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COMPUTERS IN EDUCATION

An Interactive Qualifying Project Report

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By

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1. Internet
2. Computers
3. Education

Abstract

The purpose of this Interactive Qualifying Project was to examine the integration of a new technology into a closed social structure. This new technology is the World Wide Web. This project was carried out at the Blackstone Regional Vocational Technical High School in Upton, MA, during the Worcester Polytechnic Institute 1997-98 academic year. We examined its social impact on the school and made recommendations on how to reach its greatest potential.

Executive Summary

For the Computers in Education Interactive Qualifying Project, we examined the social impact of integrating a new technology into a closed social structure. We provided access to the World Wide Web into the Blackstone Valley Regional Vocational Technical High School, which did not previously have access to the Internet. Once implemented, we interviewed the faculty and administration to analyze the impact of this new technology.

After collecting our data, we analyzed it in a variety of ways. We used mathematical analysis of data obtained from our surveys. We summarized quotes taken from interviews into categories. We also used our own observations of Valley Tech. By using these three forms of data organization, we were able to formulate recommendations for the future of Valley Tech's World Wide Web site.

The recommendations covered a variety of points obtained from our data and observations. Our recommendations were: 1) The school needs to have a permanent web master. 2) The school needs to publicize and communicate more effectively internally. 3) The school should have, from the time of conception, long terms plans for projects of this magnitude. 4) The school should invest in a better Internet Service Provider.

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1.0 Introduction

The Interactive Qualifying Project was completed at Blackstone Valley Regional Vocational Technical High School, or Valley Tech for short, located in Upton, Massachusetts. We did a case study of Valley Tech installing the Internet at their school. The goal of this project was to examine the installation and to study how the faculty would use this new tool to benefit the student body. We examined this new technological development and its impact on education.

Due to the extreme cost of providing an entire publicly funded high school with enough computers and a server, progress with the installation was slow. Over the two previous academic years, projects with Valley Tech have run all the networking cables, and had familiarized the faculty with the use of newer computers and modern software. However, the project of installing the Internet at a high school is major task that could take multiple years to execute fully.

The administration of Valley Tech approached WPI, asking whether a project team could provide them with a presence on the World Wide Web. This provided opportunity for a project team to study how educators receive and use this new, often misunderstood technology. While completing the web pages for Valley Tech, one important fact became apparent: the faculty, while excellent at teaching the vocational trades, was generally unaware of the World Wide Web as an educational tool.

WPI's student body benefits from the convenience of classrooms and dormitories connected to campus-wide Internet. At WPI, we put the Internet to extensive use; class help, homework assignments, and solutions are posted on line allowing them to be available to everyone with a computer. With a computer in almost every dorm room, and

professor's office, and more than enough computers available to students in numerous computer labs, Internet access has become a way of life at WPI. Instant access can lead to a learning environment where students can more effectively use the available resources. At WPI, students register for classes and apply to the school over the Web. This means that anyone in the world with Internet access can very easily find out about WPI and apply. This saves the school money for bulk mailing and printing brochures, if nothing else. It also gives WPI a more global outlook.

Valley Tech could benefit by drawing from this experience. Many of the same benefits WPI receives can apply to Valley Tech. Four main goals were stressed as the web pages were developed: 1) to recruit students, 2) to benefit the student body academically, 3) to improve communication within the school, and 4) to improve public relations with the Blackstone Valley community.

Once in place, however, this new tool was initially not used to its fullest potential. This is not to say the conditions will not improve, but for now, there are a few 'kinks' in the system. We discovered a pressing issue facing the faculty: a lack of access to, and knowledge of, computers. The Internet is still in its infancy, and much of the Valley Tech faculty is unaware of its potential. They lack the experience to fully and competently use this new tool. This, however, is correctable. By in service training, or possibly another project team given the proper guidance, the Internet may be used more at Valley Tech.

The single most important source of information for this project was the Valley Tech faculty. Numerous informal and formal interviews were conducted. This allowed us to gauge the level of understanding of the Internet, as well as gain insight into what

they wanted for the web pages. We sent out a survey towards the end of the project, allowing us to measure the faculty opinion of this new tool, as well as their plans for future use. By completing our web project, we were able to examine how a technological development affects society. Based on the discovered impact and results, we were able to construct a list of recommendations for the future of Valley Tech's World Wide Web site.

2.0 Background

Three major areas explored at the start of this project. The first was to gather information about Valley Tech itself. This involved a look at the faculty -administration relationship, and the impact of this relationship on the project. In addition, a look into the history of the World Wide Web made it easier to explain to the faculty the more important points of the web. Lastly, we researched many web design issues that ensured the highest quality of pages for the time allotted in our project.

We created the web pages based on faculty information. That time, we were able to examine its potential impact, and to observe the school population's attitude towards the implementation of a new technology.

2.1 Blackstone Valley Regional Vocational Technical High School

Valley Tech is a publicly funded regional vocational high school. The school has a population of roughly 900 students each year with approximately 85 teachers in both traditional academic and vocational fields.

The school is set up with a main front corridor, with three distinctive classroom and laboratory wings. In addition, there is a small wing for the superintendent's office. The principal and in-school administrators are located near the center of the main hallway. This facilitates an easy day-to day running of the school. The superintendent's office, which was running the computer project, is not in a prime physical location for interaction with a large portion of the faculty and staff.

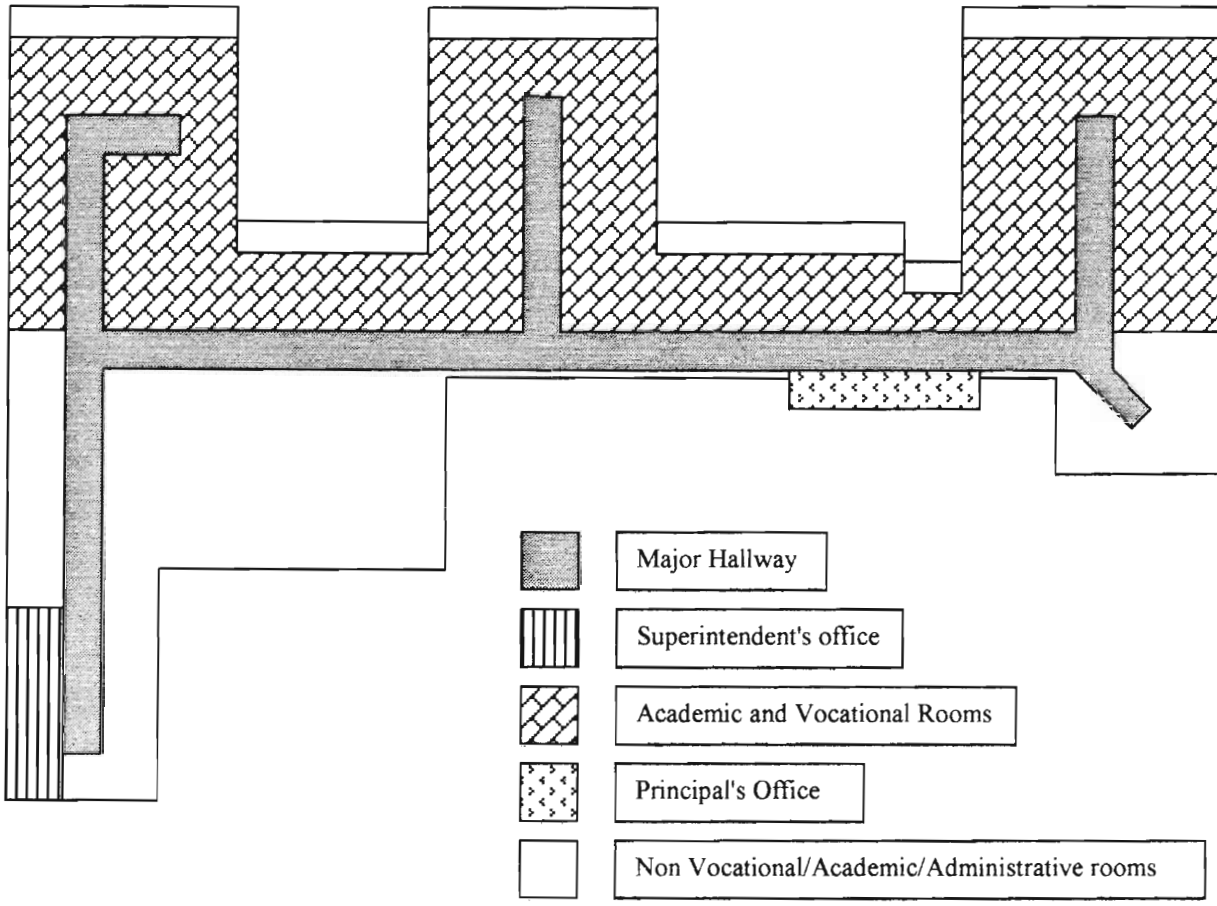

Fig 2.1.1 Valley Tech Floor Plan

The school has a hierarchical chain of command for administrative purposes. The two top administrators at Valley Tech are the Superintendent and the Principal. The Superintendent is in charge of most external school affairs, such as recruitment of new students and obtaining state funding. The principal is involved with the 'in house' issues, such as organizing class time and providing services for the students.

