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LETTER FROM THE EDITOR

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As has been the case with the previous issues of the journals supported by the Allied Academies, the articles contained in this volume have been double blind refereed. The acceptance rate for manuscripts in this issue, 25%, conforms to our editorial policies.

The Editor of this Journal will continue to welcome different viewpoints because in differences we find learning; in differences we develop understanding; in differences we gain knowledge and in differences we develop the discipline into a more comprehensive, less esoteric, and dynamic metier.

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ENTERPRISE RESOURCE PLANNING SOFTWARE AS AN ORGANIZING THEME FOR MBA CURRICULA

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ABSTRACT

Business education has been largely function-centric since it emerged from its origins in Schools of Economics. Curricula were based on a core of fundamentals; studies in such areas as Accounting, Economics, Finance, Information Systems, Management, Marketing, and Operations Research. Beyond the core of fundamentals courses, graduate business programs offered breadth courses, electives courses, and a capstone course in strategy. Recent radical downsizing in corporate America and related innovations such as business process reengineering have led function-centric business organizations into the post industrial information age. Strategic value chain principles have been widely applied in many businesses. Enterprise-wide computing solutions have approached being, for the first time, a unifying business technology. Enterprise resource planning software (ERP) is becoming a way for firms to organize their strategy within this technology. This paper recommends that business schools grappling with curricular revision issues consider using the ERP structure of these software packages as an organizing theme for such revisions.

INTRODUCTION

Business education has been largely function-centric since it emerged from its origins in Schools of Economics. The science of wealth became a practical apprenticeship in general business commerce. Curricula were based on a core of fundamentals; studies in such areas as Accounting, Economics, Finance, Information Systems, Management, Marketing, and Operations Research. Beyond the fundamentals core, graduate business programs offered breadth courses and electives in such areas as New Product Development, Entrepreneurship, Business and Society, International Business, Real Estate, and Banking. Most programs offered an end-of-program capstone course in business or management strategy. Economists' theory of the firm often became lost amidst disconnected and unrelated course offerings. Meanwhile, the radical downsizing of corporate America and innovations such as business process reengineering led function-centric business organizations into the post industrial information age. Porter's (1985) Value Chain principles have been widely discussed in the business research literature and have been applied in many businesses.

Originally, computers were used to automate existing business systems. Breakthroughs in client-server architectures have led to the creation of enterprise-wide solutions in commerce and

industry that have approached being, for the first time, a unifying business technology. A German software firm, SAP AG, is the leading enterprise resource planning software (ERP) firm today (Curran, et al., 1998). Founded in 1972, SAP has defined over 800 business practices and modeled them using graphical representations of events and tasks (Blain, 1997). Many leading firms have adopted SAP or other ERP software implementations. This paper recommends that business schools grappling with curricular revision issues consider using the ERP structure of these software packages.

For many firms, these software packages have allowed firms to do many things that were impossible with earlier, non-integrated software (Atre & Storer, 1995; Borthick, 1992, 1993; Elliot, 1996). Online analytical processing (OLAP) software (Callaway, 1995; Fairhead, 1995; Ricciute, 1994) has enabled managers to compile and analyze their planned and actual results in a variety of ways. Hammer (1999), notes that ERP software is an integrating tool. As such, it combines with OLAP and data mining technologies to give managers integrated enterprises.

In the next section of this paper, we will present a brief history of MBA curriculum revision in U.S. business schools. The two following sections will provide a description of ERP software and present arguments for using ERP software as an organizing theme for MBA curriculum revision today.

THE CALL FOR MBA CURRICULUM REVISION

In 1908, Harvard offered the first MBA program. Growth in MBA programs was slow until the GI-Bill induced an increase in students in the years following World War II. As the practice of business administration became more regimented and "scientific" by use of mathematical models, return on investment formulae, and engineering-like behavioral control of human resources in the first half of the twentieth century, business schools gradually adapted to the trend. In some cases, business schools even led the trend.

The launch of the Soviet Union's Sputnik satellite spurred a resurgence of interest in mathematics and science education throughout the U.S. in the late 1950s. This trend pressured business schools to become more quantitative in their courses and to follow the sciences' publishing model for empirical research (Gordon & Howell, 1959). A Carnegie report on higher education in business (Pierson, 1959) that was highly critical of the business educational practices of that time increased the pressure substantially. These changes dominated the curricular designs of business schools for almost thirty years.

Hancock (1998) noted that business schools became the guardians of these new sciences of business and saw themselves as gatekeepers for those who wanted to become the master practitioners of these sciences. Accrediting agencies, notably the American Assembly of Collegiate Schools of Business (AACSB), took on the job of sanctioning these business school guardians. Most curricula in MBA programs featured a separate course in each core area taught by business professors that had developed research reputations and significant technical skills in that area.

The only integrative element in most of these programs was the final capstone course. The goal of this capstone course, often titled "business policy" or "management strategy," was to

combine the individual skills and knowledge of the core courses into a common experience (Arben, 1997). These courses often used the case method and were taught by professors who were specialists in strategic management. To maintain their standing in the academy, these professors had to engage in significant specialized research programs that often added little to their teaching of this integrated capstone course. Thus, the only course in most MBA curricula that included an integrative experience was taught by professors who were spending most of their time and professional skills on unrelated activities.

By the early 1990s, business schools began to once again feel pressure from outside the academy to revise curricula that had lost touch with the needs and realities of business practice. Distance learning, accreditation standards, new missions, and other changes in the business education environment are requiring institutions to develop new levels of what management theorists call "organizational plasticity" (Gioia & Thomas, 1996; Kimberly & Bouchikhi, 1995).

The University of Tennessee and the University of Southern California were among the first in this latest trend of revision. Both of these schools created interdisciplinary, team-taught programs (Cudd, et al., 1995). Both the business press and academic journals have been eager to report stories about curriculum redesign projects at Harvard, Wharton, Indiana and many other business schools (Bongiomo, 1993; Byrne, 1991; Hettenhouse, 1998; Lord, 1993, Watkins, 1996). Survey results reported by Cudd, et al. (1995) indicate that 84% of business schools were undergoing or planning to undergo curriculum revision within the next five years. These survey results include indications that many schools are adding courses in globalization, communications, and teamwork. Other schools are incorporating these skills into courses that resemble current content offerings. A number of schools report increased use of team teaching and courses or entire programs organized around topical business themes, such as total quality management (TQM) or business process reengineering (BPR). Although not specifically a curriculum issue, many programs report that they are requiring new applicants to have significant business experience prior to being admitted.

Most of these innovations lack a common unifying theme that is of the same magnitude and strength as the scientific management movement that captured the mood of U.S. business education in the early 1960s. One way of identifying a common theme that could support a wide range of curriculum organization issues is to examine current trends in business practice. We examine one such trend, ERP software, in the next section.

ERP SOFTWARE

Berman (1998) notes that 70% of the largest 1,000 U.S. firms have implemented ERP software such as SAP, Baan, J. D. Edwards, Oracle, or PeopleSoft. Many firms in the next tier, with revenues ranging from $50 million to $1 billion, are considering implementing such software. ERP software requires a consideration of, and often modification of, the business processes of a firm. As such, its implementation is often accompanied by a complete review and examination of the business processes of the firm. Since it is enterprise-level software, it demands a conscious integration effort that includes all elements of the firms activities and processes.

Hammer (1999) explains that using ERP software forces firms to become integrated enterprises. Such enterprises demand extremely high levels of teamwork, understanding of key business processes, and distillation of business knowledge. In the course of implementing an ERP system, firms often find themselves moving both authority and responsibility from upper levels of management down to the operational levels. This allows people in the firm to break down traditional barriers and work toward shared goals in the collective spirit so often discussed but seldom before implemented. Individual departments simply do not have the ability to sustain an existence as individual empires secluded in functional silos.

In a typical ERP software package, the enterprise solution is built from existing modules that accomplish information gathering and processing activities for individual business processes (Curran, et al., 1998). In many cases, such as the logistics modules, the integration is accomplished not only within the enterprise, but also extends outside the firm to other participants in the industry's value chain. The exact titles and specific purposes of these software modules vary somewhat in ERP packages offered by different vendors. In this paper, we will use some of the SAP modules to illustrate our approach.

SAP was founded in 1972 to provide integrated business software for large enterprises that integrates all elements of an organization's activities (SAP, 1999). The software is designed to show results for such things as specific supply chains and customer relationships in addition to providing the usual outputs needed by a large organization to keep its bills paid, its financial statements prepared in a timely fashion, its sales and distribution network under control, and its human resources function operating in conformity with myriad laws in multiple jurisdictions.

