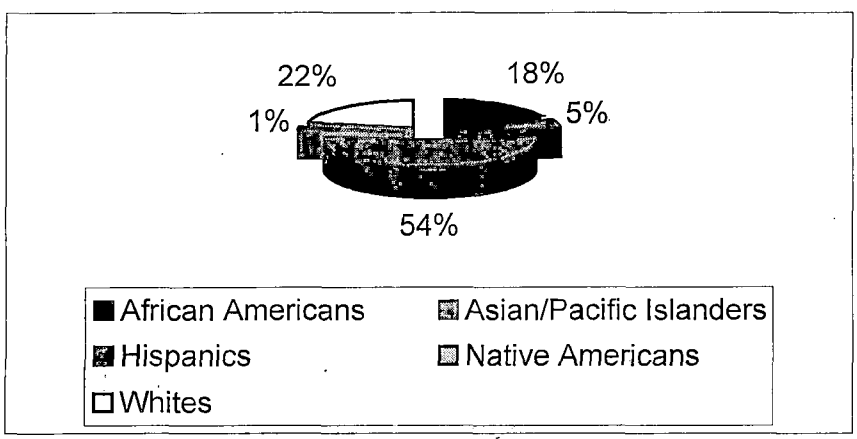


Figure 1.

Ethnicity of San Bernardino High School

If the course cannot be taught in primary language and supplemented with back-up courses in English as a Second language, hands on training was the next best method for educating the student. Cisco curriculum provides experiential training.

Vital language skills and thinking processes can be most efficiently acquired in the home language, and then applied to English, because language learning occurs holistically and builds on previous cognitive gains (California Department of Education, 1990). Cisco training provides scaffolding that enhances a bilingual student's cognitive abilities developing connections as well as providing a theme.

CALLA teachers must ask students higher-level question. Higher-level questions are those which ask students to consider reasons, compare alternatives, find similarities and differences, form opinions, and analyze evidence (Chamot & O'Malley, 1998).

History of Computer Networking

Cisco academy was a relatively new program with academy emerging throughout the world. Many of these students entering the program had little or no experience

with networking computers. The program helps develop marketable skills in computer networking.

There will be over three million job openings for Internet specialists in the next six years (Cisco System, Inc, 2001). According to Cisco Systems, Inc., more than 8,431 academies, 232,013 students enrolled, 27 empowerment zones, 50 states plus D.C., and 133 countries will fill this void.

Computer networking grew out of the escalation of computing power at the personal computer level. No longer were computers controlled at the mainframe level, individuals could develop projects at their locations. With this revelation, organizations determine personnel can work on the same project from different counties and needed a way for them to communicate without team members being in the same proximity. In networking, it is possible for different types of computers to communicate regardless what type of computer is used on a network (Cisco, 2000).

Networking was the solution to the problems hence computers became decentralized throughout the world and teams were able to communicate from several locations. Early computers were standalone devices (Cisco, 2000). Each computer was operated independently of other computer system and did not have the capabilities to communicate

with each other. These systems were costly and inefficient. A solution was needed that would successfully address three problems: duplication of equipment and resources, inability to communicate efficiently, and lack of network management (Cisco, 2000).

With the rapid escalation of computer networking, there has been a tremendous expansion of Wide Area Networks (WAN). Because of the rapid acceleration, there was a need for standards and trained networking technicians.

Table 1 is a partial list of the top 10 fastest growing occupations. Colleges did not graduate significant amount of trained students to fill the void of vacant positions for IT professionals.

CISCO Systems, Inc. came up with a solution to resolve the problem that is mutually beneficial to the schools and CISCO. It developed a program to be implemented within the high schools, trade schools, and colleges.

> Colleges and technical schools, however, couldn't crank them out fast enough. That's when companies like Cisco turned their attention to high schools-filled to overflowing with thousands of trainable youths just drooling at the though of landing high-tech jobs with fat salaries. Cisco sank $50 million to develop and launch the academy. Now, the program is offered in 120 countries and 13 languages. And although

> tech companies are getting rid of employees faster than investors are dumping dot-com stocks-in March, Cisco announced it would cut 17% of its global workforce-there's still an acute shortage of skilled IT workers worldwide. A report released last year by International Data Corp. Canada says there will be almost two million unfilled networking jobs around the world by the year 2004. By then, Cisco shouldhave a big pool of possible recruits waving the company's own accreditation certificate. (Robin, 2001, p. 2)

Table 1.

Computer Specialist Occupational Growth

Occupation	Number of Jobs		Percent Change	Education or Training Required
	2000	2010		
Computer software engineers, application	380,000	760,000	100	Bachelor's degree
Computer support specialist	506,000	996,000	97	Associate degree
Computer software engineers, system software	317,000	601,000	90	Bachelor's degree
Network and computer systems administrators	229,000	416,000	82	Bachelor's degree
Network systems and data communications analysts	119,000	211,000	77	Bachelor's degree
Desktop Publishers	38,000	63,000	67	Postsecondary vocational award

(as cited in Loschert, 2002)

CISCO System, Inc. was not obligated to hiring any graduates therefore selecting the best candidate and at the same time inundating networking with their trained technicians. Organization will only purchase equipment where they can find trained individuals to support such equipment.

Cisco developed a program to teach students how to design, build and maintain computer networks. The course requires 560 hours of course work over a two-year period earning credits towards Cisco Certified Network Associate's (CCNA) certificate. Cisco requires employees to have this certification before they can connect a LAN.

> Formally launched in 1997, the Networking Academy program is a comprehensive eight-semester/560-hour course that teaches students and in-transition workers to design, build, and maintain computer networks. Students are also prepared for industry standard certifications, including Cisco Certified Network Associate (CCNA™), Cisco Certified Network Professional (CCNP™), and Network+ Need for skilled technicians. (Cisco System, Inc., 2001, p. 3)

It was projected that the number of networking professionals will be approximately 24,500 by the year 2004. From that number half will be non-credentialed information technologist coming from unrelated fields. There were many institutions providing program that certified students throughout the world.

Care should be taken to ensure that the school provides alternatives for students who will not progress through the program and for continuing education of the teacher. Issues change, technology advances were accelerating and educators had a responsibility to keep abreast of changes.

The curriculum must remain viable and each teacher has the responsibility to establish an advisory committee. The members should consist of persons who are current practitioners in the subject being taught. There should be a minimum of five members. One of the most important duties of an advisory committee are to review course outlines and curriculums (Finch & Crunkilton, 1996). A curriculum evaluation is essential and maintains the freshness of the program.

The cost and procedures to change an entire curriculum can be prohibitive, but small changes can be made to keep the program alive. Good positive feedback should be part of the evaluation process affecting the curriculum, program or materials. Evaluation has the potential to assist vocational educators in making meaningful improvements. Only those changes should be made that benefit the students most (Finch & Crunkilton, 1993).

Cisco Academies in the County

There were twenty-seven Cisco academies within San Bernardino County that included five community colleges, twenty high schools, one alternative education program, and one Regional Occupational Program (ROP). The program was located at Chaffey High School, and all the way to Yucca Valley High School, for a complete list of locations, refers to Table 2.