Each of these people employs a staff to help accomplish tasks. The Superintendent has a staff of approximately ten people including publicists, technology experts, and secretaries. This office appears to have little influence on the day-to-day

affairs of the school. The principal has a staff of approximately 15 people. These people are concerned with the day-to-day running of the school.

One of the principal's subordinates, the curriculum director, has a group of thirty Vocational Technical Leaders (VTL's). These VTL's meet about once a month to discuss issues confronting them. At these meetings, they discuss upcoming curriculum changes and special projects. After these meetings, the VTL's pass the meeting's action items to the general faculty.

The students at the school receive a typical vocational education. They participate in both academic schooling, as well as a four-year vocational training program. In addition, the students participate in typical activities such as school plays, athletics and student government. The faculty and the students interact on a daily basis. John Thomas, Valley Tech's curriculum coordinator, states, "The school's main purpose is to convey data from the faculty to the students."[1]

2.2 New Technologies

In today's world, it seems impossible to ignore the presence of the World Wide Web. Almost every commercial we see on television has at the very bottom of the screen an "http://..." People read news, check sports scores, and even trade stocks on the web.

[1] Informal Interview with John Thomas in his office on March 23, 1998

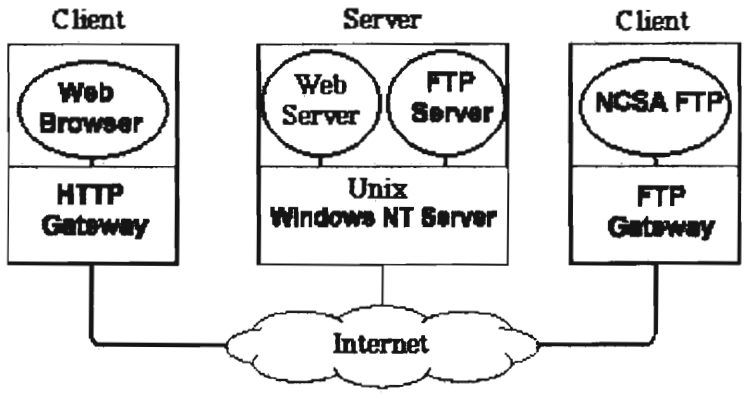

Fig 2.2.1: Client-server relationship

The World Wide Web reaches every corner of the planet, but is only a one small aspect of the Internet. The Internet is a network of computers that are all interconnected by traditional telephone lines, fiber optics, and now new wireless technology.

A computer translates information into small pieces of data, called *data packets*, and then sends the packets over the Internet to another computer that translates it back into the original information. The data packets are sent using a *protocol* through a *gateway* through the Internet. The gateway is the connecting point between the Internet and the user's computer. A protocol is the format the data packets are sent in.A single gateway can serve different protocols. For instance, web pages are transferred through the http protocol through a gateway that is connected to the Internet and thus, other computers.

A program called a *daemon* runs on a computer to allow users on the Internet to access a port. A port is simply a communications adapter between the computer and an external source. Through this port, web pages and other media are transferred to computers. The Web uses the Internet to transfer this media in a *Client-Server* relationship (Fig 2.2.1). *Client* refers to the user's machine accessing the web pages.

Server refers to the network machine and program monitoring the daemon that allows a client to view the pages.

Each computer on the Internet has a *domain address*. A client can have its computer access the web server by connecting to the appropriate domain. This domain address appears in part of the *URL* or Universal Resource Locator after "http:// ." Just like a postal address, there exists only one of each domain name. A program called a *web browser* runs on the client allowing the user to view the pages. Looking at Fig. 2.2.1 again shows the web browser connecting to a web server through the Internet.

Hypertext Markup Language, or HTML, is the language of choice for creating web pages. It is simply text that the browsers know how to translate into formatted web pages with text, graphics, video, sound, and interactive programs. The browser does all the formatting on the client. Because the browser completes all the translating, any operating system or platform can open web pages. The HTML tells the browser *what* to display, and *where* (center, aligned to the right, aligned towards the top, etc) to display it, but it is the browser's job to format it, and display it on the monitor. This provides ease of authoring, since the designer does not need to take into consideration things like the user's monitor or window size.

A web page can also have *links* go out of date without destroying the rest of the display, making pages easily maintainable. A link is simply a means of connecting related pages. A link describes the location in terms of a new URL. When the user clicks his or her mouse button on a link, the browser again connects to the domain address specified in the URL, downloads the web page and any media associated with it, and displays it on the screen with the proper formatting.

Hypertext is not a new idea, however. In fact, "Hypertext has been an idea waiting for technology to catch up with it. In order to implement active links, it is necessary to use a dynamic display medium such as a computer screen. Hence, in the 1960's in some research laboratories, several groups started using large mainframe computers in order to explore the potential of hypertext."[2] With the addition of the personal computer, the power to create web pages is now available to the individual user. As computers become capable of presenting a variety of communication media- sound, graphics, and video, it becomes possible to link this media to hypertext. This communication media is known as *hypermedia.*

The result is that large amounts of information can be shared all over the world with the click of a mouse button. With fiber-optic cable and wireless technology prices dropping constantly, high-speed connections can be found everywhere making that information more easily accessible than ever.

2.3 Project History

To begin our project we spent the first half of A-Term 97 familiarizing ourselves with programming in HTML. After this, we compiled a network of Web pages for Valley Tech. This involved getting the whole project approved by the school's administrators, interviewing faculty and administration, planning with the school's technical director, and then creating the Web pages. We then collected data and information on integrating a new technology into a closed system. This involved directly interviewing the Valley Tech faculty, reading books and journals, and examining other Interactive Qualifying

[2] "User-Centered Design of Hypertext/hypermedia for education." By Cliff McKnight, Andrew Dillon and John Richardson. Taken from Educational Communications and Technology

Projects of a similar nature. The next step was to organize our data, and then analyze it and compare it to our own observations.

During this time, we presented the goals of our project to Valley Tech's vocational team leaders. In this presentation, we explained what could be done via our project. Ideas such as posting homework assignments and course syllabi caught faculty attention. We presented a web page in progress, as well as a complete web page for a fictional teacher. This was necessary because a large portion of Valley Tech's faculty have never used the World Wide Web.

After this conference, we met individually with vocational leaders. We received input from these leaders on topics they wanted covered in their departments' pages. Also during this time, we slowly built our pages as more and more information came in. Some vocational leaders gave us a great deal of information, while others did not.

We also interviewed and observed the faculty and students. At the end of our project, we surveyed faculty members to provide statistical data from which we could draw conclusions about how well Valley Tech received the project.

2.4 Web Page Design

While designing Valley Tech's web pages, there were many design issues to be resolved. While keeping in mind the suggestions from the on-site advisor, we also consulted design studies from psychologists and other experts.

A few general rules governed the formatting of the text. Relative size of symbols is a good way to show significance or importance. The number of sizes used, however, should be less than five, because people can have difficulty comparing and remembering more. Underlining is a simple way to make a text object stand out on a display. We tried

to use it sparingly, however, since it can reduce legibility. Color was an important issue in the design. The pages needed to stand out but remain legible, so we chose white background with black text.