The main SAP modules include: financial management, control (which accumulates costs by cost center, activity, order, project, and/or profit center), treasury management, capital investment management, production planning and control, sales and distribution, human resources, plant maintenance, materials management, and enterprise control. Some of the more specialized modules include applications for conducting electronic commerce, managing foreign exchange transactions, and doing business in particular geographic areas of the world. SAP also offers specialized vertical integration for specific industries such as automotive, banking, chemicals, real estate, health care, construction, oil, utilities, and retail.

Other ERP vendors offer a similar range of modules (Baan, 1999; Edwards, 1999; Oracle, 1999; PeopleSoft, 1999). In all cases, these ERP vendors offer complete integrated business solutions. Many large firms have used outside consultants to help them install these ERP software packages. The need for consultants arises, in large part, because these are more than just software packages, they change the way firms do business and the way firms think about themselves doing business.

ERP SOFTWARE AS A CURRICULUM-ORGANIZING THEME

The integration and need to rethink business organization structures that flow from ERP software implementations provide tangible way to implement those desired goals in MBA curricula. Instead of haphazard stabs at implementing teamwork and shared goals in MBA

courses, ERP software principles provide a structure for implementing these features that is used increasingly in major corporations today.

In addition to providing a tangible model for implementing soft skills such as interpersonal communication and team-building activities, ERP software can provide an organizing theme for other elements in the MBA curriculum. For example, most MBA programs include courses in accounting. These courses are usually taught by professors that have done considerable research and have high degrees of expertise in one of the narrow areas of academic accounting. The use of ERP modules to organize the accounting elements of the MBA curriculum could lead to a completely different set of courses.

Instead of one financial accounting course and one managerial accounting course, a business school may decide to have a financial management course based on that module and then offer a course in control that was based on the ERP controlling module. Such a course would include elements of cost accounting, management theory, organizational design, human behavior regarding incentives, and related topics. The ideal instruction in such a course may come from a team of professors rather than one with a high level of specialization. Alternatively, a seasoned business executive who has taken an executive-in-residence appointment might be an ideal instructor for this course. The treasury management module and the capital investment module might work well in a reengineered finance course. In all cases, these modules could be used to emphasize the integration of business processes across the enterprise. For example, both the financial accounting course and the finance course might use elements of the financial management module to show the integration of fixed asset accounting with the capital investment process.

Similar opportunities abound for use of other ERP elements as structuring themes for MBA courses. The sales and distribution module could be used to organize and integrate marketing and management course offerings. The enterprise control module would be an excellent fit with strategic management or business policy courses, as would the industry-specific module for conducting electronic commerce. International business courses could use the international development modules for one or several geographic areas. Courses in real estate or health care management would find modules specific to those industries available to support teaching in those areas.

Some MBA programs, such as Bentley and Carnegie Mellon (Crowley, 1999), are including specific tracks or degrees that emphasize information technology. Classes are held in Internet-enabled, networked classrooms that allow students to use ERP and other software directly in finding solutions to business problems. Federal Express has joined with the University of Memphis to create an Internet curriculum model that is available for adoption at business schools (Roman, 1997). This model was created in response to the severe shortage of information technology professionals that have a good understanding of business processes.

CONCLUSIONS

The world of business is enthusiastically adopting ERP software. Schools of business can gain a practitioner’s edge by using some elements of these software offerings as an organizing

theme for curriculum revisions that are currently underway. By using ERP software to tie courses to business processes, MBA curricula will give students a reason to engage in teamwork and goal sharing activities. This approach can also give students a better view of the integrated enterprise of the future.

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COLLEGE STUDENTS' PERCEPTION OF ELECTRONIC COMMERCE AND INTERNET PURCHASING

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ABSTRACT

The purpose of this paper is to study the perceptions of college students on electronic commerce and use of Internet purchasing. Two hundred students from three universities in three different states were surveyed. Research indicates that most students use the Internet to check company or product information rather than directly purchasing products. One of the major reasons students don't use the Internet for online purchasing is the concern of security. A multiple discriminant analysis was conducted to describe the relative weight of each characteristic of students who tend to purchase on-line.

INTRODUCTION

Advances in microprocessor and communication technology during the last few years has made the Internet the most challenging area in the field of management information systems. Today, millions of people have become aware of the usefulness of e-mail and the Internet for accessing information through PC-modem and telephone lines. The Internet is a computer network connecting more than one hundred thousand individual networks all over the world (Laudon & Laudon, 1996; 1997). Using the Internet, people communicate through e-mail, Usenet Newsgroup, chatting, FTP, Telnet, and World Wide Web (WWW). Millions of web sites have been created for commercial and educational purposes (Lee, Osborne, & Chen, 1996).

The Internet has been used in defense and academic research for many years. The commercial use of the Internet, also referred to as electronic commerce or e-commerce, was not permitted until the early 1990s because the government subsidized the Internet (McKeown & Watson; 1997). Forrester Research in Cambridge, Massachusetts expects online sales to increase from $4.8 billion in 1998 to $17 billion in the year 2001 (Furger, 1998). Why is the Internet becoming a powerful tool for marketing and communication? There are many reasons, the main one being that the Internet connects more than 40 million people from 100 countries. Consumers can access information from a remote location through the Internet if they are connected to a telephone line or a network. Another reason that the Internet is becoming a

powerful tool for marketing and communication is that it provides a variety of services. For example, e-mail provides communication between consumers and companies, and through electronic data interchange (EDI), buyers and sellers can exchange standard business transaction documents such as invoices or purchase orders. Finally, the ability to combine video clips into the Internet is a significant step in establishing Internet marketing as a powerful communication forum.

The purpose of this research paper is to investigate the perceptions of college students on the uses and successes/failures of Internet purchasing and the concept of electronic commerce. College students represent individuals who are more knowledgeable in technology than individuals in previous generations. This study provides information related to the following research questions:

1. What are the primary functions of college students in using the Internet for purchasing products or services?
2. What are the obstacles to consumer purchasing on the Internet? Is security a primary concern as suggested in the literature? Can different payments be used to avoid the security problems?
3. Which presentation format (hypertext, audio, or video form) in Internet marketing is the most persuasive to consumers?
4. How often do college students use the Internet? How long do college students use the Internet per week (e.g., checking product information)?
5. What products are popular in Internet purchasing and communications?
6. What are the characteristics of the students who use the Internet to purchase products and services?

LITERATURE REVIEW

Numerous studies have been written about the Internet. Many of these studies focus on technical topics, case studies., and the use of the Internet for educational purposes (Carroll, 1994; Kanuk, 1996; Vernon, 1996; Ullman, William & Emal, 1996; Mahmoon & Hirt, 1995). Knowledge about the Internet, however, is still in the early stages simply because the Internet has become popular only in the last few years. While a fair amount of case studies in e-commerce (e.g., Amazon.com) have been discussed, (Hitt, Ireland,& Hoskisson, 1998), few empirical studies have concentrated on the theoretical construction of using the Internet for consumer purchasing. Technical barriers such as speed, security and maintenance are the main concerns in using the Internet in marketing. With the continuous improvement of hardware and software in microcomputers and communication channels, use of the Internet for consumer purchasing is full of potential.

Jannet (1996) suggests that the Internet, as an interactive marketing tool, has the following three functions: 1) informing consumers about products, services, discounts; 2) creating brand awareness and preferences; and 3) selling products through on-line purchasing. Jannet (1996) further indicates that interactivity is one of the key characteristics why the Internet

is so powerful in marketing. To purchase a product, consumers need to get information regarding the product, the price of competitors, as well as other facets of merchandising. The Internet does provide a low-cost, no-hassle, and convenient way to search for this type of information. Most Internet sites provide a full time service (24 hours and seven days a week) for consumers to purchase a product or service.

The present format of e-commerce may affect the consumer's perception about the information appearing on the Internet. Present forms of advertising information are limited primarily to hypertext and still pictures. Video clips have not been widely used because their implementation requires vast amounts of storage and faster transmission speed. In some cases, they are simply too slow to be accessed by every consumer. Fortunately, advances in computer communication technology (such as ISDN) during the last few years have made transmission of digital video information a viable method in Internet marketing.