Table 2.

San Bernardino County Superintendent of Schools Regional Cisco Networking Academy

Number	Local Academy	Phase
1	A.B. Miller High School Fontana USD	1
2	Apple Valley High School Apple Valley SD	2
3	Arroyo Valley High School San Bernardino City USD	3
4	Barstow Community College	4
5	Barstow High School Barstow USD	2
6	Big Bear High School Bear Valley USD	4
7	Cajon High School San Bernardino City USD	1
8	Chaffey Community College	4
9	Chaffey High School Chaffey JUSD	4
10	Colton High School Colton-Redlands-Yucaipa ROP	4
11	Copper Mountain College	4
12	Eisenhower High School Rialto USD	3

Number	Local Academy	Phase
13	Hesperia ALT. Ed. Center Hesperia USD	1
14	Hesperia High School Hesperia USD	2
15	Lucerne Valley High School Lucerne Valley USD	3
16	Rancho Cucamonga High School Chaffey JUSD	4
17	Redlands High School Redlands USD	3
18	Rialto High School Rialto USD	3
19	Rim of the World Senior HS ROP - Rim of the World USD	2
20	San Bernardino Valley College	2
21	San Gorgonio High School San Bernardino City USD	3
22	Serrano High School Snowline Joint USD	2
23	Upland High School Upland USD	4
24	Victor Valley Community College	2
25	Victor Valley HS, ROP Victor Valley Union High SD	2
26	Yucaipa High School Yucaipa/Calimesa JUSD	1
27	Yucca Valley High School (ROP) Morongo USD	1

(Cisco System, Inc., 2002, p. 4)

Doctor Fischer, San Bernardino County Superintendent of Schools referred to a meeting he attend with local government officials, stated, our students' need to become technology proficient in order to attract High-Tech employers. San Bernardino County has attracted low-tech employers for too long with dire consequences that impeded growth in the region. He alludes to Kaiser Steel employing up to ten thousand people only to be replaced by American

Steel employing one thousand. Employers such as the United States Air Force closing Norton Air Force Base, George Air Force Base, and March Air Force Base relinquishing more than ten thousand employees causing havoc to the Inland Empire economy.

Technical education was looked at as a panacea to low wage within a semi-depressed area. Computer support employees can make between $7.48 to $31.16 per hour in the Los Angeles area (see Table 3). Those IT professional making the most money were certified. Survey conducted of Microsoft-certified professional believed that their certifications had resulted in salary increases for 58 percent. Briggs estimated that earning an MCSE credential could add approximately $11,000 per year to a previously uncertified individual's salary (SYBEX, 2001).

Table 3.

Employment Development Department Computer Support Specialists Labor Market Information

Los Angeles	2000	Low	High	Median
All wages		$7.48	$31.16	$18.33

(California Employment Development, 2000, p. 15)

As the county government leaders viewed it, with trained information technologist and technology oriented

businesses, this would be the impetus to lure lucrative employment to the Inland Empire. Technology companies would come to the Inland Empire and the tax base would go up. Companies would find trained technologist and the county would receive more taxes, thus improving the quality of life.

Many accolades are touted about Cisco Academies successes within San Bernardino County. The average on the finals is 81%. Students from this program have installed network for business and educational organizations as well as some graduates have become instructors. A list of benefits and success stories follows.

Cisco proclaims benefits and success stories and can be seen in the following bullets:

- 1284 students enrolled
- 52 Instructors
- 81% average on finals
- CRYROP hired two female students from our academies to teach at local high schools
- CRYROP students and instructor rewire Fedlham Library
- Veteran Administration (VA) hospital in Loma Linda hires several students from Cajon High School
- Hesperia Sheriff Department hires student from local academy to provide tech support
- Cooper Mountain College sets up satellite academy on 29 Palms military base
- San Bernardino Valley College poised to offered upper level Cisco classes
- Cisco Students help wire temp SBCSS Child Development location

- Cisco students help wire TechEd 2001 Ontario, CA
- Cisco students participate in Skills USA (VICA) Internetworking Competition
- AB Miller instructor part of Cisco Assessment Team. (Cisco Networking Academy Program, 2001, p. 7)

These are some local academy success stories and students can receive local employment in the field.

Establishing Cisco Academy

Several steps must be followed to establish Cisco Academy at your school, submit intent to participate, confirm new local academy, site visit scheduled, distribute and execute contracts, and instructor begins training.

Equipment must be purchased along with a maintenance agreements that must be maintain to keep the equipment in working condition for training. A list was distributed explaining what minimum equipment is required in order to establish the program. The Lab pack was sold in bundles that accommodate twenty-four students needed for installation training and twenty-four students can work on-line curriculum while waiting to use the lab equipment. Table 4 represents a bundle of required equipment needed for the Cisco academy program.

Table 4.

Cisco Bundles

CCNA PREMIUM BUNDLE		
Routing Products	Quantity	Net Price
CISCO 2620	4	
CISCO 2621	1	
S26B-12107	5	
WIC-2T	10	
CAB-AC	5	
CAB-SS-V35MT	5	
CAB-SS-V35FC	5	
SUB-TOTAL		10,215.75
Switching Products		
WS-C2950-24	2	
SUB-TOTAL		1,427.09
Support Products		
CON-SNT-26XX	5	
CON-SNT-C2950-24	2	
SUB-TOTAL		1,197.00
GRAND TOTAL		12,839.84

(Cisco System, Inc., 2001)

Porter Collegiate Success

Porter Collegiate Institute is located in the suburb east of Toronto, Canada. It was referred to as the "Last Chance High." It was a magnate school for trouble youth, the campus where other school shipped off its problem students. Since the introduction of Cisco Academy, the stigma of problem kids has gone away. The students are engaged and focus on learning. But peek into Anant Sukhram's classroom on a typical weekday morning these days, and you'll see no signs of the school's old rep (Robin, 2001).

What contributed to the turn around at this school? Well, school principal Mark Booth will tell you he owes the new improved image in part to networking giant Cisco Systems Inc. Students do not emulate the problems and headaches of trouble youth.

Sukhram did state the program gives his students a substantial foundation in understanding of networking-fundamentals that they can transfer to a career. Cisco academy was an excellent school to career program.

Cisco's program was empirically designed to add relevancy to the course. It provided task analysis and was evident by the sequence of learning objectives. A student

cannot proceed to the next level without mastering the first sequence of terminal objectives. Concept analysis was implemented in the design of this curriculum; every lesson builds upon a hierarchy, thus called scaffolding.

San Gorgonio High School

The program at San Gorgonio High School was called TechLinks that was a business information technology career pathway. TechLinks was comprised of several programs to include computer information technology, repair, and network administration. The career path encompasses a Cisco Academy's curriculum in which students can obtain the CCNA.

Students enter the program as sophomores and follow a sequence of course that culminates at 12th grade. Cisco training was incorporated into a course content that includes: How a computer works, Operation of a computer, Computer repair, maintenance and troubleshooting, Computer networks and installation, Communications information technology, and Computer business application.