For the general design of each page, we created a standard template. Each page has the same header and footer. Graphical icons for the main page and the previous page make the options easily noticed.

Text was placed above and below each picture. This can break up the page into smaller sections, and adding a graphical touch to each page. Graphics on a page are almost a necessary thing. Studies have indicated that different people process things in different ways. Depending on the way someone thinks, graphics can have a better impact than text. We tried not to put too many pictures on each page, though, keeping Network Lag and access times in mind. Reducing each picture in size cut down on the length of download time. They are all in JPEG (pronounced "jay-peg") format to lower size in bytes, as well. "JPEG is a standardized image compression mechanism... that stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard."[3]

The pages needed an easily navigable architecture. A main page with a number of more general pages linked to it was the basic structure. This allows the user to traverse the tree and easily find desired information, like following a table of contents in a book.

[3] JPEG image compression FAQ, http://www.netmeg.net/faq/computers/jpeg/01.html

3.0 Procedures

We gathered our sociological data using three different methodologies. These three tools were survey analysis, direct interviewing and natural or casual observation. Each form gathers data in a different way, limiting any possible and inadvertent biases. We received 22 surveys completed by a diverse cross section of teachers and administrators. In addition, we directly interviewed a number of people. The natural observation occurred with significantly more people, including student subjects.

3.1 Surveys

We needed a method of quantifying Valley Tech's feelings towards the new Internet access. The best way to do this involved a simple survey, where faculty's and administrators' feelings on a certain subject would be easily measurable on a numerical scale. This data could be easily analyzed, and trends in answers would indicate how well this project was being received.

We also included a section for free response questions. This would give us another source of data from which we would be able to identify trends in faculty opinion. These trends would be harder to find and the results would be up to our interpretation, but it would give a direct insight into how they were thinking.

The survey had fifteen questions, with ten multiple-choice, and five free response questions. The surveys covered everything from the computer and Internet usage of the person filling out the survey to how the reader felt the administration handled the implementation of Internet access at Valley Tech. A copy of the survey is located in appendix 'A '.

In the multiple choice questions, the respondent is asked to rate, on a scale of one to five, his or her agreement or disagreement with a statement. The first two questions of the survey gauge how teachers view the Internet's future role in the education of the student body. Questions three, four, and five inquire as to the faculties perceptions of how the Internet will affect their professional lives. Questions six and seven deal with the faculty's views on how the project was handled by the administration, while eight, nine, and ten delve into the personal computing habits of the person filling out the survey.

In the free response section, the respondent is given room to put down a few of their own ideas regarding a statement. The first two questions asked to identify benefits they might see from the Internet, as well as any detriments. This will show how the faculty views the Internet, and any bias they might have regarding the installation of it. The next question gives insight into how the administration planned to put the Internet to use for the benefit of the student body. It asks, "What goals of having Internet access were conveyed to you, if any, by the administration?" A negative response here would show either a significant lack of planning on the part of the administration, or a lack of involvement by the faculty member. We also ask their opinion on why they think the Internet is being provided at Valley Tech. The end of the document provides a space for additional comments.

We sampled members from a faculty size of 85 teachers and administrators that directly influence the students and their curriculum. We sampled a random cross-section of teachers and administrators in our surveying. Each teacher or administrator was assigned a unique number. Then using a random number generator, we choose twenty-five names of faculty members who would fill out the survey. Out of the twenty-five

names we sent to Valley Tech, Valley Tech gave us back a schedule with names of those names that we would be able to meet with. This eliminated any response bias we might get by simply distributing the surveys. If we did this, the only surveys we might get back would be ones from people who had a strong opinion one way or the other.

3.2 Interviews

Having performed the survey, we decided to interview a number of faculty members. The format of this interview was very loose. Each faculty member explained his or her views of the project in general. Depending on each interviewee's response to this question, we asked either more questions or none at all. This process allowed exploration of any information not directly addressed in our survey. Many people spoke for ten minutes or more, while others had no significant comments. A good question often used to open up the interview was "How well were you informed about this project?" Generally, this could lead to any number of additional questions .

3.3 Natural Observations

Finally, we used natural observation as our last investigative tool. This is a very powerful tool for our project's purposes. This process involved our viewing people through our own experiences and thoughts. Through natural observation, we gained insight into the faculty's educational background, as well as their teaching styles. This indirectly helped us formulate some of our conclusions.

These three forms of data accumulation gave us a wide-angle view of the impact of our project, which allowed us to complete a more objective analysis on the impact of this project.

4.0 Observations at Valley Tech

We compiled data in both numeric and empirical forms from our surveys and interviews. This data gives us insight to the actual conditions, represented through our data, at Valley Tech. We displayed our numeric data in histograms. Histograms are a mathematical plot of a response versus a frequency of response. Histograms also allow the elimination of certain responses for various questions as well. For the empirical responses, we analyzed quotes taken from faculty interviews. This gave us the ability to represent our mathematical findings in a less concrete, more open ended, manner.

4.1 Survey Analysis

After completing the installation process of the Web pages for our project, we interviewed, observed, and surveyed the faculty and administration at Valley Tech. From these processes, we gathered data in the form of numerical and empirical information. After collecting the data, we organized and analyzed it. This allows us to justify our conclusions both mathematically and empirically.

We analyzed our histograms, representing it in a graphical form. This allowed us to view responses and any statistical trends in our data. We plotted a histogram for each of our ten quantitative response questions. This allowed us to see if responses were normally distributed, were skewed or were bimodal in nature.

Using the central limit theorem, we constructed a 95% confidence interval to see if the data collected statistically proved the faculty agreement or disagreement with the questions. A 95% confidence interval means that out of 100 random samples of the same population, 95 of them will return similar results. This would lend statistical significance to our data. In order to do this we used a process known as hypothesis testing. First, a

hypothesis is posed. In this case, the hypothesis is the population mean is either greater than or less than three. A greater than three mean states the faculty as a whole agreed with the statement posed in the survey. A mean of less than three states the faculty disagrees with the statement.

We found the critical 't-score' for 21 degrees of freedom, in this case 1.721. This critical 't-score' is a baseline to determine if each hypothesis is statistically acceptable. Next, a test 't-score' is calculated. Comparing the test score to the critical score determines if the hypothesis is acceptable. The following formula calculates the test score:

$$t_t = \frac{\bar{x} - \mu_{\bar{x}}}{\frac{s}{\sqrt{n}}}$$

Where:

- x is the mean of the sample you are looking at.
- μ_x is the estimated mean, normally 3
- s is the standard deviation of the sample
- n is the sample size

Eqn. 1.1

For a hypothesis that asks if the mean is greater than a number, the test score must be less than the critical. For one that asks if the mean is less, the test score must be greater.[4]

[4] Triola, Mario F., Elementary Statistics, Addison-Wesley, 1995

Question 1: "Internet access will benefit the student body at Valley Tech."

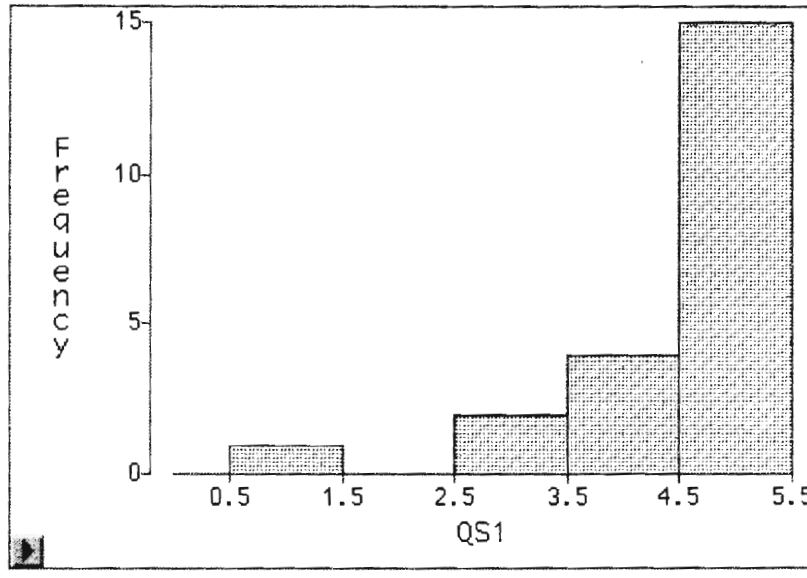

Fig 4.1.1a: Question one histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	4.4545	Sum	98.0000
Std Dev	1.0108	Variance	1.0216
Skewness	-2.2990	Kurtosis	5.8052
USS	458.0000	CSS	21.4545
CV	22.6906	Std Mean	0.2155

Fig 4.1.1b: Question one response analysis

As you can see, this histogram is skewed significantly to the right. There is enough evidence to support the claim that the faculty believes the Internet will benefit the students. This is so skewed, that, with a 95% level of confidence, we can say the faculty strongly agrees and the mean is greater than four.