A video-based marketing information system can be used in combination with traditional and/or existing marketing methods. There are three major approaches in using an Internet-based system for marketing: 1) hypertext, 2) audio, and 3) video forms. There are a number of examples in which organizations use an Internet-based system for marketing. First, real estate shows which are broadcast on the Internet enable consumers to view and browse housing information and video clips, eliminating the need for unnecessary travel. Second, a video clip system can be broadcast on the Internet by a movie rental store. Third, prospective travelers can use the Internet to find out information on rates, rooms, and nearby sightseeing attractions for hotels throughout the world. Finally, by analyzing the usage data from the World Wide Web site, hotels can learn more about consumer preferences (Bartolacci, 1996).

Obstacles of Internet Marketing and E-commerce

Previous literature has discussed the barriers and disadvantages to Internet marketing (Jannet, 1996). There remain some barriers and disadvantages that may lead managers to decide against the use of Internet marketing. The first barrier identified is the relatively small number of consumers reached over the Internet in comparison to other advertising media. The number of businesses and homes equipped for interactive marketing is still small. The second barrier is the impersonality of Internet business. Brand name recognition among consumers demands that the relationship between businesses and consumers exists long before and after the sale.

The third barrier is that security and privacy is a major concern. There are two security weaknesses inherent in the current infrastructure of the Internet (Everett, 1988). First, the Internet network of high-speed telecommunication lines (Internet backbone) may have problems with one or more of its telecommunication lines breaking, thus, Internet services can be disrupted. Second, because messages and information pass from host to host, they are susceptible to interception and being recorded. There is virtually no law that prevents any Internet service provider (ISPs) from observing, recording, selling, or giving away any information that passes through host computers. There are various Internet security tools that can help organizations protect their information (Everett, 1998). The most common security technology for credit card transactions is a Secure Socket Layer (SSL) a type of encryption

package that makes language passing through the Internet indecipherable. Unfortunately, according to Furger (1 998), half of all e-commerce sites don't use encryption to protect customers.

The Way of Payment in E-commerce

To protect the consumer's financial and security information, Internet sellers are using a variety of payment methods. Today, there are three ways a consumer can make a payment after purchasing a product from the Internet. First, a consumer can check product information and then enter the credit card information on the Internet. Although this is a simple and easy way to purchase products, many people hesitate to use this method for security reasons. Second, a consumer can check product information and then call the company directly and charge the product to a credit card. Third, a consumer can check product information on the Internet and then mail the company a check.

METHODOLOGY

The primary purpose of this paper is to investigate the perceptions of college students on the uses and successes/failures of Internet purchasing and the concept of electronic commerce. To answer research questions one, two and three, several null hypotheses have been derived:

Hl:	Students spend the same amount of time in a) purchasing products; b) checking product information, or c) checking a company's general information (such as company service information, warranty, or discounts) (H_O: $\mu_1=\mu_2=\mu_3$).

This hypothesis is used to answer research question one: what are the primary functions of college students in using Internet for purchasing products or services? Jannet (1996) suggests that Internet marketing has three different functions (as listed in hypothesis 1). Hypothesis one attempts to determine which function is the most influential to students in purchasing on the Internet.

H2:	There is no difference in the type of payment method used by students when ordering products from the Internet (H_O: $p_1= p_2 = p_3$). The three ways for consumers to purchase products on the Internet are: a) a consumer can check product information and then enter the credit card information on the Internet; b) a consumer can check product information and then call the company directly and charge the product to a credit card; or c) a consumer can check product information on the Internet and then mail the company a check.

Hypothesis two answers the research questions: What are the obstacles to consumer purchasing on the Internet? Is security a primary concern as suggested in the literature? Can different payments be used to avoid the security problems?

H3: The degree of enhancement of consumer perception from using different presentation format of Internet marketing (i.e., text descriptions, photos/pictures and video clip) are the same (H_O: $p_t = p_h = p_v$).

Hypothesis three is used to answer the research question: which presentation format (hypertext, audio, or video form) in Internet marketing is the most persuasive to consumers?

The other research questions: how often do college students use the Internet? how long do college students use the Internet per week (e.g., checking product information)? what products are popular in Internet purchasing and communications? what are the characteristics of the students who use the Internet to purchase products and services? will be answered using a descriptive analysis from the survey.

A survey questionnaire was administered to test hypotheses Hl to H3. The survey was administered in various business classes. The Friedman test, a nonparametric test procedure was used for hypothesis Hl because ordinary data was collected from the survey. The chi-square (X^2) test was also used to test hypotheses H2 and H3 for equal proportion. The data was coded and analyzed using SPSS/PC+.

RESULTS AND DATA ANALYSIS

Procedures

The subjects are business undergraduate students from three different universities in three different states: Texas (Central Area), Georgia (Eastern Area), and Washington (Western Area). From July to December 1998, two hundred and one students in eight different classes, from freshman to senior level, were randomly chosen for the survey. Two non-usable questionnaires reduced the sample size to one hundred and ninety-nine for a response rate of 99%. Seven-three percent of the students are from age 18 to 25. Twenty-six percent of the students are above age 25. Twenty-two percent of incomes are between $10,000 to $17,500, fifteen percent of incomes are between $17,500 to $35,000, and eleven percent of incomes are above $35,000. The income levels are fairly equally distributed. When asked about the knowledge level of computers, fifty-six percent of the participants ranked themselves 3 on a scale of 1 to 5. The remaining participants are evenly distributed throughout the (1-5) Likert scale.

Results

Research Question One

Various questions were asked concerning the purposes of using the Internet for purchasing products or services. Table 1 shows the percentage of students using the Internet for purchasing, checking product information, or company information.

The Friedman test was used to test the Hypothesis 1, which states that students spend the same amount of time in a) purchasing products; b) checking product information, or c) checking a company's general information (H_O: $\mu_1=\mu_2=\mu_3$). The assigned values 1, 2, 3, 4, 5 were used to

code the data for never, rarely, sometimes, often, and very often, respectively. The Friedman test is used to compare two or more related samples. In Table 2, the mean ranks for the functions of the Internet are calculated and compared, resulting in a test statistic with an approximate chi-square distribution of 122.781. The critical value of the chi-square table at the probability level of .05 with 2 degree of freedom is 5.991. Thus, the null hypothesis is rejected because 122.781 is much greater than 5.991.

Table 1
The Frequency Information for the Use of Internet in Consumer Purchasing or Information

	Never	Rarely	Sometimes	Often	Very Often	Total
Check Product Information	45 22.6%	54 27.1%	69 34.7%	28 14.1%	3 1.5%	199 100%
Check a Company's General Information	54 27.1%	40 20.1%	71 35.7%	30 15.1%	4 2.0%	199 100%
Purchase Products	143 71.9%	19 9.5%	28 14.1%	8 3%	3 1.5%	199 100%

Table 2
Friedman Test in Comparison of Different Functions of Internet

Use of the Internet	Mean Rank	N=199
Check Product Information	2.29	Chi-Square = 122.781
Check General Information	2.22	df = 2
Purchase Products	1.49	Asymp. Sig. 0.00

Research Question Two

Table 3 indicates that consumers (students) prefer to check the product information and then mail a check to the company. Table 3 also shows the chi square test results for different payment methods. To test the Hypothesis 2, which states that there is no difference in the type of payment method used by students when ordering products from the Internet (HO: $p_1 = P_2 = P_3$), we have used the chi-square test for proportion. In the chi-square test, the observed frequency and expected frequency are compared. In Table 3, the chi-square is 7.824. The critical value of chi-square table at the probability level of .05 with 2 degree of freedom is 5.991. Thus, the null hypothesis is rejected because 7.824 is greater than 5.991.

Table 4 shows the major reasons people will not buy from the Internet. These findings support the literature which suggests that security is a major concern when purchasing products

or services on the Internet. In the survey, students were then asked if they would buy from the Internet if security were improved. The results suggests that if security were improved on the Internet, nineteen percent of participants say they would definitely buy from the Internet and twenty-five percent of participants say they probably would buy from the Internet.