> Two years of intense training will provide the student with the option to be tested for journeyman certification. 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, Apple Talk, Frame Relay, IP

RIP, VLANs, RIP, Ethernet, Access Lists. (Career Certifications, 2001)

The program's asserts student can benefit from TechLinks. Students will make connections between school and the world of business information technology by...

- Learning through "hands-on" training and industry related projects.
- Gaining academic and career skills that will prepare them for entry level positions, advanced training, and college education.
- Exploring career opportunities in the field by participating in internship/shadowing experience in business and industry. (TechLinks Computer Technology, Repair & Network Administration, 2000, p. 8)

One issue that worried district administrator was the limited number of student completing the networking program. Forty-five students per class are enrolled in the sophomore year and only eight to twelve students successfully complete prerequisite to qualify for advance courses. We are concerned about the money being invested into these programs throughout the county with only eight students being able to advance, however, San Gorgonio has an excellent program (P. Kempthorne, personal communication, September 22, 2001).

Vocational Programs Reducing Dropout Rates

Current research emphasizes vocational education does contribute to reducing the dropout rate amongst high school students. More at-risk students are completing vocational education programs like Cisco Academy. The SRI International study suggest that occupational and vocational education may decrease the likelihood of students dropping out, as well as benefiting other aspect of school performance (Wagner, 1991).

The success of occupational and vocational education programs was attributed to many factors. Vocational instruction was usually empirically in nature, hands-on, and practical oriented. Vocational programs tend to provide students with practical experience that transcends into paid position after graduation. Early research on the topic suggested that students who had paid work experience during secondary school were more likely than other students without such experience to find jobs for pay after leaving school (Haxazi, Gordon, & Row, 1985).

Students who have difficulties with concept attainment fare better with visual and kinetic learning models. Cisco's academic program provides this structure and learning model. Occupational and vocational programs

are replete with visual and experiential projects. Hands on projects tend to facilitate concept attainment and the repetitive tasks lead to concept and technique retention. How does the military obtain success with its educational programs with training diverse student populations? Military educational programs were abounding with visual aids and activities; these techniques are proven successful.

One cause of high school dropout was the socioeconomic level of students. Some parents, although well intentioned, are pressuring their children to get a job and contribute to the family income. These parents typically see little value in an academic education when they perceive that their child has no chance of ever going to college. Much like the parents' career, parents believe the sooner their children obtain work, the sooner the students can become independent.

Vocational education programs can provide vision to parents and students to see immediate goal achievement. Programs are laid out such as accounting, business, computer skills, Cisco academies, graphic arts, horticulture, and safety programs leading to employment after high school graduation. Cisco academies are programs established to teach students how to install network

systems for computers. A student said, "Why should I complete high school? I cannot afford to go to college."

> Universities and other organizations within communities were awarded grants to replicate dropout prevention programs with a proven vocational education component, writes the report. While the site represented a variety of strategies to prevent dropping out, seven of the projects used the Cooperative Federation for Education Experience (COFFEE) model. COFFEE programs feature a shortened school day in an alternative school setting that intertwines academic and vocational instruction, notes the report. Project COFFEE also includes small class size, a highly structured environment, strong personal counseling, physical education and intense monitoring and evaluation of student progress. (Frantz, Strickland, & Elson, 1987, p. 3)

The class sizes are limited to a specific amount of students, usually thirty students or less. Smaller class sizes lead to better student/teacher ratio; student feel the teacher has time to pay more attention to the individual student's need. Research suggests that smaller class sizes improve student learning and test scores.

Some students drop out of school because they lack structure in their daily lives; vocational programs such as Cisco academy are generally well structured and provide students with a routine and well-grounded foundation. Many programs such as Cisco academy, Microsoft MOUS (Microsoft Office User Specialist), and other educational programs have specific formats and a qualifying examination that

lead to industry certification that enhances the student's marketability for employment.

Perkins III is an important catalyst for secondary school reform and postsecondary education authorizing tech-prep programs. It promotes work-based learning and implementing new technologies to encourage external partnerships. These partnerships should include business, labor organizations, and institutions of higher educations. Partnerships with the community are an integral part of improving the school environment and establishing positive programs for student to flourish.

Students have the same classmates until their successful completion of the program. One reason for students successfully completing a program was peer support; a student can ask another student for academic, emotional, or financial support. Another benefit is the teacher has time to get to know the student and can provide a tailored curriculum that best suits the student's need. The teacher has an opportunity to properly assess and counsel students. Twenty years after passage of Vocational Education Act of 1963, the National Commission on Excellence in Education (1983), in *A Nation At-Risk*, declared that the failures of public education, deriving in part from the weakening of the public school

curriculum, demanded a return to basic academic foundations, to the almost total neglect of vocational education (Frantz, Strickland, & Elson, 1987). The belief was that students would improve academically from a purely traditional curriculum and vocational programs were deterrent to high academic attainment. Vocational education had no part in a comprehensive high school. Comprehensive high schools are purely academic in nature. The Office of Vocational and Adult Education, U.S. Department of Education countered with a strong statement in support of vocational education emanating from the National Center for Research in Vocational Education at the Ohio State University (Tolar, 2001). A report title *The Unfinished Agenda* (National Commission on Secondary Vocational Education, 1984) laid the foundation for vocational education arguments that stated students need to receive a mix academic and vocational experience in their high school curriculum. This report was used to support the establishment of programs such as Cisco academies, an example of tech prep programs. An example of a tech prep program is Cisco academy.

Research suggests that vocational programs were beneficial and do reduce the number of students dropping out of school. Vocational courses seem to be a positive

factor in keeping students in school (Lillie, 2001). Research from The Quality of Vocational Education: Curricular Tracks and High School Vocational Education split research into three different categories: academic, general, and vocational curriculum. Academic courses had a three percent dropout rate that is consistent with academic curriculum rates around the world. In Japan, the academic course dropout rate is four percent. Vocational courses came in second with a dropout rate of sixteen percent. Finally, general courses came in with a drop out rate of twenty-one percent. Wagner estimated that a student with a typical background would have an eight percent chance of dropping out in vocational education program and a 15 percent likelihood of dropping out (as well as a greater chance of failure and more absences) in a non-vocational program (Weber, 1998). Wagner concluded: "Hence, vocational education appears to offer the potential for a significant benefit to students with disabilities in terms of their school performance and school completion.

Grasso and Shea used regression analysis to calculate the drop out rate by gender, race, commercial, and vocational programs. Their findings revealed a reduction in the drop out for white males at sex percent and an

increase in dropout rate for African American males by seven percent in general and commercial programs. African American males fared better under vocational education programs with a reduction in dropout rate of seven percent. Commercial programs reduced dropout by nine percent for white women and by three percent for African American women; other vocational programs reduced dropout by eight percent for white women and by four percent for African American (Lillie, 2001).

Learning Strategies

Contextual teaching and learning was a conception of teaching and learning that helps teach related subject matter content to be applied to real world situations and motivates students to make connections between knowledge and its application to their lives as family members, citizens, and workers and engage in the hard work that learning requires (Blanchard, 2000). This teaching methodology was well suited for the needs of Cisco Networking curriculum. It included several strategies significant for learning, emphasizes problem solving, recognize the need for teaching and learning to occur in a variety of contexts such as home, community, and work site, teach students to monitor and direct their own

learning so they become self-regulated learners. Students are encouraged to learn from each other that develops team building which was stated by SCANS as being significant for high-tech employment.