Question 2: "Internet access will benefit the student body at Valley Tech once they have graduated."

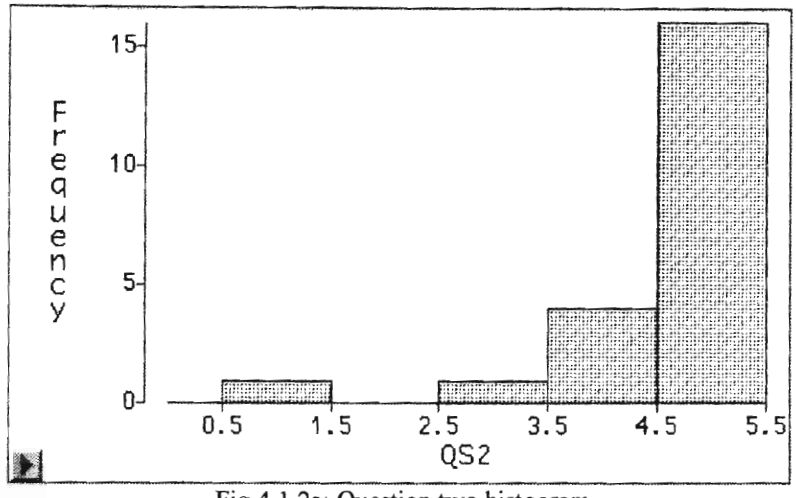

Fig 4.1.2a: Question two histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	4.5455	Sum	100.0000
Std Dev	0.9625	Variance	0.9264
Skewness	-2.7848	Kurtosis	8.6908
USS	474.0000	CSS	19.4545
CV	21.1750	Std Mean	0.2052

Fig 4.1.2b: Question two response analysis

This question is similar in nature to question one. It is heavily skewed to the right and is uni-modal. The data does support the assumption that the faculty agrees that the Internet will benefit students once they have graduated. Along with question one, this question shows that the faculty is more than likely in favor of this new educational tool.

Question 3: "Internet access will improve the quality of teaching at Valley Tech."

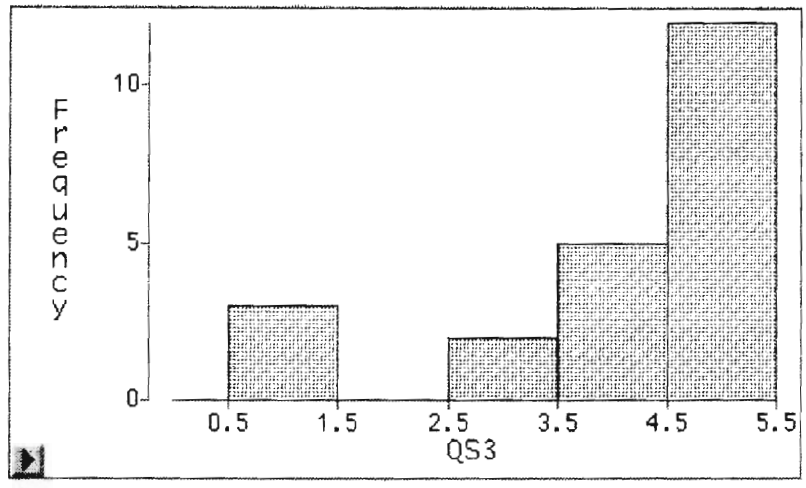

Fig 4.1.3a: Question three histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	4.0455	Sum	89.0000
Std Dev	1.3965	Variance	1.9502
Skewness	-1.4730	Kurtosis	1.0268
USS	401.0000	CSS	40.9545
CV	34.5203	Std Mean	0.2977

Fig 4.1.3b: Question three response analysis

This response is also skewed right, and the confidence test also supports that the faculty believe the internet will improve teaching at Valley Tech. This is evident because many teachers believe technology is the gateway to the future of education, as we casually observed at Valley Tech.

Question 4: "Internet access will ease the workload of faculty at Valley Tech."

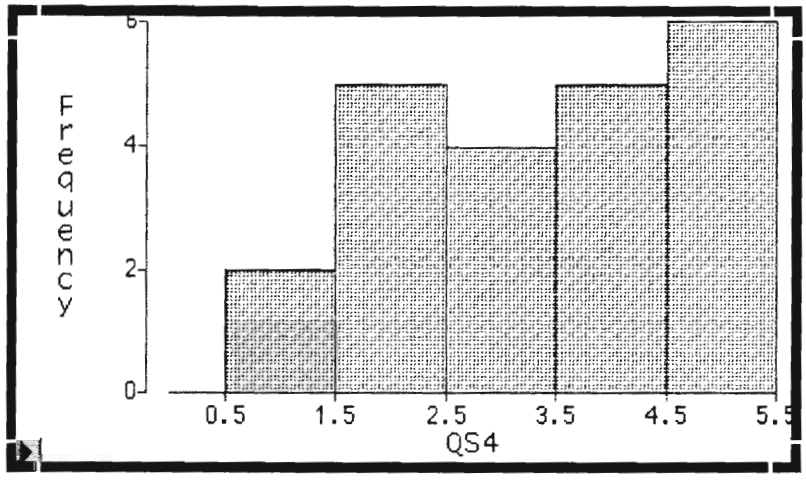

Fig 4.1.4a: Question four histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	3.3636	Sum	74.0000
Std Dev	1.3644	Variance	1.8615
Skewness	-0.2414	Kurtosis	-1.2194
USS	288.0000	CSS	39.0909
CV	40.5620	Std Mean	0.2909

Fig 4.1.4b: Question four response analysis

The response to this question is skewed to the right, however not significantly. The confidence test failed here. This means we can not accurately tell if they agree or disagree, and are unsure whether or not the faculty agrees with this statement.

Question 5: "Having the Internet at Valley Tech will improve communication between faculty and students."

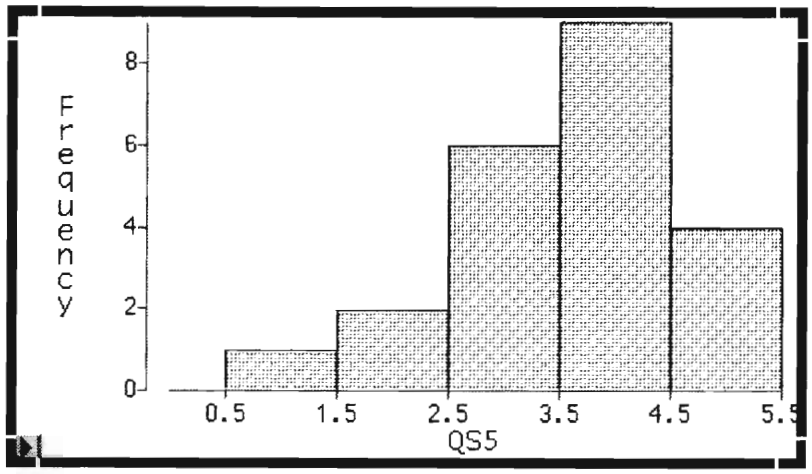

Fig 4.1.5a: Question five histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	3.5909	Sum	79.0000
Std Dev	1.0538	Variance	1.1104
Skewness	-0.6660	Kurtosis	0.3563
USS	307.0000	CSS	23.3182
CV	29.3449	Std Mean	0.2247

Fig 4.1.5b: Question five response analysis

The mean here is 3.5909, which leans slightly, but not significantly, towards agreement. There is no way from this data to tell if the faculty believes that communication will improve. A lack of experience with the Internet could be a cause.