Table 3
Chi-Square for the Preferred Payment Method for Purchasing from the Internet

Method	Observed Frequency	Expected Frequency	
Check product information, then call them to charge it to a credit card	42	45.3	N = 136
Check product information, then mail them a check	60	45.3	Chi-Square = 7.824
Check product information, then enter your credit card information on the Internet	34	45.3	df = 2
Total	136		Asymp. Sig. = 0.020

Table 4
The Major Reasons People Will Not Buy From The Internet

Reasons	Frequency	Percentage
Lack of security	134	67.30%
Inability to judge the product	77	38.70%
Can't see or feel the product	70	35.20%
Expensive	15	7.50%
Do not have an Internet connection	12	6%
Knocked/kicked off line	8	4%
Frequent interrupt of communications	6	3%
The speed of Internet is too slow	2	1%

Research Question Three

The study indicates that thirty-five percent of the students do not purchase from the Internet because they can not see or feel the product. Thirty-nine percent of the students do not want to purchase a product from the Internet because of the inability to judge the product based on the information provided from the Internet. One way to improve this is to use a multimedia

format in Internet marketing. Multimedia refers to using images, pictures, or video forms so consumers can see the product. Table 5 indicates the results of what form of product advertising on the Internet is most appealing to participants.

Table 5 also shows the chi-square test results for different presentation forms of on-line advertising. To test Hypothesis 3 which states that consumers don't perceive a difference in the form of presentation methods used by web sites (HO: $p_t = p_h = p_v$), chi square was used to test whether there is an equal proportion among each method. In Table 5, the chi-square is 115.552. The critical value at the probability level of .05 with 2 degree of freedom is 5.991. Thus, the null hypothesis is rejected because 115.552 is much greater than 5.991.

Table 5
What form of product advertising on the Internet appeal to you most?

Presentation Form	Observed Frequency	Percentage	Expected Frequency	
Text description	12	6%	58	Chi-Square = 115.552
Photos/pictures about the product	123	61%	58	df = 2
Video clips	39	19.6%	58	Asymp. Sig.= 0
Missing Data	25	12.6%		
Total	199	100.0%		

Research Question Four

Table 6 shows how often the participants use the Internet. About twenty percent of participants use the Internet one or two times per week. About twenty-six percent of participants use the Internet three to five times per week and thirty-five percent of participants use the Internet more than five times per week.

Table 6
How Often College Students Use the Internet

	Frequency	Percentage
None	6	3%
Occasionally (1-2 times a month)	34	17.10%
1-2 times a week	39	19.60%
3-5 times a week	51	25.60%

More than 5 times a week	69	34.70%
Total	199	100.00%

Table 7 indicates the amount of time students use the Internet. About fifty percent of the students indicated that they use the Internet anywhere from one to five hours per day. Nineteen percent of students indicated that they use the Internet between six and ten hours, and nine percent of students indicated that they use the Internet for more than ten hours per day.

Table 7
How Long College Students Use the Internet

Time	Frequency	Percentage
Less than 1 hour	45	22.60%
1 hour to 5 hours	99	49.70%
6-1 0 hours	38	19.10%
More than 10 hours	17	8.50%
Total	199	100.00%

Research Question Five

Table 8 shows the products/services students actively seek information about on the Internet. Automobile information, books, and financial services are the product or service areas from which college students most actively seek information.

Table 8
The Product/Services Students Actively Seek Information About On The Internet

Product/Service	Frequency	Percentage
Automobile Information	82	41.20%
Books	61	30.70%
Financial Service	60	30.20%
Real Estate	37	18.60%
Housewares/Groceries	24	12.10%

Other	40	20.10%

Research Question Six

Research question six investigates the characteristics of students who purchase products/services on the Internet. In this study, students have been divided into two different groups: a) the student who sometimes, often, and very often purchases products/services, and b) the student who never or rarely purchases products/service on the Internet.

Table 9 indicates the characteristics of these two different groups in terms of gender, age, marital status, income level, a computer at home, and computer knowledge. A multiple discriminant analysis was conducted to describe the relative weight of each characteristic of students who sometimes, often, and very often purchase on-line. The standardized discriminant function coefficients are shown in Table 10. We can clearly tell that income level, Internet access at home, computer knowledge, martial status, and employment are important characteristics to determine whether a person who will tend to use on-line purchasing. Age and gender may not have a strong relationship with on-line purchasing. By eliminating age and gender, a linear regression model can be used to calculate a standard weight:

$$Z = 0.575 * X_1 + 0.459 * X_2 + 0.326 * X_3 + 0.317 * X_4 + 0.225 * X_5$$

Where

Z: Standard weight of on-line purchasing

X_1*:* Income levels (five levels, 1-5)

X_2*:* Internet Access at Home (yes=2 or no=l)

X_3*:* Marital Status (single=l, married=2, or divorced=3)

X_4*:* Computer Knowledge (five levels, 1-5)

X_5*:* Employment (yes=2 or no=l)

We can use this model to calculate the probability of whether a student will purchase on-line. If the Z score of a student is zero, there is 50-50 probability that a student will purchase on-line. If Z is negative, there is less than a 50 percent probability that a student will purchase on-line (Zikmund, 1997). The related statistics of the model are shown on Table 11.

Table 9

Students Purchase Products/Service vs. Students Do Not Purchase on the Internet			
Factor	Factor Level	Never or rarely purchase on the Internet	At least sometimes purchase on the Internet
Gender	Male	86	20
	Female	72	17
Age	18-25	76	10
	25-40	14	9
	40-55	8	1
Marital Status	Single	128	18
	Married	26	17
	Divorced	3	2
Employed	Yes	107	27
	No	50	10
Computer Knowledge	1 (Beginner)	2	
	2	25	2
	3	94	18
	4	32	14
	5 (Expert)	4	3
Internet Access at Home	Yes	34	22
	No	93	3

Table 10
Standardized Discriminant Function Coefficients

Factor	Score
Age	-0.03579
Martial Status	0.318278
Income Level	0.594631
Computer Knowledge	0.33163
Internet Access at Home	0.458582
Gender	0.067267
Employed	0.232155

Table 11

The Summary of the Multiple Discriminant Model

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		170	85.4
Excluded	Missing or out-of-range group codes	0	.0
	At least one missing discriminating variable	29	14.6
	Both missing or out-of-range group codes and at least one missing discriminating variable	0	0
	Total	29	14.6
Total		199	100.0

Wilks'Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Significance
1	.784	40.319	5	.000

Standardized Canonical Discriminant Function Coefficients

Factor	Score
Marital Status	0.317
Income Level	0.575
Computer Knowledge	0.326
Internet Access at Home	0.459
Employment	0.225

Structure Matrix

Factor	Score
Marital Status	0.741
Income Level	0.581
Computer Knowledge	0.538
Internet Access at Home Employment	0.039

Pooled within-groups correlation's between discriminating variables and standardized canonical discriminant functions. Variables ordered by absolute size of correlation within function.

Group Centroids

Purchase:	No	-0.26106
Purchase:	Yes	1.04425

1. *Note: No= Never or rarely purchase; Yes= At least sometimes purchase on the Internet.*
2. *Unstandarized canonical discriminant functions evaluated at group means*

CONCLUSIONS

Eighty percent of the students responding to the survey use the Internet at least one time per week. Moreover, seventy-seven percent of the students spend at least one hour per week on the Internet. College students tend to use the Internet to check product information and check general information on a company more than to actually purchase a product. When purchasing a product, however, the students indicated that they prefer to check the product information and then mail a check to the company as opposed to using a credit card. This indicates that students are still concerned about giving their credit card number on the Internet. In fact, students indicated that they will not buy from the Internet because of a lack of security. Moreover, they do not buy from the Internet because of the inability to judge the product, and the inability to see or feel the product.

When seeking information about product and services, students most frequently seek information about automobiles, books, and financial services. When purchasing from the Internet, students believe that photos and pictures about the product are the most influential form of product advertising. Finally, students who make purchases on the Internet usually have more computer knowledge than those who never purchase from the Internet.

The main limitation in this study is that the subjects are students who may have limited income. Students, however, may spend more time on the Internet than other types of respondents. For future research, a study could be conducted on alumni, faculty or business men and women to see if their responses are similar to the sample used in this study.

APPENDIX C
THE QUESTIONNAIRE
INTERNET USE SURVEY

This study is designed to obtain information about Internet use for a research project. **This survey is completely confidential and is not used for any commercial purpose.** You do not have to place your name on the questionnaire. Thank you.

1. How often do you use the Internet (average)?

_____None _____ Occasionally or l-2 times per month _____1-2 times a week
_____3-5 times a week _____More than 5 times a week.