Cisco's curriculum touches upon Gardner's Multiple Intelligences. Spatial Intelligence was necessary for determining the proper sizes for cables. Musical or tonal intelligence would be needed to decipher beeps emanating from the computer system. Table 5 provides a complete list of Gardner's Multiple Intelligences and examples of each intelligence.

Table 5.

Multiple Intelligences

Verbal/ Linguistic	Logical/ Mathematical	Visual/ Spatial	Body/ Kinesthetic
Reading	Abstract symbols	Guided imagery	Folk
Vocabulary	Outlining	Active Imagination	Role playing
Formal speech	Graphic/ Organizers	Color schemes	Physical Gestures
Journal	Number Sequences	Patterns/ designs	Drama
Creative Writing	Calculation	Painting	Martial Arts
Poetry	Deciphering Codes	Drawing	Body Language
Debate	Showing Relationship	Mind mapping	Physical Exercise
Impromptu speaking	Syllogisms	Pretending	Mime
Humor/jokes	Problem solving	Sculpture	Inventing
Storytelling	Pattern games	Pictures	Sports/ games

Interpersonal	Interpersonal	Musical/Rhythmic
Giving feedback	Silent reflection methods	Rhythmic patterns
Intuiting others' Feelings	Metacognition Techniques	Vocal sounds/ tones
Cooperative learning	Thinking Strategies	Music composition/ creation
Person-to-person Communication	Emotional processing	Percussion vibrations
Empathy practice	"Know thyself" procedures	Humming
Division of labor	Mindfulness practices	Environmental Sounds
Collaboration skills	Inventing	Instrumental sounds
Receiving feedback	Focusing/ concentrations skills	Singing
Sensing others' Motives	Higher-order Reasoning	Tonal patterns

(Seven Ways of Teaching by David Lazear 1991)

Students will use directed reading-thinking activity to assist with connecting prior knowledge with new information by providing a reader generated bridge between previously learned and new information. Students learn through scaffolding information from chapter to chapter and must make the relevant connections. This strategy was pragmatic due to the low-test scores in reading and writing at San Bernardino High School. Table 6 was indicative of San Bernardino High School's student achievement in math and Language Arts.

Table 6.

The Averaged Growth in Reading, Math, and Language

Stanford 9 Achievement Test	99/00	00/01	Average Growth
Reading	37.8	34.9	-2.9
Math	44.1	46.1	2.0
Language	43.4	41.2	-2.2

(San Bernardino High School, 2001b, p. 4)

Language Arts

The survivability of vocational programs today requires the linking of core curriculum with such programs as Language Arts and Mathematics. The standards in Language Arts met by Cisco's training are vocabulary and concept development, reading comprehension, research and technology, as well as listening and speaking strategies.

It was necessary for the student to organize and deliver oral communication in logical patterns of organization, for example cause and effect. It was important for the student to delineate from the cause and effect of problems created by the end-user.

The student must master networking jargon essential for information technologist by distinguishing between the denotative and connotative meaning of words. The trainee

must interpret the meaning of words and concept imperative to the implementation of networking systems. Vocabulary was development through repetitive tasks as well as language-developed games. The uses of graphic organizers are imperative to facilitating concept attainment and are recommended by English language development training. Graphic organizers, or schematic representations of information, can help students understand and remember content information (Chamot & O'Malley, 1994). Types of graphic organizer that were used are semantic webs, spider maps, Venn diagrams, timelines, T-list, flow charts, and various kinds of charts.

Math Content Standards

Math standards were utilized as well as Language Arts standards. Algebra 1 Standards at a Glance, San Bernardino City Unified School District are represented in table seven.

The student must master the base numbering system and convert binary and hexadecimal numbers. The math skills essential to solving these problems are conversion, exponential and multiplication skills. The binary numbering system was used with IP addresses. Table seven is compilation of standards for Math skills required for

students in Algebra. Each quarter, students must be taught and demonstrate proficiency at each task.

Table 7.

Algebra 1 Standards at a Glance

Algebra 1 Standards at a Glance		
1st Quarter	2nd Quarter	3rd Quarter
Identify and use arithmetic properties with integers, rational, irrational and real numbers	Solve equations and inequalities in one variable	Solve quadratic equations and apply the quadratic formula to problems
Determine whether a relation defined by a graph, set of ordered pairs, or an equation is a function and explain why	Solve a system of two linear equations algebraically and graphically	Use operations with exponents and taking a root

Students will need to express mathematical terms in exponents and need the ability to manipulate exponents. These skills are acquired before 10th grade and must be reiterated upon the beginning of Cisco training.

Competency

Secretary's Commission on Achieving Necessary Skills (SCANS) was appointed by Elizabeth Dole the Secretary of Labor to establish what skills are essential for student

success in the workforce. The commission was to promote high wages and high performance economy through higher educations and better training. The following skills are applicable to Cisco Networking academy's philosophy of training and preparing the next generation of information technologist.

Table 8 shows the skills and competencies identified by SCANS.

Cisco training develops skills identified by SCANS as being key to succeeding in high paying occupations. Students expand team building as well as communication skills deem crucial for employment in the twenty-first century. Cisco's trainees must document information as well as decipher and express users needs for installing complex networking systems. The intricacy of computer networking was an integral part of design that is conducive to high-order thinking the advantage of establishing a Cisco Academy at the high school has many accolades. It brings prestige to the institutions, it provides job skills and certification, it was a well-structured curriculum, and its part of a career path. It is a prestige's program to have Cisco Academy at our high school (Adams, personal communication, October 22, 2001). It is well written, well though out, and the

Table 8.

Workplace Competencies and Foundation Skills

Workplace competencies
1. Resources - know how to allocate time, money, materials, space, and staff. 2. Interpersonal skills - able to work on teams, teach others, serve customers, lead, negotiate, and work well with people from culturally diverse backgrounds. 3. Systems - understand social, organizational, and technological systems; able to monitor and correct performance; can design or improve systems. 4. Technology - understand how to select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot equipment.
Foundation of Skills - competent workers in the high-performance workplace need:
• Basic Skills - reading, writing, arithmetic and mathematics, speaking and listening. • Thinking Skills - the ability to learn, to reason, to think creatively, to make decisions, and to solve problems. • Personal Qualities - individual responsibility, self-esteem and self-management, sociability, and integrity.

The Secretary of Labor's Commission on Achieving Necessary Skills, 2002, p. 1

support is good (Robins, 2001). The disadvantages were it was rigorous, lead to some students not advancing to the next course, and the course was not flexible.

The concerns to San Bernardino High School administrators would be should programs like San Gorgonio's or Arroyo Valley's, be establish or create its own. San Gorgonio has integrated other computer

specialties for the student to complete if they cannot complete Cisco training. As of this time, Arroyo Valley High School students have no alternatives if they should prove unsuccessful.