Question 6: The administration effectively informed the faculty as to why the Internet access is being installed at Valley Tech.

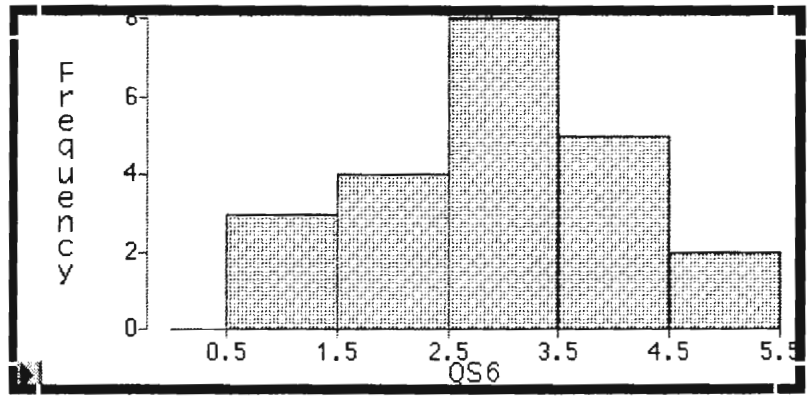

Fig 4.1.6a: Question six histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	2.9545	Sum	65.0000
Std Dev	1.1742	Variance	1.3788
Skewness	-0.0987	Kurtosis	-0.5435
USS	221.0000	CSS	28.9545
CV	39.7428	Std Mean	0.2503

Fig 4.1.6b: Question six response analysis

As is shown, the mean response is not significantly lower than three. So we cannot say the faculty feel one way or another.

Question 7: "The administration's reasoning for installing Internet access in the school has been made clear to you."

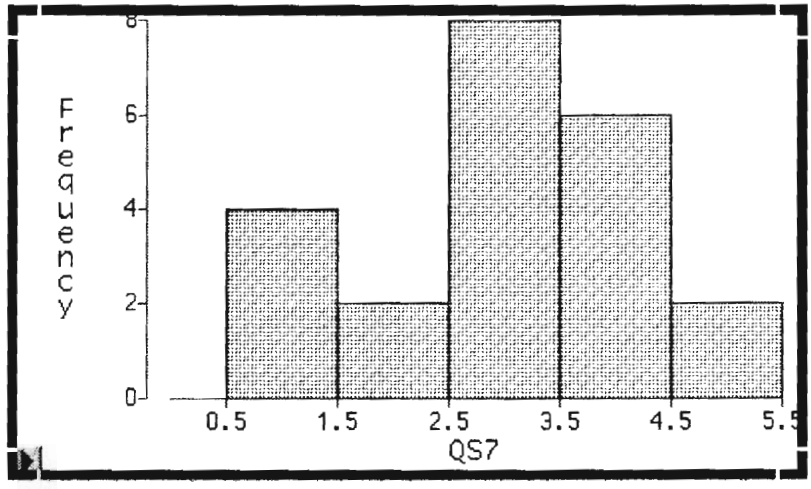

Fig 4.1.7a: Question seven histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	3.0000	Sum	66.0000
Std Dev	1.2344	Variance	1.5238
Skewness	-0.3342	Kurtosis	-0.6416
USS	230.0000	CSS	32.0000
CV	41.1476	Std Mean	0.2632

Fig 4.1.7b: Question seven response analysis

The mean here is 3.0000, so no statistically significant data as to whether or not the faculty agreed with the statement is available

Question 8: "How often do you use computers?"

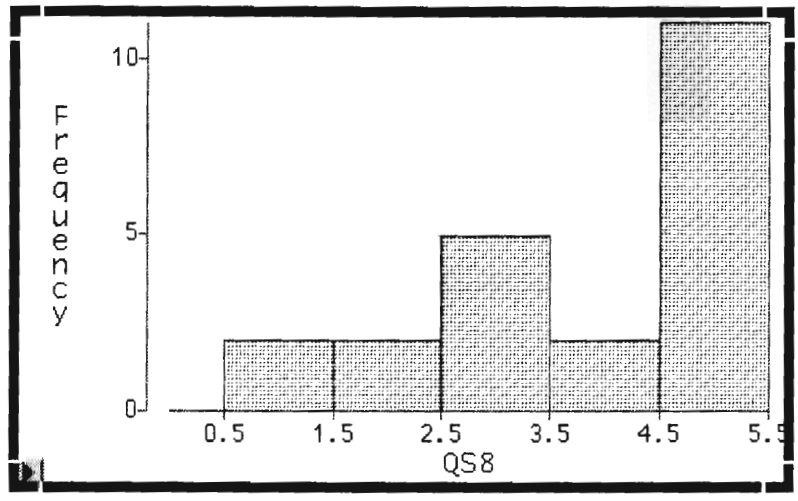

Fig 4.1.8a: Question eight histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	3.8182	Sum	84.0000
Std Dev	1.4019	Variance	1.9654
Skewness	-0.7862	Kurtosis	-0.6628
USS	362.0000	CSS	41.2727
CV	36.7168	Std Mean	0.2989

Fig 4.1.8b: Question eight response analysis

Here we can say that the average teacher at Valley Tech uses a computer greater than once per week.

Question 9 and 10: "Have you ever used the Internet?" "If so, how often?"

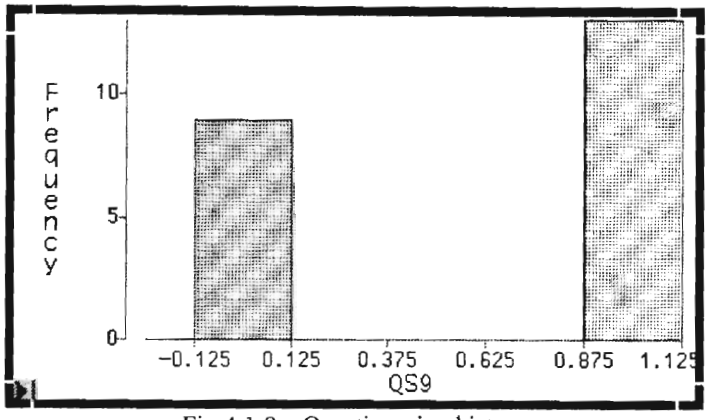

Fig 4.1.9a: Question nine histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	0.5909	Sum	13.0000
Std Dev	0.5032	Variance	0.2532
Skewness	-0.3974	Kurtosis	-2.0367
USS	13.0000	CSS	5.3182
CV	85.1631	Std Mean	0.1073

Fig 4.1.9a: Question nine response analysis

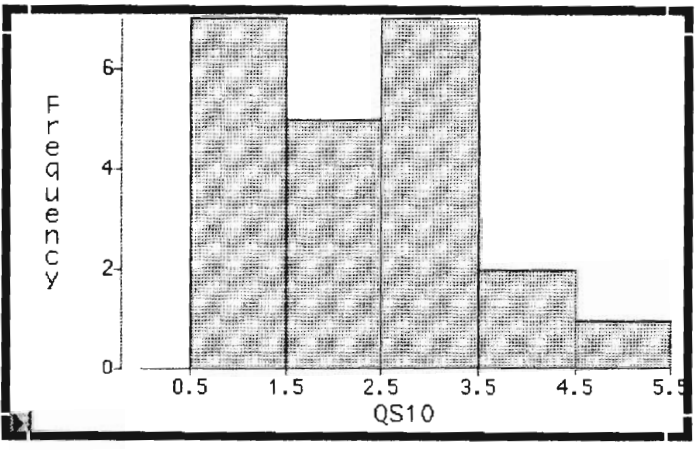

Fig 4.1.10a: Question ten histogram

Moments			
N	22.0000	Sum Wgts	22.0000
Mean	2.3182	Sum	51.0000
Std Dev	1.1705	Variance	1.3701
Skewness	0.4842	Kurtosis	-0.4272
USS	147.0000	CSS	28.7727
CV	50.4933	Std Mean	0.2496

Fig 4.1.10b: Question ten response analysis

This data states that the average teacher uses the Internet less than once per week.