2. How many hours do you use the Internet (average) per week?

_____less than 1 hour _____ 1 hour to 5 hours _____ 6-10 hours _____ more than 10 hours

3. Which application(s) do you use most on the Internet? (check one or more)

_____E-mail _____ World Wide Web _____ Newsgroups _____Gopher _____ Telnet
_____ Ftp _____ IRC _____ Other

4. For which purpose(s) do you use the Internet? (check one or more)

_____ Fun _____ Education _____ Purchasing _____ Commercial Information
_____ Non-commercial Information (Research) _____ E-mail
_____ Job search _____ Other

5. Do you use the Internet to check product information?

_____Never _____ Rarely _____ Sometimes _____ Often _____ Very Often

6. Do you use the Internet to check general information about a company (address, telephone, help line)?

_____Never _____ Rarely_____ Sometimes _____ Often_____ Very Often

7. Have you purchased a product through the Internet?

_____Never _____ Rarely _____ Sometimes _____ Often_____ Very Often

8. What kinds of products do you purchase from the Internet? (rank them if there are two or more)?

_____ computer products _____electronics _____books _____entertainment (rent a movie on the Internet) _____Others

9. What are the major reasons you would NOT buy through the Internet? (check one or more)

_____ Lack of security _____ Expensive _____ Inability to judge the product
_____ Do not have an Internet connection _____ The speed of the Internet is too slow
_____ Frequent interruption of communication _____ Knocked/kicked off line

_____ Can't see or feel the product _____ Other _____

10. How would you rank the effectiveness of advertising in various media, using "l for ,'most effective," "2" for "second most effective," and so forth:

_____TV _____ Radio _____Internet_____ Newspaper _____Magazine
_____Mail _____Thrifty Nickel _____Other

11. If you purchase from the Internet, which way do you prefer?
_____Check product information, then call them to charge it to a credit card
_____Check product information, then mail them a check
_____Check product information, then enter your credit card information on the Internet

12. If security were improved on the Internet, you: (check one)

_____ definitely would buy _____ probably would buy _____ may or may not buy
_____ probably would not buy _____ definitely would not buy

13. What do you do when an advertisement comes on the Internet?

_____ read it _____ignore it _____ leave the Internet
_____quit/ press "no thanks" button _____change the screen _____ Other

14. Does it irritate you that too much advertising comes over the Internet?

_____Never _____ Rarely _____ Sometimes _____ Often _____ Very Often

15. What forms of product advertising on the Internet appeal to you most?
_____text descriptions
_____ photos/pictures about the product
_____video clips (i.e. movie shows about the product)

16. Which aspects of Internet advertising are most annoying to you? Use 1 for "most annoying," "2" for "second most annoying," and so forth:

_____interrupts my search _____ ads having no "quit" buttons
_____pop-up" ads _____ other: _____

17. For what purpose do you use Internet advertising? Use "l" for "most frequent," "2" for "second most frequent," and so forth:

_____price comparison _____seasonal sales _____ determine availability
_____convenience/reduce travel _____size/color/style _____ product information

_____other: _____

18. For which products/services do you actively seek advertising on the Internet?

_____financial services _____ automobile information
_____real estate _____ housewares /groceries
_____books _____ services_____

_____other: _____

19. What is your age? _____Under 17 _____18-25 _____26-40 _____41-

20. What is your gender? _____Male _____Female

21. What is your marital status? _____Single _____Married _____ Divorced

22. Are you presently employed? _____Yes _____ No

23. What is your income level?

_____Less than 10,000 _____$1 0,000 to $17,500
_____$17,500 to $27,000 _____$27,000 to $35,000
_____$35,000 to $50,000 _____$50,000 to $75,000
_____.$75,000 to $125,000 _____$125,000 or more

24. What is your knowledge level of computers? (On a scale of 1 to 5 , with "5" being expert's level, "1" equivalent to a beginner's level) Please circle

Beginner's Level Expert's Level

1 2 3 4 5

25. Where do you have Internet access?

_____Home _____Work _____School _____
__Other:_____
_____

26. My class is:_____ My major is: _____

I sincerely appreciate your time and effort in completing this questionnaire. Thank you for your help.

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EXPANSION INTO THE FUTURE: HEALTHCARE AND INFORMATION SYSTEMS TECHNOLOGY

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ABSTRACT

This paper examines the current state of health care information systems. While progress has been made, the industry still needs vast improvement to catch up with technology. An integrated healthcare information system would provide numerous benefits to the industry.

INTRODUCTION

In a world where the local "discount city" maintains an on-line, real-time inventory system, where current stock quotes are just a click away on everyone's web-browser, and where practically anyone and everyone can become an instant "expert" on nearly anything simply by playing around on the Internet, it seems as though the U.S. healthcare system could do something more with information. The United States has some of the top healthcare facilities in the world. But, as far as information goes, it has been slow to institute automated systems.

Today's healthcare information system has not keep up with information science. However, slowly but surely, this status is changing. Many, but not yet most, healthcare providers and insurers have begun to maintain electronic records; healthcare intranets are becoming more common occurrences around the country; even the Internet is becoming a strategic healthcare tool in some areas. But still something is lacking. All of the healthcare players do not have an information system, and those that do are not truly linked. The American healthcare system needs something well-constructed, operationally efficient information system that connects providers, insurers, and patients around the country and can drive American healthcare to the bounds of its capabilities.

This system is needed to provide more enhanced service through offering providers, insurance carriers, and patients advantages in care, billing, and planning. The advantages this system would offer are vital for the growth and continued development of the healthcare system.

However, this information system will not be without limitations. Problems with security, provider use, cost, time, standardization and the continued need for some paper-based records would all place pressure on this information system. However, with the possibilities offered by technology, these limitations can be overcome.

Despite the fact that most areas of business and industry throughout the United States place focal emphasis on information technology, the healthcare industry simply does not. Although high tech proliferates in almost every other area of clinical practice, information technology is often only found in isolated "islands of information" within provider and insurance institutions (Bringing healthcare online, Internet). Working toward an on-line, integrated healthcare information system should be a primary objective of the healthcare industry in the next century.

HEALTHCARE AND INFORMATION TECHNOLOGY - THE PRESENT STATE

Across the Unites States today, one does not find a healthcare information system that is integrated and automated. Rather, one finds, amid a sea of relative confusion, a few isolated "islands of automation" which combine with manual, paper-supported operations to create a larger healthcare system. This system can principally be segregated into three, hierarchal levels: level one, local isolated; level two, local integrated; and level three, system-wide integrated.

Local Isolated

A healthcare information system that functions in an integrated, responsive manner, must, at its most basic level, consist of components that operate with a high degree of automation. Today, in the American healthcare information system, this is simply not the case. According to a 1998 survey by the Healthcare Information and Management Systems Society, only two-percent of 1,700 healthcare information executives have a fully operational computer-based patient record (CPR) system in operation, and nearly twenty-five percent have not even begun to plan for CPR systems (Serb, 1998). A separate survey indicates that only slightly more than one-third of the nation's healthcare networks have some sort of electronic patient record system in operation (Menduno, 1998). Providers receive little incentive from insurance companies to become electronic; the majority of insurance companies do not accept electronic claim filing (Moynihan & McLure, 1998). Without automated records, at the local, isolated level, it is difficult, if not impossible, to exchange up-to-date information within each system itself, let alone with other healthcare entities. However, for those who are automated, advancement to the next level, local integration, is possible.

Local Integrated

Considering how few local healthcare systems operate with automation, it is no surprise how few operate on the next level, integrating within the organization and with other local healthcare systems. However, there are healthcare organizations who are constantly pushing forward to make this possibility a reality. Use of both intranets, which most commonly link doctors within organizations, and remote access capabilities, which allow doctors "unconventional" access to patient information (such as after hours from their homes), is on the rise throughout the country (Serb, 1998). Some geographic locations have even gone so far as to implement community health information networks (CHIN). CHINs connect hospitals, medical clinics, physician offices, insurance companies, pharmacies, and other related organizations within a specific geographic region. They provide each of these entities patient clinical and financial information via integrated computer and telecommunications capabilities (Lassila, Pemble, DuPont & Cheng, 1997). One example of a CHIN is the Minnesota Health Data Institute's "MedNet." MedNet is a secure "network of networks" which links major health plans' networks with other

healthcare parties within the state (Starr & Starr, 1997). Even given these advances, no healthcare organization has truly integrated with, and few have even explored the next level of system wide integration.

System-Wide Integrated

At the present time, the U.S. healthcare system is anything but integrated. Few, if any healthcare organizations have even explored the possibility of using a system with nationwide access, such as the Internet, in their information pursuits. Some of the systems which do allow national access, such as the government funded Patient Centered Access to Secure Systems Online research project (PCASSO) primarily only address one area of the healthcare information problem-the need for patients to have ready access to their own health records. The issues of linking providers and insurance carriers has not been a forefront issue. Although few healthcare entities have explored this encompassing level of the healthcare information structure, this is the area where ultimate expansion needs to be aimed. It is at this level in which an integrated, efficient healthcare information system must be developed.