Cisco academy was an alternative to many students who contemplate dropping out of school for various reasons. One main reason for students dropping out of school was social economics. Parents and students alike can perceive completing a vocational program within two to three year and obtaining immediate significant employment at minimal cost. Going to college was too far into the time horizon especially when students main concerns were with daily eating and living conditions.

Summary

Teaching information technology is not only just prudent; it laid the foundation for the future work force. Many companies are desperate for technically proficient workers. As in the past, many high school graduates traditionally have not pursued college and are in need of skills essential for today's labor market. While pursuing this online curriculum offered by Cisco systems, Inc., student will learn essential networking skills and earn

certification necessary to obtain gainful employment in the computer industry.

Vocational education programs have resulted in the reduction in the dropout rate and documented evidence is available by researcher such as Grassco and Shea. Cisco training meets all of the needs of SCANS, language arts and Math standards. These programs were positive solution to reducing students' dropping out and funding for these programs should not be curtailed. Although much of the research is dated, further research on this topic was vehemently recommended.

CHAPTER THREE

METHODOLOGY

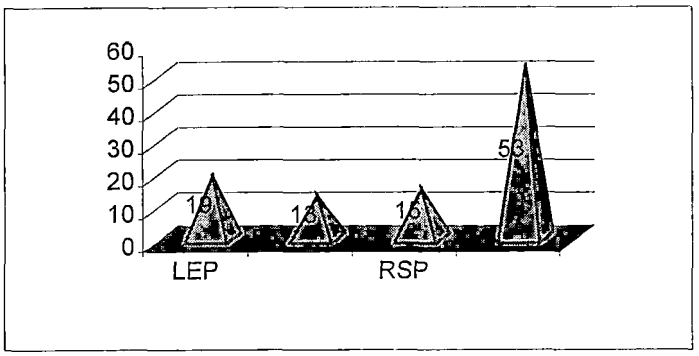
Introduction

Chapter Three documents the steps used in developing the project. Specifically, the demographics of the population served by this course were explored. Next, the content and resource was validated in this thesis. Finally, the design and scope of the curriculum was outlined.

Population Served

The curriculum was designed for students at community college level as well as high school students throughout the world. The implementation of this curriculum will meet the criteria to serve the diverse student demographics of San Bernardino High School, that was represented by 54% Hispanic, 22% White, 18% Black, 5% Asian/Pacific Islander and 1% Native American. Out of this population, 19% were identified as Limited English Proficient (LEP)/ Non English Proficient (NEP), 13% GATE, and 70% eligible for reduced or free lunch. Figure 2 is a graphical representation of the information provided. It depicts the significant comparison of each special needs group from English language learners to Resource students. All having

deficiencies in the English language and will require services to overcome comprehension problems.



(San Bernardino High School, 2001a, p. 14)

Figure 2.

Special Program Students

Curriculum Development

Curriculum Resources and Content Validation

Validation for the curriculum culminates from the synthesis of many resources, ERIC documents, Cisco Networking Academy Program: First-Year Companion Guide, Cisco Academy Brochure, San Bernardino County Superintendent of Schools Academy meeting, California State Standards for computer education, Curriculum Development in Vocational and Technical Education (Finch & Crunkilton, 1998), and equipment training manuals. Section validating lesson will follow in the curriculum adjustment.

Curriculum Design

The following objectives are modifications to the program not required by Cisco Academy, however these procedures are required to ensure student success.

- Semester 0
  - Safety issues concerns to be addressed when working in the Laboratory.
  - The ethical issues involved with IP addresses and network passwords.
  - Effective use of memorization techniques used to facilitate recalling key terms.
  - How one can improve comprehension for technical reading and writing.
  - How to properly maintain equipment.

Techniques used to improve basic math and problem solving skills.

The Cisco Networking Academies program consists of four semesters. The program is designed to teach students the skills needed to design, build, and maintain small to medium-size networks (Computer Support Specialists, 2002). The following curriculum was required by Cisco Networking Academies for semester I through IV.

- Semester 1
  - Identify and describe the functions of each of the seven layers of the OSI reference model.
  - Describe data link and network addresses and identify key differences between them.
  - Define and describe the function of a MAC Address.
  - List the key internetworking functions of 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.
  - Identify the functions of each layer of the ISO/OSI reference model.
  - Define and explain the five conversion steps of data encapsulation.
  - Describe the different classes of IP ADDRESSES (AND SUBNETTING).
  - Identify the functions of the TCP/IP network-layer protocols.

- Semester 2
  - Examine router elements (RAM, ROM, CDP, show).
  - Describe connection-oriented network service and connectionless network service, and identify their key differences.
  - Define flow control and describe the three basic methods used in networking.
  - Identify the functions of the TCP/IP transport-layer protocols.
  - Manage configuration files from the privileged exec mode.
  - Identify the functions performed by ICMP.
  - Control router passwords, identification, and banner.
  - Identify the main Cisco IOS™ software commands for router startup.
  - Check an initial configuration using the setup command.
  - Log in to a router in both user and privileged modes.
  - Use the context-sensitive help facility.

- Use the command history and editing features.
- List the commands to load Cisco IOS software from: flash memory, a TFTP server, or ROM.
- Prepare to backup, upgrade, and load a backup Cisco IOS software image.
- Identify the parts in specific protocol address examples.
- List problems that each routing type encounters when dealing with topology changes, and describe techniques to reduce the number of these problems.
- Configure IP addresses.
- Verify IP addresses.
- Prepare the initial configuration of your router and enable IP.
- Add the RIP routing protocol to your configuration.
- Add the IGRP routing protocol to your configuration.
- Configure standard access lists to figure IP traffic.

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

➢ Semester 3

- List the required IPX™ address and encapsulation type.
- Configure IPX access lists and SAP filters to control basic Novell traffic.
- Enable the Novell IPX protocol and configure interfaces.
- Monitor Novell IPX operation on the router.
- Describe the advantages of LAN segmentation.
- Describe LAN segmentation using bridges.
- Describe LAN segmentation using routers.
- Describe LAN segmentation using switches.

- Name and describe two switching methods.
- Describe full and half-duplex Ethernet operation.
- Describe network congestion problem in Ethernet networks.
- Describe the benefits of network segmentation with bridges.
- Describe the benefits of network segmentation with routers.
- Describe the benefits of network segmentation with switches.
- Describe the features and benefits of Fast Ethernet.
- Describe the guidelines and distance limitations of Fast Ethernet.
- Distinguish between cut-through and store-and-forward LAN switching.
- Describe the operation of the Spanning Tree Protocol and its benefits.
- Describe the benefits of virtual LANs.

- Semester 4
  - Differentiate between the following WAN services: LAPB, Frame Relay, ISDN/LAPD, HDLC, PPP, AND DDR.
  - Recognize key Frame Relay terms and features.
  - List commands to configure Frame Relay LMIs, maps, and sub interfaces.
  - List commands to monitor Frame Relay operation in the router.
  - Identify PPP operations to encapsulate WAN data on Cisco routers.
  - State a relevant use and context for ISDN networking.
  - Identify ISDN protocols, function groups, reference points, and channels.
  - Describe Cisco's implementation of ISDN BRI.

Summary

This chapter validates the information obtain in this project. Information was analyzed and synthesized from information from ERIC, trade journals, brochures,

textbooks, pamphlets, and interviews, amongst other sources.