The way the question was designed there is no way to tell how much less.

4.2 Personal Observations

Throughout the year we spoke informally to faculty and interviewed them. We were able to gain a degree of understanding of their views on this project and the effect of the Internet. One teacher said, "I think this will help both students and teachers in general, but I'm not sure how it will help me personally." Another said, "As a technophobe, I'm leery of most technological advancements. However, once I've been exposed, I'm sure I'll take more interest and be less apprehensive." It is clear that while many of the faculty members do not understand the World Wide Web, they are at least optimistic towards it.

Other faculty members understand the capabilities of it, but still do not get the entire effect. There are other, underlying problems. "The problem is not the access, I'd love that, it's the computers. $1500 out of a $7000 budget is not justifiable." Another teacher added towards the end of March, "The English department didn't even have a computer up until last week." "It's too bad, all this great technology, and no machines." This is all very true. Computers are an essential part of this technology, and that the school went ahead with the Internet before all classrooms were ready may have been an untimely decision.

Other faculty members know the power of the web, and could have been great motivators, had they been more aware that this was happening. "We need a more concentrated approach, rather than just smacking [an explanation of the technology] here and there. Time needs to be dedicated towards this." "I didn't really know what was going on, I heard about this through the grapevine." Quotes like these suggest to us that a

memo here and there about the installation of the Internet is not doing enough to make the faculty aware.

One thing is clear, many of the faculty members of Valley Tech see the potential of the web. "Internet access and technology are no doubt paramount concerns fit in with one million other paramount concerns. There's reading scores, professional development, and career exploration. The Internet should however be another tool to address these concerns." Another faculty member said "I think this is a great project and will be a very valuable resource to improve student learning." These same faculty members also acknowledge there are people who do not see this as a valuable resource. "Some teachers don't see the value, they have a filing cabinet full of 1984 curriculum. Technology is a big thing to the people who want it, the others just don't care."

The bottom line is there will be faculty members who will greatly utilize this new technology, and others who will continue going to their old filing cabinets, until they are better informed. A solution might be to educate faculty on effectively using this, but as one teacher put it, "Everybody is just so busy."[5]

[5] All quotes are from formal Interviews conducted on Mar. 27, 1998 with faculty members of Valley Tech.

5.0 Observations at Valley Tech

Several observations occurred during our Project at Valley Tech. These included the following items. 1) Correlations between faculty member's responses to various questions/statements, based on answers to other questions/statements on our survey. 2) There appeared to be a lack of feedback and communication between some teachers and administrators. 3) Valley Tech does not have a mission statement for the long-term success of their new computer network. 4) Valley Tech needs to train a webmaster, or hire an independent consultant act as one. 5) Valley Tech should examine upgrading their Internet Service Provider in the future in order to use the Internet's potential.

5.1 Correlation between Observations

The first step to determining if two questions' responses correlate is to plot the responses from both questions in a scatter-plot. A scatter-plot has the range of responses to one question along one axis, and the range of responses to the other along the second axis. The plotted points represent each survey, and how it responded to the two questions.

The next step is to find the correlation coefficient (r). The correlation coefficients were found from the following formulae:[6]

$$r = \frac{1}{n-1}\sum_{i=1}^{n} X_i' Y_i'$$

Where:

$$X_i' = \frac{X_i - \mu_X}{S_X} \qquad Y_i' = \frac{Y_i - \mu_Y}{S_Y}$$

And:

- n is the sample size
- S_X and S_Y are the standard deviation of the two variables
- μ_X and μ_Y are the means of the two variables

[6] Chen, M., Nandram, B., Petruccelli, J.D., MA2611 Class Notes, A term 1997, pub under NSF grant DUE 9254087

The correlation coefficient varies form $0 \leq r \leq 1$. r=1 is perfect correlation. If r=0 then there is no correlation between the two. The following correlation coefficients and scatter plots were done on Microsoft Excel.

The correlation coefficient is again hypothesis tested. The critical 't' value is determined for twenty degrees of freedom, and we want a 95% confidence interval. In this case the critical value is 2.086. The following formula[7] creates a test value for 't':

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$$

This value is compared to the critical 't' value, and if it is greater, there is some correlation present.

Determining exactly how much correlation is statistically significant is not an exact science; i.e. it is open to the person doing the analysis' judgement. There are two criteria that need to be filled for two variables to have a relationship: 1) is the association linear? 2) Is the correlation of any practical significance?[8] The scatter-plot gives a good indication to linearity of the correlation, and the correlation coefficient gives an indication to the statistical significance of it. As a rule of thumb, the larger the sample size, the larger the correlation coefficient should be.

5.1.1 Correlation between statements one and two

The first statements we correlated were statements one and two; one reads: Internet access will benefit the student body at Valley Tech, and two reads Internet access

[7] Triola, Mario F., Elementry Statistics 6th Ed., Addison-Wesley, New York, 1994
[8] ibid

will benefit the student body at Valley Tech once they have graduated. These are asking similar things, and as such, should be expected to correlate well. We used this as a baseline, to check our methods.

SUMMARY OUTPUT

Regression Statistics	
R	0.757919123
R Square	0.574441396
Adjusted R Square	0.552043576
Standard Error	0.688152552
Observations	22

Table 5.1.1 Regression Statistics for Statements 1 and 2

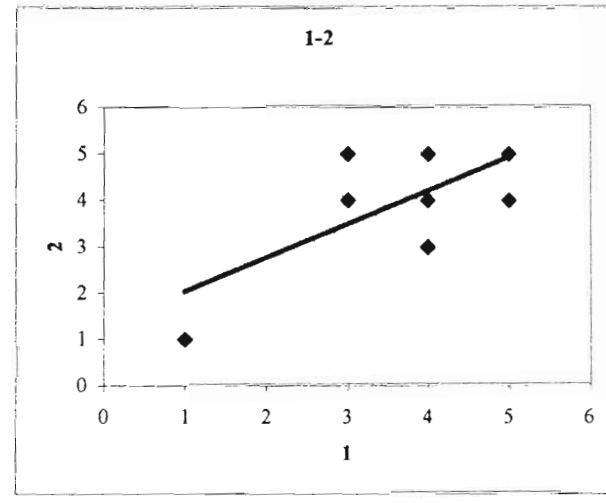

Fig 5.1.1 Scatter-plot for Statements 1 and 2

The data suggests a correlation between faculties perceptions of the Internets benefits before and after graduation. The correlation coefficient is .7579, which gives a test value of 35.6. This correlates well and we expected as much. Any deviation might result from a significant lack of understanding on the part of the faculty.

5.1.2 Correlation between statements eight and six

Question eight asks the faculty member how often he or she uses computers. While question six asks if the administration effectively informed the faculty as to why the Internet access is being installed at Valley Tech. Upon analyzing the two, we discovered a slight correlation.

SUMMARY OUTPUT

Regression Statistics	
R	0.4116
R Square	0.1693749980
Adjusted R Square	0.1278
Standard Error	1.0966
Observations	22

Table 5.1.2 Regression Statistics for Statements 1 and 2

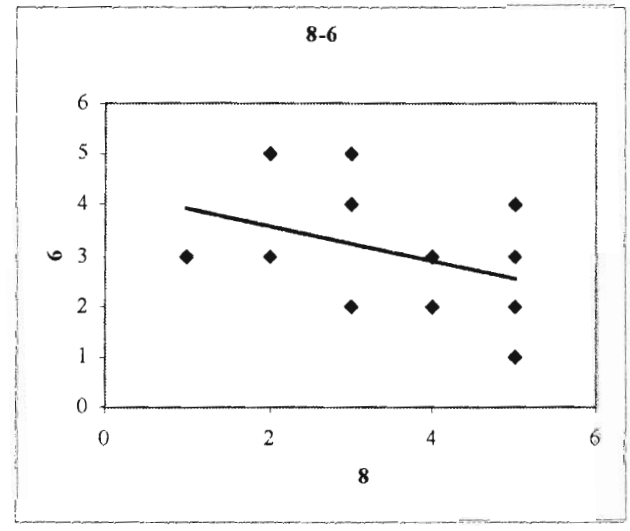

Fig 5.1.2 Scatter-plot for questions eight and six

5.1.3 Correlation between statements ten and six

Question ten asks the faculty member if he has ever used the Internet, and if so, how often. Upon analyzing the two, we discovered a slight correlation here also.