CONCEPTUAL MODEL
NATIONALLY INTEGRATED HEALTHCARE INFORMATION SYSTEM

If the healthcare information systems of this country are to be utilized to their fullest potential, eventually, the U.S. will operate with a nationwide, integrated information system. Through this system, each of the healthcare industry's primary sectors, providers, insurers, and patients, will have access to patient clinical data. For this system to exist, several changes will quite obviously have to be made.

All local systems must first develop fully electronic records. These records must be of the type that exist within a "virtual" healthcare information department-authorized users will have system wide, immediate electronic access to patient information (Odorisio 306). Second, a nationwide framework must be made available in which a system to input, store, and retrieve data may be developed. Third, a system must be developed in this framework through which each of the three sectors can input data and access its processed output--usable, accessible information.

Obviously, the first stage, developing a fully automated record system, is under way, but potentially years from completion. The completion of this first stage necessitates a committed effort on the part of healthcare insurers and providers to make this ideal a veritable reality.

The second stage of this process, creating a nationwide framework, could be achieved through establishing a new network that physically connects each authorized sector participant to a main database. While providing a great amount of security, the implementation of such a system would likely be both physically and financially impossible. A more viable solution would be to use what is already in place, the Internet.

Utilizing the Internet would still entail creating a database into which the information from the three sectors could be inputted, stored, and received. Ideally, all information would be stored in a central database, securing the integrity and completion of patient records. However, such an expansive creation would likely be impossible in realistic form. The creation of this database would result in somewhat of a problem with regard to its originator and manager. A privately managed database would create a necessary monopoly, not likely to be viewed with high esteem by federal regulators. A government managed system, through adding another layer of typically inefficient bureaucracy would create what many dislike,

too much oversight and, most likely, inefficient operation. Perhaps the best solution would be to adopt a set of standards with which each sector could input and access information, and allow intranets encompassing states or even regions to maintain data warehouses for the input information. Authorized users would be given access to any of these databases through use of a web-browser.

By utilizing the Internet, a viable healthcare information system can be developed to manage the electronic patient records of individual providers and insurers, through participation in geographic intranets. Such a system would offer the healthcare industry the ability to overcome current obstacles and expand with new opportunities.

ADVANTAGES OF INTEGRATED HEALTHCARE INFORMATION SYSTEMS

An integrated, nationwide healthcare information system will benefit its three primary sectors, healthcare providers, insurers, and patients, in a number of ways. These benefits will primarily be recognized in patient care and cost savings. All of the benefits and uses described below are not obtained solely from the large, integrated information system itself. Some of them will be brought about through utilizing the systems and improvements created as a base for the larger, integrated system (such as electronic records and local intranets).

Patient Care

With the use of an integrated healthcare information system, physicians will be provided with easier and more effective access to their patients' clinical data and to relative, possibly critical information.

If an expert system were integrated into the information system, it could potentially save millions of dollars, and possibly quite a few lives. According to the Journal of the American Medical Association, adverse drug reactions fall between the nation's fourth to sixth leading cause of death (Menduno, 1998). Not a fact to be taken lightly. With the ability to connect healthcare providers through networks, smaller providers could conceivably have access to resources that have previously been out of their reach.

Even if an expert system is not added to the network, care providers will be able to offer patients better service as their status will be measured by much more efficient means. With such a system, doctors will be capable of updating and accessing patient records after hours, gaining a colleague's opinion on a patient's condition (even if they are thousands of miles apart), or reviewing a patient's entire medical history before prescribing treatment.

With an information system that can be accessed via the Internet, even patients can gain passage to their own medical records. In an era where patients, especially those with potentially terminal or lifelong illnesses, are choosing to become more educated about their health, an information system that provides needed details could become invaluable. The PCASSO system already has a security system that would allow patients to utilize such an information system to further their education about their illness. This system classifies each piece of a patient's record into one of five security categories:

- Low: anonymous or "nonpatient-identifiable" data (can be used by researchers, etc.)
- Standard: regular patient information without special sensitivity
- Public Deniable: information that demands extra security, such as HIV status, mental-health records belonging to celebrities

- Guardian Deniable: teenage abortion or other records that can be kept from parents or guardians
- Patient Deniable: information that could cause harm to the patient if known (such as confidential information provided by a relative)

Classification such as this protects the security of patient records, while at the same time, allows individuals the opportunity to monitor their own treatment process. This facet of the information system could potentially become one of the most valuable. As Dr. Dan Masys, director of Biomedical Informatics and associate clinical professor of medicine at the University of California, San Diego stated:

> "In America, to some extent, we still have the Norman Rockwell view of health care, with the physician who knows all and the patient not having to worry about it. But the reality-especially when you become seriously ill-is that there are some very complicated and not-so-black-and-white issues and lots of choices to be made. The better educated you are, the better able you'll be to participate in taking care of your own health (Breckinridge, online, 4)."

Cost Savings

With the cost of healthcare perpetually on the rise, any cost savings are welcome. An integrated, up-to-date healthcare system would offer many such savings.

Saving to Providers. Historically, adverse drug events have cost hospitals $2,200 to $3,500 per ease; the use of a network expert system could eliminate many of these, potentially saving millions of dollars per year (Menduno, 1998). With such a system, doctors eventually will be able to order prescriptions and check insurance eligibility almost instantaneously, saving valuable time, effort, and hence, money (Serb, 1998). Further, administrators should also be able to utilize such data to improve operational performance and obtain information to -support crucial decisions (Scheese, 1998). Utilizing this system, providers should be able to operate in a more effective manner, saving insurance carriers and patients the cost of needless treatment. This advance should conceivably allow care to be evaluated more for performance rather than price (Millenson, 1998).

Savings to Insurance Providers. An integrated information system should also greatly benefit insurance providers with many cost savings. Currently, insurance premiums are often based on out-of-date or incomplete data--there simply is not an effective means to gain the current data quickly enough. This delay sometimes translates into significant losses-an anticipated $75 to $105 million loss for Aetna and nearly $70 million loss for Oxford, in 1998 alone (Haugh, 1998). Further, with an inside track on patient records, health management organizations can monitor the effectiveness of contracted, network physicians within the organization. By monitoring performance in terms of cost and results per-episode, improvement in outcomes and competitiveness can be realized (Breckinridge, online, 1). As mentioned above, insurance carriers should also be spared the cost of much patient treatment that is unnecessary.

Savings to Patients. In addition to the more advanced care that an integrated information system will offer, patients should also receive substantial cost benefit. By possessing the capability to access their own records, patients could possibly customize their treatment to meet individual needs, thus avoiding duplicated and unnecessary treatment. Also, as mentioned

above, with healthcare providers' possession of a wider base of clinical data, unnecessary treatment will hopefully almost be eliminated.

An integrated, nationwide system should benefit each sector of the healthcare industry sufficiently to justify its implementation and use. However, such a system is not without problems and limitations.

PROBLEMS AND LIMITATIONS OF THE INTEGRATED INFORMATION SYSTEM

In order to be effectively used by the healthcare industry, the information system discussed would be faced with at least five problems and limitations that it must overcome or compensate for in order to become a success. These factors are: security, doctor utilization, cost and time to implement, standardization, and the still present need for some manual records.

Security

As everyone surely realizes by now, the world wide web is not a foolproof, totally secure method of communication. However, enough systems are in place today that protected communication can be accomplished fairly easily. The problem which still exists, however, mainly lies in limiting access to this protected information. Through the use of passwords, as well as limited physical access, electronic records should be provided the utmost security. This qualification is necessary from both a legal and ethical standpoint (Fotsch, 1998a). However, with the use of the Internet, the possibility for unauthorized use of the information system will most certainly always be present.

Doctor Utilization

When a system such as this is in place, office staff will be forced to use it-it will be part of their job description, they will not have a choice. But what about the physicians who are defiant to the use of the system? Possibly due to resistance to change, fear that ethical standards will be compromised, fear that the new system will create more work, or other reasons, physician resistance to the use of networks for clinical purposes could be very much a reality.

A 1998 survey by Healthcare Financial Management revealed that forty-percent of the polled physicians stated "that they probably would not use computers or networks for clinical purposes even if training were provided and services were made available free or at a very low cost (Fotsch, 1998a, 27)." Quite obviously, this reveals but one thing-doctors must be considered in the design of this network. It is absolutely imperative that physicians feel they are gaining an advantage by using the system.