Cisco Systems' educational department proscribed the curriculum, however semester 0 was a modification of the program to increase the success rate of students pursuing the course.

CHAPTER FOUR

BUDGETARY CONSIDERATION

Introduction

Program cost varied depending on the amount of students accepted in the program and which routing and switching equipment selected. Many programs were funded through Cal Perkins and TAP grants. San Bernardino High School's initial funding for this project came from a TAP grant.

Program Startup Cost

Typical start-up costs are from $25,000 to $80,000. The high school's start-up cost will be at the lower end due to the room already having 40 computer systems for students to complete work. A minimum of 930 squares is required in order to conduct Cisco training and to place equipment. Cisco minimum requirements for computer memory were 128 DIMM random access memories (RAM).

To begin a program, $5,000 per year for two-years must be paid to the Regional Academy, thereafter only $2,000 per year. These fees provides for updated training to maintain the instructor's credential. A maintenance fee for maintaining the Cisco academy must be paid annually after the first year. Meter readers and testing equipment

must be purchase. Fluke's offers a start-up kit for $2,550 that provides enough equipment for eight students to use. A minimum of $1,500 was required for the community server necessary for downloading the curriculum. An academy program must purchase Cisco equipment, which was sold in bundles from $5,000 to $15,000 that serves twenty-four students. The high school must fund the program from internal funds and no outside funding was provided for the program.

Summary

The computers are an integral part of Cisco curriculum and the systems are in place with 128 RAM. A TAP Grant was allocated to pay for the initial startup fees. Future problems might arise from the maintenance and instructional fee requirement.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

Introduction

Included in Chapter Five was a presentation of the conclusions gleamed as a result of completing the project. Further, the recommendations extracted from the project are presented. Lastly, the Chapter concludes with a summary.

Conclusions

The conclusions extracted from the project follows.

1. To ensure successful completion rates, the program should incorporate remedial math instruction to eliminate any deficiency hindering possible completion. This satisfied Algebra 1's standards identify and use arithmetic properties with integers, rational, irrational and real numbers.
2. It was necessary to implement a remedial English program to facilitate students' ability to comprehend technical reading that was covered under comprehension and analysis of grade-level-appropriate text. Standard 2.6 was demonstrated use of sophisticated learning tools

by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet)[Content Standards, 2000].

3. Bilingual Aides will assist students needing help translating to their primary language.
4. The program should be promoted to all students not just the student who fits the stereotype of a computer enthusiast.
5. Many students lack intrinsic value and self-esteem and need a program to validate their self worth.
6. Some students believed program with an outside credentialing process were valid. They do not believe going to college was a viable alternative and, they needed immediate economic relief because of the stigma attached to being socially and economically disadvantaged.
7. Cisco academy is E-Learning that collaborates with education to provide certification in networking with a potential to make a lucrative income upon graduation.

8. Although the networking industry provided an abundance of laid off information technologist, there will be a significant need for network professional to install hospital, educational, government, and private industry systems.

Recommendations

The recommendations resulting from the project follows.

1. Students should be tested to determine if they would need remedial assistance.
2. Prerequisite course should be met before a student can enter the program.
3. Bilingual Aides should be acclimated to Cisco's terminology before students are enrolled in the course.
4. Contextual teaching strategic should be implemented in teaching strategies.

Summary

Chapter Five reviewed the conclusions extracted from the project. Lastly, the recommendations derived from the project were presented.

San Bernardino High School student population will benefit significantly from a partnership with Cisco to

create a local pool of trained networking technicians. These graduates will have the potential to feed the CCNP program at the local community college or seek immediate employment in the networking field throughout the world.

Students' self-esteem will grow with the knowledge that their accomplishment will help them successfully compete with other students around the world and determine what their limitations and strengths are.

APPENDIX

CURRICULUM

Cisco Prep Training

For:

San Bernardino High School
June 16, 2002

Introduction

This project was developed in order to establish a CISCO academy at San Bernardino High School. The program implementation was designed for students seeking an entry-level computer networking employment within the computer industry. Chapter one was an overview of this project. The context of the problem was synthesized from similar studies, significant of the project, and assumptions. Subsequently, the limitation and delimitation that affect this project were discussed.

There will be a significant shortage of trained networking technicians over the next decade. This group was expected to grow 44.5 percent by 2005, about 23,000 jobs (Local Area Networking-Related, 2001). CISCO Systems, Inc. discovered there were insufficient amounts of trained technicians and decided to develop a training program in concert with the educational system.

Typical start-up costs are from $25,000 to $80,000. The high school's start-up cost will be at the lower end due to the room already having 40 computer systems for students to complete work. A minimum of 930 squares is required in order to conduct Cisco training and to place equipment. Cisco minimum requirements for computer memory were 128 DIMM random access memories (RAM).

The curriculum was designed for students at community college level as well as high school students throughout the world. The implementation of this curriculum will meet the criteria to serve the diverse student demographics of San Bernardino High School, that was represented by 54% Hispanic, 22% White, 18% Black, 5% Asian/Pacific Islander and 1% Native American. Out of this population, 19% were identified as Limited English Proficient (LEP)/ Non English Proficient (NEP), 13% GATE, and 70% eligible for reduced or free lunch.

Students' self-esteem will grow with the knowledge that their accomplishment will help them successfully compete with other students around the world and determine what their limitations and strengths are.

Table of Content

Safety Issues

Grade Level: High School 11th grade

Time: One Hour

Subjects: Safety

Objectives:

At the conclusion of these activities, the student will be able to:

- Use a wrist bracelet correctly,
- Identify unsafe conditions in a laboratory,
- Explain what is ESD.

Introduction

Safety is an integral part of training that is essential to impeding any accidents and to foster good working habits. Many concepts and safety issues must be master by students to assure positive learning conditions. The student will learn what are safe and unsafe conditions and what is the appropriate attire for working in the laboratory. Students will be able to work effectively after this training and eliminate any unsafe conditions.

Handbook Resources and Content Validation

Course Technology created a curriculum to standardize procedures throughout the information technology and has further learning. It provides a comprehensive section on safety issues and ESD.

Standards

Business Technology Core Standards: Occupational Safety - demonstrates knowledge of safety practices and maintains the work environment in a safe and secure manner.

Procedures

1. Show the students different types of ground bracelet or static strap and demonstrate how to properly wear and use them.

2. Have the students demonstrate the use of ground bracelets or static straps.

3. Explain to the student the effects of ESD and show how it has destroyed microprocessors.

4. Activity for the students, have students rub their feet on a carpet and then touch a voltmeter.

5. Explain the importance of unplugging equipment before opening chassis or installing equipment.

6. Demonstrate the deleterious effects of house play in a laboratory setting.

Evaluation

Students will take the safety quiz and must pass with 100% accuracy. The quiz will encompass static straps, ESD, horseplay, unplugging equipment before installation, and safety conditions in a laboratory.

Networking and the OSI Reference Model 3

Overview

Grade Level: High School 11th grade

Time: Twelve Hour

Subjects: Cisco

Objectives:

At the conclusion of these activities, the student will be able to:

- Specify the seven layers of the OSI reference model;

- Describe a LAN;
- Describe a WAN.