SUMMARY OUTPUT

Regression Statistics	
R	0.439356747
R Square	0.1930343511
Adjusted R Square	0.150562475
Standard Error	1.029453465
Observations	22

Table 5.1.3 Regression Statistics for Statements 10 and 6

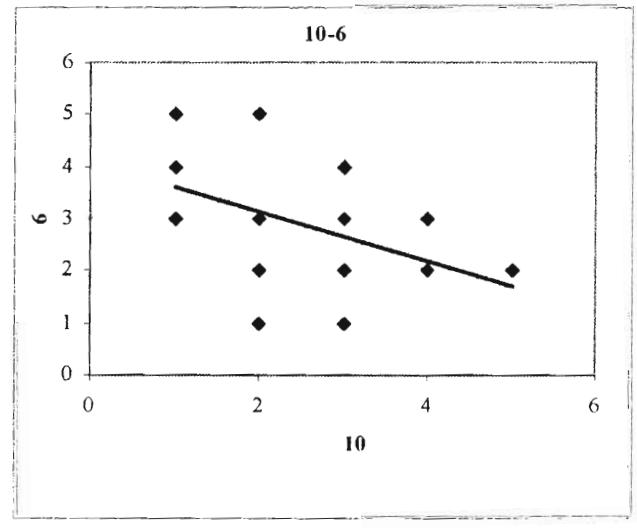

Fig 5.1.3 Scatter-plot for questions 10 and 6

The correlation is not overwhelming, but cannot be overlooked. The test value was 9.9 and 10.9 for sections 5.1.2 and 5.1.3 respectively. These results suggest that the more computer experienced a faculty member, the less effective the administration seemed to them. Also, the contrary conclusion suggests that the less knowledgeable faculty members viewed the administration's job as more effective.

One possible reason for this is that a teacher with a vast knowledge of computers could see the administration not keeping the faculty as up to date on this project, as they should be. This is because they anticipate taking bold steps quickly with a technology with which they are familiar. To a novice computer user, however, the administration is moving forward with great strides in the installation of this project. After all, they are not familiar with the technology, and feel they are well informed.

5.1.4 Correlation between questions five and eight

Question five reads: Having the Internet at Valley Tech will improve communication between faculty and students. Question eight asks how often does the faculty member use computers.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.234725142**
R Square	**0.055095892**
Adjusted R Square	**0.005364097**
Standard Error	**1.068392768**
Observations	**22**

Table 5.1.4: Regression statistics for questions 5 and 8

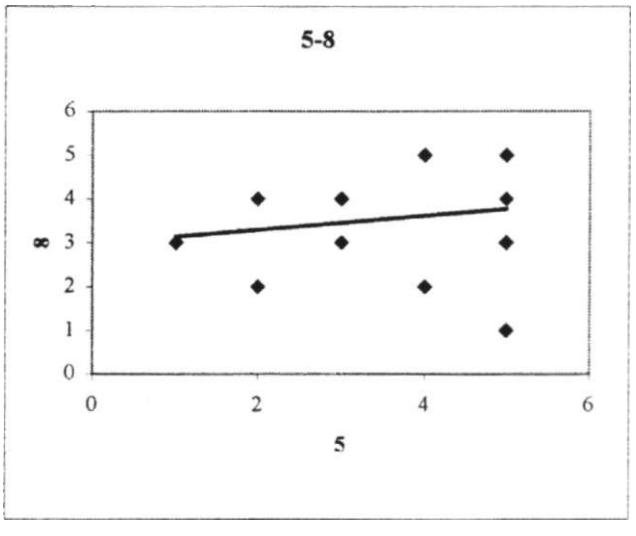

Fig. 5.1.4: Scatter-plot for questions 5 and 8

The test value for this correlation is 4.97, which passes the correlation test. There is some correlation here, but not a strong amount. As seen in the graph, it is a positive correlation. This suggests that the more knowledge a faculty member has, the more inclined he or she is to think that the Internet will improve communication. This would make sense, since e-mail and posting of assignments will give the student body easier access to information.

If the administration were to familiarize the student body with the benefits of this new access, this suggests the faculty would be even more receptive to this project. Many teachers are genuinely concerned for their students' future, and will break their backs trying to educate them. If students could spark interest in this project, then many more faculty are likely to jump-on-the-bandwagon. This would also allow teachers less familiar with the web and email to see an everyday and useful real-world application.

5.2 Improved Communication

There seemed to be a lack of communication and feedback at Valley Tech between anyone person, and the rest of the school. The physical location of the administration office could have caused this. The Superintendent's Office is located in a corner wing, far removed from most classrooms. Therefore, the physical layout of the building presented a natural deterrent to teachers openly communicating with the projects administrators. In addition, the Superintendent's Office interacts with the school committee and town officials more than with the people in-house at Valley Tech. Had the principal administered the project, we feel better communications and feedback could have been achieved. There are two reasons behind this. First, teachers go to the principal's office to check their mail. If faculty members are already in the principal's

office, it is not an inconvenience to ask a quick question or offer a suggestion. Second, faculty members already interact with the principal's office on day-to-day basis. People are more likely to speak with someone more openly if they are familiar with that person.

5.3 Goals and Mission Statement

During our time there, Valley Tech never set clearly defined goals for this project. In addition, evidence suggests they did not convey the goal of installing a computer network to the school. Nine out of sixteen surveys, that had the essay questions answered, responded "none" or a similar phrase to question thirteen. Question thirteen reads: What goals of having Internet access were conveyed to you, if any by the administration?

At the beginning of our IQP, the network was supposed to be in-place by October 15, 1997. In hindsight, this was an unrealistic goal, given that the network was not fully in place until the beginning of January. When goals are not met, people have a negative expectation for future goals and interest is lost.

Second, it appears that the administration never gave any justification for the integration of the World Wide Web. Through interviews and natural observation, the word 'assume' was frequently used when questions about the project goals were used. This suggests that the administration relayed little or no goals to the faculty population. If they were, they were spoken in such an informal way, that much of the faculty did not know of them.

5.4 Training

Another recommendation we have for Valley Tech is to find a competently trained web master. Currently there is no webmaster for Valley Tech. We recommend either training an existing faculty member with courses in html, web page maintenance,

etc. or hiring a professional consultant. Without acting on one of these proposals, Valley Tech's Web site will become dormant and unattractive. This will also reduce the ability of the Web's to help as a recruiting tool.

There are pros and cons to each of these options. Hiring a consultant is very costly. An average consultant could charge as much as $50 to $125 per hour for his or her services. This will hinder the updating of the site due to a cost deterrent. A consultant, however, would be available immediately to update the site.

By training a faculty member, the school would save money in the long run. It would cost approximately $2,800 to train a webmaster with four courses ranging from network administration to HTML and web page design[9]. After that, the school would have a certified webmaster, comparable to the consultant. This is a significantly smaller cost deterrent to updating the pages. Faculty and students would feel more comfortable approaching a familiar face with recommendations for the web site, and it is more likely a workshop on the use of the web would be organized if a faculty member were in charge. The downside is that this training takes time, and there would still be a period in which the web pages would need to be updated by someone. If the faculty member were to leave the school, another would have to be trained.

5.5 Better Internet Service

The last recommendation we have for the future of Valley Tech's web site is to obtain a better Internet Service Provider, or ISP. An upgraded ISP would allow for more memory storage in Valley Tech's account allowing for a larger web site. In addition, the better service would give every person at Valley Tech an independent e-mail address.

[9] Applied PC - Training, inc. Westboro, Massachusetts

The cost of such a service is $57.50 a month[10]. If every faculty member, student and administrator used e-mail to spread information around the school, the amount of money saved by not needing paper memos can justify the cost of this service.