Perhaps through emphasis on the idea that the physician's office becomes virtually boundless with this system, or through emphasis on the idea that this system will make a doctor's life easier-the benefits of the system must be stressed. Because, quite obviously, if the doctors do not input data, the system has nothing to process, and it becomes a failure.

Cost and Time to Implement

For a provider or insurer that has limited or missing electronic data banks, conversion to an information system such as this will be both time consuming and costly. The key to overcoming this limitation is in discovering the cost benefit that such a system can offer. Simple cost-benefit analysis cannot readily apply to a system such as this. Such a system is not traditional, and requires an alternative method of valuation. To justify the cost that conversion will entail, each sector must come to view information "as a valuable resource that increases individual, departmental, and organizational performance and productivity ... a competitive advantage (Scheese 57)." It is only by this means that such a large expenditure will stand the chance of acceptance ill any organization.

Standardization

Around the country, each individual healthcare provider and insurance carrier has its own method of storing patient data. One might link patient records by social security number, another by an internally assigned identification number, and still another by last name. The point is, there are few, if any, standards that govern the form of medical records. In this current state, a massively integrated information system could never function. Standardization is necessary.

To facilitate the exchange of patient information among applications on a network, users must be able to exchange and correctly recognize unique "patient identifiers" (Fotsch, 1998c, 26). In order for this to be accomplished, a patient indexing system must be developed, one which will allow management of discrete clinical data from various systems in a manner that insures all entered information will remain associated with the correct patients and providers (Fotsch, 1998b, 27). The Health Insurance Portability and Accountability Act of 1996, which requires nearly all claims payers to support electronic claims processing and uniform national standards for code sets and identifiers by the year 2000 is definitely a step in the right direction (Moynihan, 1998). Clearly, standardization is not merely a limitation that can be compensated for, but an obstacle that must be overcome before any information system such as this can be installed.

Paper Records

Even if a seemingly full-fledged electronic record system is placed within an organization, the need for some paper records does not entirely disappear. Doctors' notes and observations, often recorded on patient charts, still must be consulted for immediate analysis, audits of prescribed treatments, and research (Beckham, Englert, Davis & Koch, 1998). Until physicians stop using pens and pencils entirely, this need will likely never be overcome--it must simply be dealt with.

CONCLUSION

With the healthcare industry spending $7 billion dollars on information technology annually, and with an expected doubling of this figure by the end of the decade, serious potential for improvement in the way healthcare information systems operate exists (Lassila et al., 1997). However, according to Health Care Investment Visions, most makers of healthcare software are not basing their business foundation on "new-generation technologies" such as the Internet (Tech tomorrow, 1998). Certainly something can be done with the U.S. healthcare information system. But, will this something ever be accomplished?

The current healthcare information systems in this country are limited by a number of factors. All patient records are not electronic. Without electronic records, exchange of information within an organization and among organizations can hardly be accomplished in a timely and efficient manner. Further, the healthcare information systems of today exist in relative isolation. Few are connected through shared networks, and those that are link at the local level, not in a nationwide system. For the healthcare industry to take full advantage of the potential of information technology, a nationwide, integrated healthcare information system should be developed.

Such a system would offer numerous advantages to each sector of the healthcare industry. This system will allow healthcare providers to offer better care through more efficient dissemination of knowledge to physicians, via expert systems, colleague evaluation, and patient opinion. Further, this system will offer cost benefits to the healthcare provider, insurer, and patient. Combined, these two areas of potential advantage should create a more accepted and productive healthcare system.

Although this system would offer its users a number of advantages, it is not without limitations. Problems with security, usage, cost, standardization, and the ever-lasting presence of paper records would have to be overcome or dealt with in order for the system to operate with any degree of success. However, given the advantages such a system would offer, these limitations seem to be surmountable obstacles.

An integrated, nationwide healthcare information system would provide everyone with a more efficient, affable operation: Although the benefits well-justify this endeavor, reaching this point will be a long, hard struggle. There is no doubt the healthcare system in the United States will eventually reach this point, but how, and when, are far different questions.

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STUDENTS' PERCEPTION OF EFFECTIVENESS USING DIFFERENT METHODOLOGIES OF TEACHING ADVANCED BUSINESS STATISTICS

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ABSTRACT

The primary focus of this research was to investigate student's perceptions of the effectiveness of various methodologies of teaching advanced business statistics. A questionnaire was administered to students enrolled in advanced statistics in the fall semester, 1998. An analysis of the results indicates that students exhibited a strong opinion regarding the use of the manual approach (hand-held calculator) as compared to utilizing a computer software package (MINITAB). The students clearly preferred utilizing the manual method of learning to the use of a computer software package

INTRODUCTION

Most universities and colleges require students to take one or more statistics courses in many different majors, e.g., education, psychology, business, etc., for the non-specialist. This paper focuses on methods utilized in teaching statistics to those non-specialists who are majoring in a field within business. The traditional method currently used in teaching statistics is widely viewed as being ineffective (Cobb, 1993; Mosteller, 1988). One of the reasons generally given for this lack of success is that current statistical teaching methodology neglects to establish a definitive linkage between statistics in the classroom and its use in "real world" applications (Yilmaz, 1996). The non-specialist does not aspire to be a mathematical theorist, but needs only to use statistics as a tool in analyzing or solving a problem. This paper does not intend to imply that mathematical theory is unimportant, but takes the position that the use of statistics as a tool is equally important to those people involved in the ongoing everyday activities of business and life. The teaching of applied statistics should be approached as a skill. The teaching of any skill involves repetition and the actual performance of an activity, i.e., "hands-on" training. In short, you cannot acquire statistical competencies via the passive role of listening to lectures or observing the professor solve a statistical problem - you can only acquire these skills by being an active participant, i.e. by performing the activities yourself. Smith (1998) states that students

should design the study, collect the data, analyze the results, prepare written reports, and give oral presentations.

The successful use of statistics involves many components, for example, basic mathematical skills, problem selection, model building, data gathering (possibly from global databases or data warehouses), interpretation, computer literacy, software selection and utilization, and clearly communicating the statistical results to those interested parties. Ethics and legal issues also play a major role in the use and interpretation of statistics; however, these important issues are outside the scope of the current paper. It has been documented ad nauseam that when students enter universities they lack the basic foundation mathematical skills required to immediately enroll in mainstream mathematical courses. Perhaps this is because individuals tend to avoid what they are not successful in doing, which in this case, can lead to math anxiety or math phobia. Hogg (1991) found that "students frequently view statistics as the worst course taken in college." In the fall of 1998, there was a total of 2,583 first time freshmen at Middle Tennessee State University of which 1,106 freshmen had to take at least one developmental mathematics course (Bader, 1999). Many students hope that if they can just get past this course that everything will be all right, which is of course, is a non sequitur because they will have to utilize these statistical skills in many courses. Ideally, the statistical courses should view the entire scope of an individual's life (1) statistics is an important part of each student's professional development: and (2) statistics is an important part of each student's everyday life (Iversen 1985, Moore and Roberts 1989, Moore and Witmer 1991). Rumsey (1998) believes that selecting a textbook which contains relevant, real-world examples and exercises, real-world data sets of varying sizes, and text written in the general education themes is vital to satisfying these two goals.

Many students who enroll in the statistics courses do so without sufficient computer literacy skills, and, therefore, spend their time attempting to master those requisite computer skills, ultimately neglecting the in-depth understanding of the statistics which was the objective of the course. Additionally, students appear to be more interested in acquiring computer skills than mathematical skills, probably because it is much more fashionable to talk about computers than statistics, and, very importantly, students are aware that computer skills are advertised as a prerequisite for most jobs whereas they seldom find mathematical competencies advertised as a prerequisite for jobs.

The recommendations of the American Statistical Association and the Mathematical Association of America (ASA/MAA, 1998) Committee on Undergraduate Statistics should be integrated into the methodology utilized for teaching statistical courses. These recommendations are to teach statistical thinking; to emphasize more data and concepts, less theory and fewer recipes; and, to foster active learning. There are several approaches for teaching statistics to the non-specialist: (1) the use of manual calculations by using a hand-held calculator, (2) the use of a computer package, and (3) a combination using both the manual and computer software package. A computer package, such as MINITAB, could be selected which would enhance the student's ability to visualize and explore basic statistical concepts. MINITAB provides the means to generate the output and then allows the student to become statistical thinkers.