Introduction

Networking is the interconnection of workstations, peripherals (such as printers, hard drives, scanners), cabling, and other devices. Through the implementation of networking, it is possible to connect many devices to streamline and share resources.

Handbook Resources and Content Validation

Cisco developed its curriculum on-line because it is expedient and can be modify without going to print and disseminate textbooks.

Standards

Computer Science and Information System Standards suggested for grade levels 12-14.

- Computer Systems Configuration - evaluate, select, install, and configure computer components, peripherals, and operating systems
- Local and Wide Area Networks - evaluate, operate, and manage computer networks
- Problem Solving - prioritize, analyze, and solve system problems

The OSI Reference Model

The OSI reference model describes a network scheme that ensures greater compatibility and interoperability between different networks.

Table 1.1.
The OSI Reference Model

7	Application	Network processes to application
6	Presentation	Data representation
5	Session	Interhost communication
4	Transport	End-to-end connections
3	Network	Addresses and best path
2	Data link	Access to media
1	Physical	Binary transmission

(Cisco Networking Academy Program, 2001, p 27)

At this point, it would behoove the instructor to use flash cards as recommended by Cisco's training guide and CALLA instructional support. To enhance this approach, group work will assist students with the development of conceptual ideas such as the OSI Reference Model, which can be seen, in table 1.1. This table represents the layers of networking and their applications.

Figure 1.1 represents words to help students recall the seven layers of networking. In order to communicate with its peer layer in the other system, each layer uses its own layer protocol. Students have trouble recalling pertinent information and the use of acronyms have proved to best support this method of learning as demonstrated in figure 1.1. It is advantageous for students to look at several different representations of the model. If the student cannot connect with one representation, perhaps they can connect with another model. Redundancy is not bad in this method.

Figure 1.1
The OSI Model

Application	**A**ll
Presentation	**P**eople
Session	**S**eem
Transport	**T**o
Network	**N**eed
Data Link	**D**ata
Physical	**P**rocessing

The OSI model is a key concept essential for mastering networking ideas and many graphs depicting details are available. It illustrates how computers communicate and are interconnected. This subject is usually the first subject discussed about networking and develops the concept of how it works.

Table 1.2
The OSI Model

Host A	◄——————►	Host B
Application	◄——————►	Application
Presentation	◄——————►	Presentation
Session	◄——————►	Session
Transport	◄——Segment——►	Transport
Network	◄——Packets——►	Network
Data link	◄——Frames——►	Data link
Physical	◄——Bits——►	Physical

(Cisco Networking Academy Program: First-Year Companion Guide, 2000, p. 29)

Table 1.2 represents how each computer communicates at the seven-layer level. It is important to know if the communication is by bits or by segments.

Students will work in collaborative groups of five with each student being relegated to a specific role. One student will be in charge of the group, one reporter, one writer, and two students will develop flash cards and implement repetitive training on the concepts. Students will have an opportunity to discuss the meaning and interpretation of this model and obtain further clarification from fellow students. After reviewing 41 studies of cooperative learning that contrasted cooperative learning, he came to the following conclusion: Achievement is enhanced by cooperative learning when cooperating pupils are rewarded as a group, while each pupil is individually accountable for his or her learning (Cohen, 1994).

Word development grows from the use of concepts. As learning takes place, students draw upon and increase the use of conceptual banks. This is called schemata and was implemented throughout the design of Cisco academy program. Concepts can be described as the categories into which our experiences are organized and the related web of ideas brought about through categorization (Roe et al., 1998). Concept attainment was an important part of learning and the use of scaffolding was essential for students' success with Cisco training.

One solution developed to enhance special needs students comprehensive abilities would be to define terms such as converted, binary, encapsulated, alphanumeric, uncorrupted, chunks, and interface. The use of specific strategies with problem solving will be aided by Metacognitive knowledge or student awareness of the task demands, their personal experience with similar tasks, and the types of strategies that will be most effective with these tasks (Chamot, 1994).

Another technique employed to facilitate cognitive memory of the various models will be mnemonics. Many secondary students are not familiar with memory strategies such as mnemonics. This strategy was implemented with great success in courses where regurgitation of terms was required.

These activities will culminate with a quiz before the students takes an on-line exam from Cisco academy. The following questions are from Cisco's training guide on the OSI model.

Review Questions

1. Which of the following is not a reason why the OSI model is a layered network model?

   a. A layered model increases complexity

   b. A layered model standardizes interfaces.

   c. A layered model enables specialized development effort.

   d. A layered model prevents changes in one area from affecting other areas.

2. Which layer of the OSI model handles effort notification, network topology, and flow control?

   a. The physical layer

   b. The data link layer

   c. The transport layer

   d. The network layer

3. Which layer of the OSI model establishes, maintains, and manages sessions between applications?

   a. The transport layer

   b. The session layer

   c. The presentation layer

   d. The application layer

4. Which best describes the function of the presentation layer?

   a. It provides data representation and code formatting.

   b. It handles error notification, network topology, and flow control.

c. It provides network services to user applications.

d. It provides electrical, mechanical, procedural, and functional means for activating and maintaining the link between systems.

5. Which layer of the OSI model provides network services to user application?

a. The transport layer

b. The session layer

c. The presentation layer

d. The application layer

6. Which of the following correctly describes the five conversion steps of data encapsulation when one computer sends an e-mail message to another computer?

a. Data, segments, packets, frames, bits

b. Bits, frames, packets, segments, data

c. Packets, segments, data, bits, frames

d. Segments, packets, frames, bits, data

7. An e-mail message is sent from Host A to Host B on a LAN. To send this message, the data must be encapsulated. Which of the following best describes the first step of data encapsulation?

a. Alphanumeric characters are converted into data.

b. The message is segmented into easily transportable chunks.

c. A network header is added to the message (source and destination addresses).

d. The message is converted into binary format.

8. An e-mail message is sent from Host A to Host B on a LAN. Before you can send this message, the data must be encapsulated. Which of the following best describes what happens after a packet is constructed?

   a. The packet is transmitted along the medium.

   b. The packet is put into a frame.

   c. The packet is segmented into frames.

   d. The packet is converted to binary format.

9. An e-mail message is sent from Host A to Host B on a LAN. Before you can send this message, the data must be encapsulated. Which of the following best describes what happens after the e-mail message's alphanumeric characters are converted into data?

   a. The data is converted into binary format.

   b. The data has a network header added.

   c. The data is segmented into smaller chunks.

   d. The data is put into a frame.

10. Which best describes a data gram?

   a. A message sent to the source to confirm receipt of uncorrupted data

   b. A binary representation of routing information

   c. A data packet less than 100 bytes in size

   d. A network-layer packet

Local Area Network

LANs connect workstations, peripherals, terminals, and other devices. LANs make it possible for businesses using computer technology to efficiently share such things as file and printers (Cisco, 2000). LANs are intended to operate within a limited geographic are while connecting physically adjacent devices. Several overhead transparencies are available that depict a LAN arrangement along with explanations. It is imperative for special needs students to visualize concepts and several are available. Howard Gardner has brought to our attention Lazear's findings, which is the Multiple Intelligences.