[10] http://www.ultranet.com/virtualhost/plans.shtml

6.0 Recommendations for Future Work

With the completion of this project, it is beneficial to identify what work still could be done at Valley Tech. Valley Tech now has this great new technology implemented, but unfortunately, no one to maintain it. Assuming Valley Tech does not consider an in-house webmaster, a group of WPI students can build upon the study we have made. They could create several classes to teach web page maintenance. This will allow teachers and faculty to update their own department pages. This can include several topics, ranging from the simple editing of a page for homework updates, to the creation of entirely new pages that link up to the existing work.

The WPI students can build their project from our results. For instance, our survey concluded that a problem with the social structure was that the level of communication between groups within the school was not ideal. A project in which communication is a major factor should notice a significant change. A group of students could be instructors in efficient communication technologies to further this study. Then the entire school could be evaluated. This type of project should conclude that communication between the groups is at its highest point. This is because students and faculty are involved.

An even more ambitious project would rely on the school purchasing a better Internet service. If the school had the capabilities of a better provider, a group of WPI students could place the Valley Tech admissions application on the web. Alternatively, they could put an application that a prospective student could download, print and mail in to Valley Tech. This would be an interesting study on how the impact of the web on the business side of a school. Would more applications be filled out? Is there a major

difference in quality between applications submitted by hand and the ones entered on the web? These are all questions waiting to be answered by a new project team.

We are sure each of these projects would eventually spawn other projects making, Valley Tech a interesting site to study the impact of technology.

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Appendix A: WPI / Valley Tech Internet Survey

Worcester Polytechnic Institute / Valley Tech Internet Survey

Over the past year, Valley Tech has been working with Worcester Polytechnic Institute in upgrading the computers at Valley Tech, establishing an Internet presence, and making access to the internet available to the faculty and the student body. There are many advantages to this, as well as disadvantages. Our role at Worcester Polytechnic Institute has been to assist Valley Tech in the creation of 'web pages', and also to study how internet access can affect the quality of education at Valley Tech. We would like to find out your opinion on the project so that we may make recommendations to the administration on how to proceed with projects like this in the future. Remember, your opinion counts, and these surveys are conducted in confidence, so do not put your names on them. Thank you for your time.

Please evaluate the extent of your agreement or disagreement with the following statements.
Please Circle a number, and use the scale below.
1 Strongly disagree
2.disagree
3.No Opinion
4.Agree
5.Strongly agree

1. Internet access will benefit the student body at Valley Tech.

1 2 3 4 5

2. Internet access will benefit the student body at Valley Tech once they have graduated.

1 2 3 4 5

3. Internet access will improve the quality of teaching at Valley Tech.

1 2 3 4 5

5. Internet access will ease the workload of the faculty at Valley Tech.

1 2 3 4 5

6. Having the internet at Valley Tech will improve communication between faculty and students.

1 2 3 4 5

7. The administration effectively informed the faculty as to why the internet access is being installed at Valley Tech.

1 2 3 4 5

8. The administrations reasoning for installing internet access in the school has been made clear to you.

1 2 3 4 5

9. How often do you use computers?

(circle one)

1. Never
2. Once a month
3. Once a week
4. Once a day
5. Greater than once a day

10. Have you ever used the internet?

Yes No

If so, how often?
1. Never
2. Once a month
3. Once a week
4. Once a day
5. Greater than once a day

9. What benefits do you see from internet access being installed at Valley Tech?

10. What detriments do you see from internet access being installed at Valley Tech?

11. What goals of having internet access were conveyed to you, if any, by the administration?

12. Why do you think the school is pushing forward with this project?

13. Please add any additional comments you might have in the space below.

Thank You For Your Time

Appendix B: WPI / Valley Tech Internet Survey Free Response Question Responses

Question 11: What benefits do you see from Internet access being installed at Valley Tech?

"More information available to students."

"It would be good for students' study and teachers"

"Web page - increased community awareness/ public relations. Internet access - as a teaching tool -student awareness - faculty awareness. Career exploration for students"

"A new World for the students to explore"

"Aid in research projects and overall information that could be gathered benefit student learning"

"I would be a great use in terms of retrieval of information for students in the social studies department. It would make my job as athletic department a lot easier in terms of paperwork and storage of information"

"Information access. Communications to the world. Process/Learning"

"Tapping into trade related web site"

"Varied sources of information . Lessons available for trading."

"Keeping up with technology is important to all."

"Students/Faculty will benefit by having printer access to information for research papers ed. Reforms issues, etc."

"The Internet will compensate for missing texts and lack of other teaching materials."

"Reference materials and a mailing site for companies"

"Great access to info for research"

"Research/Knowledge. Information (general). Exposure."

Question 12: What detriments do you see from internet access being installed at Valley Tech?"

"X-rated. Excuse to leave class/ shop."
"Possible abuse. Getting on inappropriate sites."

"None."

"If unsupervised the students will waste time and ignore lessons."

"Some type of monitoring of which web pages students can access will be needed. Example: we took pictures away from a student yesterday that were inappropriate for all but the sickest deviants."

"Keeping up with technology is important to all."

"Varied sources of information. Lessons available for teaching."

"Some shops working the time into their workdays."

"Trash on the net and unreliable sources."

"None!!"

"None."

"None"

"-None-"

"Using Internet for the wrong reason."

"?"

"None"

Question 13: What goals of having Internet access were conveyed to you, if any, by the administration?"

"None"

"Student and faculty awareness."

"Not sure"

"No specific goals were conveyed. Many were explored but ambiguous."

"None"

"None"

"Information retrieval and storage."

"Info access"

"By WPI students, some in service."

"None"

"?"

"None have been conveyed to me personally."

"None"

"None"

"Same as #9" [10]

"Non info attained"

Question 14: Why do you think the school is pushing forward with this project?

"Gateway to excellence"

"The desire for public relations."

"Keep up with technology in the workplace/world?"

"To stay current. To increase use of technology."

"To look good politically."

"It is necessary to remain current with any technology that can benefit our students and improve the delivery of info."

"To keep up with the changes in technology. Better students. Better communication."

"Obvious benefits."

"Technology gains, access to company knowledge."

"Need in a global economy."

"It's the future. Our kids will have to be familiar with the technology to be competitive."

"To get the school up to speed in the technological field."

"Not as they should be - the schooll should have been wired by last year. Net days are great but we either need more or hire someone to do it."

"To project an image of greater technology. To benefit students and staff."

"State of the art."

"To become the gate way to excellence."

"Information access."

Question 15: Additional comments (includes comments made in interviews)

"I think this will help both students and teachers in general,but not sure how it will help me personally."

"Internet access and technology are no doubt paramount concerns fit in with one million other paramount concerns. Reading scores, professional development, and career exploration. The Internet should however be another tool to address these concerns."

"I think this is a great project and will be a very valuable resource to improve student learning."

"We need more concentrated approach, rather than just smacking it here and there. Time needs to be dedicated towards this."

"As a technophobe, I'm leary of most technological advancements. However, once I've been exposed, I'm sure I'll take more interest and be less apprehensive."

"Gread Idea!"

"We need e-mail!!!"

"Need more computers availableto students. Too few are presently available. Teachers need them in the classroom ASAP."

"Hope Dave Bowman is well compensated for his excellent workplace set up and his great expertise."

"It's process rather than product. Contents, now how do we use it?"

"Some teachers don't see value. They have a file cabinet full of 1984 curriculum."

"That's the funny thing. I can type... when it comes to this though, I'm backwards."

"I didn't really know what was going on. I heard it through the grapevine."

"In some areas there is a lack of communication."

"The problem is not the access. I'd love that, it's the computers. 1500 dollars out of a 7000 dollar budget is not justifiable."

"They could have told, and I could have forgot, but I don't know what the goals were."

"It all needs to be more accessible to staff and students."

"It's too bad, all this great technology, and no machines."

"The whole problem is Bruce Tranter didn't do anything. He's trying to save money and doesn't have the follow through."

"Let's take advantage of all this while it's still kind of new."

"The lack of follow through in the long run is hurting the students."

"Dave Bowman is a god."

"Kids today will on and be able to find a job on the net."

"The English department didn't even have a computer up until last week."

"Everybody is just so busy."

"Technology is a big thing to the people who want it. The others just don't care."