Teaching and training within the Cisco training environment draws upon all seven of Gardner's Multiple of Intelligences as defined by Lazear. Person-to-person communication, tonal patterns of beeps from computers, higher-order of reasoning, journals, and graphic organizers are used to name a few techniques.

Dealing with a Lack of Prerequisites

This is a reoccurring theme throughout the San Bernardino City Unified School District where some students lack skills necessary to facilitate learning while other students were bored waiting for fellow students to catch-up.

> One of the most prevalent problems in course and curriculum design is the tendency of faculty to make false assumptions about the knowledge and skills that students bring to their courses. These incorrect assumptions leads to failure for the students who are ill prepared, boredom for their classmates who are often more than adequately prepared, and frustration for the faculty (Diamond, 1998).

It was important to assess the student's abilities before beginning this course and provide remediation for any deficiencies.

Binary and Hexadecimal Conversion

Overview

Grade Level: High School 11th grade

Time: Four Hour

Subjects: Cisco

Objectives:

At the conclusion of these activities, the student will be able to:

- Convert binary numbers
- Convert Hexadecimal numbers

Introduction

Computer systems are electronic devices that implement the use of switches. At the lowest levels of computation, computers depend on these electronic switches to make decisions. As such, computers react only to electrical impulses (Cisco, 2000). These impulses are "on" or "off", or "1s" or "0s" states. Binary is the language of computers so it is important to learn binary arithmetic.

At a higher level of computation is hexadecimal number system that is referred to as Base 16. Base 16 utilizes 16 characters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. Computer scientists use Base 16 because it makes expressing bytes more manageable (Cisco, 2000). Only two hexadecimal digits are needed to represent one 8-bit byte.

This numbering system was considered to be one of the most difficult parts of this course. Students need a comprehensive understanding of exponentials, which were learned in 9th grade. This math skill is essential for success in this course and students lacking these requirements need immediate remedial training to facilitate success.

Handbook Resources and Content Validation

Cisco developed its curriculum on-line because it is expedient and can be modify without going to print and disseminate textbooks.

Standards

Computer Science and Information Systems Standards suggested for grade levels 12-14:

- Architecture Methods - explain digital logic, machine-level representation of data, memory-system organization, and architectural use of assembly-level programming

- Data Structures - develop complex programs that are large in scope and require analysis regarding implementation issues

Procedures

1. Explain to the students how binary numbers are used.

2. Demonstrate how to convert binary numbers.

3. Have the students convert binary numbers.

4. Evaluate students' understanding of binary numbers.

5. Reiterate any misconstrued concepts and re-teach converting binary numbers.

6. Explain to the students how hexadecimal numbers are used.

7. Demonstrate how to convert hexadecimal numbers.

8. Have students convert hexadecimal numbers.

9. Evaluate students' understanding of hexadecimal numbers.

10. Reiterate any misconstrued concepts and re-teach converting hexadecimal numbers.

Evaluation

Students must pass a quiz at 80% accuracy converting binary and hexadecimal numbers.

Binary Numbers

First, it was relevant to begin this lesson by repeating powers of numbers called exponents. A refresher course was helpful reminding students' of skills learned in Algebra. Powers are used to represent repeated multiplication of the same number.

> The following example illustrates how exponents work with the number 2- the rules hold for other numbers aw well. First, 20 = 1, which is spoken "two to the zero equals one" (2 is called the base and 0 is called the exponent). This fact is not derived from previous knowledge; it is part of the definition of 2n, where n is an integer. Second, 21 = 2 ("two to the one equals two") according to mathematical definition. Third, 22 = 2 x 2 = 4: "two to the two equals two times two equals four." Continuing, 23 = 2 x 2 x = 8: "two to the three equals two times two times two equals eight." This provides a pattern that can be used for any power of 2. A common mistake is to confuse taking powers with multiplying, so be careful: 24 ≠ 2 x 4 = 8, 24 = 2 x 2 x 2 x 2 = 16 (Cisco, 2000).

These concepts are simplified using graphic organizer such as Table 6. In this table, students can visualize the answer by looking at the factor and the exponent.

Table 6.
Base 10

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
10,000,000	1,000,000	100,000	10,000	1000	100	10	1

(Cisco Networking Academy Program, 2000, p. 434)

Hexadecimal Numbers

Hexadecimal is base 16, working with the powers of sixteen. It is used to notate data link layer addressing (such as MAC addresses) and when referring to memory addresses in electronic devices (Cisco, 2000). The 16 hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. The letter "A" corresponds to the decimal number 10, B to 11, C to 12, D to 13, E to 14, and F to 15.

Table 7.
Base 16

16^3	16^2	16^1	16^0
4096	256	16	1

(Cisco Networking Academy Program, 2000, p. 439)

Table 7 represents hexadecimal number using base 16. Students can look at the table and visualize the answer. 16^3 is 4096.

The follow questions will assess competencies for students to take the on-line test.

1. Convert the binary number 1010 to Base 10.
2. Convert the Base 2 number 11110000 to decimal notation.
3. Convert the binary number 10101111 to a decimal number.
4. Convert the decimal number 1111 to binary notation.
5. Convert the decimal number 249 to Base 2.
6. Convert the decimal number 128 to Base2.
7. Convert the decimal number 65 to a binary number.

8. Convert the Base 10 number 63 to binary notation.

9. Convert the Base 10 number 31 to a binary number.

10. Convert the decimal number 198 to binary notation.

11. Is the binary number 11100011 even or odd?

12. Convert 0xAB to Base 10.

13. Convert ABCDh to Base 10.

14. Convert 0xFF to decimal notation.

15. Convert the decimal notation.

16. Convert the decimal number 65,000 to hexadecimal notation.

17. Convert 0x2B to Base 2.

18. Convert 0x10F8 to Base 2.

19. Change the MAC address 00-A-CC-3C4A-39 to binary notation.

20. Change both the IP address 166.122.23.130 and the subnet mask 255.255.255.128 to dotted-hexadecimal form.
(These questions are from Cisco Networking Academy Program: First-Year Companion Guide)

An effective method for teaching how to solve problem used in English Language development can also be implemented when instructing resource and special education students.

Table 8.
Problem-Solving Steps

How to Teach Problem-Solving Steps
• Understand the question - Teach students to understand the problem through elaboration and imagery. • Find the needed information - Help students use selective attention to find needed information. • Make a plan - Have students identify the operation and what the problem calls for, then choose a plan (e.g., write a number sentence, identify parts of the problem, work with a peer, make a table, make a list). • Solve the problem - Students write out the steps of the problem and solve it, using cooperation to review the steps they have taken. • Check the answer - Students uses a variety of approaches to verify that their answer makes sense.

(The CALLA Handbook, 1994, p. 243)

Table 8 depicts steps determined by the CALLA method to be beneficial to learning. These techniques can be used with all special need students.

These steps will facilitate the student's chances for success in the program and potentially culminate in Cisco certifications. To further enhance learning, students will use learning logs which identify gaps in student learning and helps students explore relationships between what they are learning and their past experiences.

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