Considerable discussions among MTSU statistics faculty have occurred with opinions differing as to the effectiveness of a particular methodology and the resultant outcomes. Statements range from "you don't have to know how to build a car to be able to drive it" to "if you don't know how it works you can't fix it". In an attempt to satisfy instructors at both ends of the continuum, many statistics faculty members introduce new topics to students with manual methods (hand-held calculators) then reinforce the topic with the use of a computer statistical package (MINITAB).

The College of Business at MTSU is AACSB accredited and has a state-of-art new building with computer labs and networked telecommunication facilities. Each classroom has multimedia, a projector, and is networked so that computer software is immediately available to the instructor and students alike. MINITAB for Windows is used in the classrooms and in the computer laboratory, making MINITAB available both in class and for out-of-class assignments. In addition to the computer lab, there is a separate business statistics lab in the same locale as the offices of the faculty members who teach the statistical courses. The business statistics lab staff is composed of graduate assistants whose assignment is to assist students who require additional information, as well as help then in utilizing statistical packages.

All students majoring in any field offered within the College of Business must take an introductory level course in statistics (Statistical Methods I) which covers topics in measures of central tendency, variation, probability theory, point and interval estimation, and hypothesis testing. This survey did not include students in this introductory statistic course

MTSU schedules over 10 sections of the junior level course in advanced business statistics (Statistical Methods II) each semester. While each faculty member teaching this course must cover specific core topics, the method of presentation is an individual decision. Topics covered include hypothesis testing and regression analysis. Techniques range from those faculty members who make minimal use of a statistical software package (MINITAB) to those who make minimal use of manual calculations (hand-held calculators).

RESEARCH METHODOLOGY

A questionnaire was created and administered to seven sections of the advanced statistics course (Statistical Methods II) during the last scheduled class day in the fall semester of 1998. The students were asked to relate their views on the efficacy of the dual method of presentation, i.e., utilizing both the manual (hand-held calculator) and a computer package, as well as their evaluation of the effectiveness of more or less presentation with either of the methods (See Appendix for Questionnaire). A Likert-type scale from 1 (strongly disagree) to 7 (strongly agree) was utilized to determine the student's perceptions of the benefits of one teaching methodology over the others.

DATA ANALYSIS

To identify all statements, with which students either strongly agreed or strongly disagreed a null hypothesis that the midpoint of responses = 4 was tested for each of the twenty-five statements (4 could be considered the point of indifference).

The appropriate statistical procedure to be utilized in the analysis considered the following : a t-test requires an assumption of normality; all statements were tested using an Anderson-Darling test for normality and all 25 statements were found to have responses that were not normally distributed at the 0.000 level of significance. Hence, the Wilcoxon Signed-Rank test should be used to analyze data significance. But, since the data are ordinal the Sign Test should possibly be used. To try to satisfy as many objections as possible, all 25 statements were tested using both the Wilcoxon Signed-Rank test and the Sign test. See tables 1 and 2.

Table 1
Wilcoxon Signed Rank Test
Test of median = 4.000 versus median not = 4.000
Boldface for P-value = 0.000

Statement	N	N Missing	N for Test	Wilcoxon Statistic	P	Estimated Median	Z for W	Rank
C1	**104**	**0**	**91**	**3767.5**	**0.000**	**5.500**	**6.62751**	**23**
C2	**104**	**0**	**88**	**476.5**	**0.000**	**2.500**	**-6.16431**	**2**
C3	**104**	**0**	**88**	**3628.0**	**0.000**	**5.500**	**6.94863**	**24**
C4	104	0	86	2042.0	0.462	4.000	0.73848	19
C5	**104**	**0**	**95**	**4308.0**	**0.000**	**6.000**	**7.52765**	**25**
C6	104	0	84	1080.0	0.002	3.500	-3.14414	10
C7	**103**	**1**	**93**	**496.0**	**0.000**	**2.000**	**-6.47348**	**1**
C8	104	0	82	1606.0	0.661	4.000	-0.44149	17
C9	**104**	**0**	**82**	**2832.5**	**0.000**	**5.000**	**5.22854**	**21**
C10	**104**	**0**	**83**	**901.5**	**0.000**	**3.000**	**-3.82052**	**9**
C11	**104**	**0**	**90**	**3359.0**	**0.000**	**5.000**	**5.27707**	**22**
C12	104	0	87	1798.0	0.625	4.000	-0.49096	16
C13	103	1	72	776.0	0.003	3.500	-3.01909	11
C14	103	1	72	1140.0	0.330	4.000	-0.97643	15
C15	103	1	84	1168.5	0.006	3.500	-2.74945	12
C16	**104**	**0**	**84**	**747.5**	**0.000**	**3.000**	**-4.62702**	**4**
C17	103	1	88	1688.0	0.262	4.000	-1.12343	14
C18	**104**	**0**	**71**	**358.0**	**0.000**	**3.000**	**-5.27145**	**3**

C19	**104**	**0**	**72**	**556.0**	**0.000**	**3.000**	**-4.25366**	**7**
C20	**104**	**0**	**70**	**481.5**	**0.000**	**3.000**	**-4.45351**	**5**
C21	**104**	**0**	**68**	**454.5**	**0.000**	**3.000**	**-4.39029**	**6**
C22	103	1	69	818.0	0.020	3.500	-2.32880	13
C23	**104**	**0**	**63**	**448.0**	**0.000**	**3.500**	**-3.83382**	**8**
C24	104	0	76	1431.5	0.872	4.000	-0.16309	18
C25	104	0	78	1842.0	0.134	4.500	1.50170	20

From table 1 (the Wilcoxon Signed Rank test) the statements with the strongest effects (P=0.000) are: 1, 2, 3, 5, 7, 9, 10, 11, 16, 18, 19, 20, 21 and 23.

Table 2
Sign Test
Test of median = 4.000 versus not = 4.000
Boldface for P-value ≤ 0.000

Statement	N	N*	Below	Equal	Above	P	Median	Z for Above	Rank
C1	**104**	**0**	**14**	**13**	**77**	**0.0000**	**6.000**	**6.60419**	**23**
C2	**104**	**0**	**76**	**16**	**12**	**0.0000**	**3.000**	**6.82242**	**1**
C3	**104**	**0**	**7**	**16**	**81**	**0.0000**	**6.000**	**7.88843**	**24**
C4	104	0	34	18	52	0.0668	4.500	1.94099	19
C5	**104**	**0**	**7**	**9**	**88**	**0.0000**	**6.000**	**8.31042**	**25**
C6	104	0	54	20	30	0.0121	3.000	2.61861	10
C7	**103**	**1**	**79**	**10**	**14**	**0.0000**	**2.000**	**6.74019**	**2**
C8	104	0	42	22	40	0.9121	4.000	-0.22086	16
C9	**104**	**0**	**17**	**22**	**65**	**0.0000**	**5.000**	**5.30071**	**21**
C10	104	0	57	21	26	0.0010	3.000	-3.40269	9
C11	**104**	**0**	**18**	**14**	**72**	**0.0000**	**5.000**	**5.69210**	**22**
C12	104	0	44	17	43	1.0000	4.000	-0.10721	17
C13	103	1	44	31	28	0.0771	4.000	-1.88562	13
C14	103	1	38	31	34	0.7237	4.000	-0.47140	15
C15	103	1	53	19	31	0.0219	3.000	-2.40040	12
C16	**104**	**0**	**61**	**20**	**23**	**0.0001**	**3.000**	**-4.14614**	**6**
C17	103	1	47	15	41	0.5940	4.000	-0.63960	14

C18	**104**	**0**	**60**	**33**	**11**	**0.0000**	**3.000**	**-5.81523**	**3**
C19	**104**	**0**	**54**	**32**	**18**	**0.0000**	**3.000**	**-4.24264**	**5**
C20	**104**	**0**	**52**	**34**	**18**	**0.0001**	**3.500**	**-4.06378**	**7**
C21	**104**	**0**	**53**	**36**	**15**	**0.0000**	**3.000**	**-4.60818**	**4**
C22	103	1	45	34	24	0.0161	4.000	-2.52810	11
C23	**104**	**0**	**46**	**41**	**17**	**0.0004**	**4.000**	**-3.65366**	**8**
C24	104	0	36	28	40	0.7308	4.000	0.45883	18
C25	104	0	29	26	49	0.0315	4.000	2.26455	20

From table 2 (the Sign test) the statements with the strongest effects (P=0.000) are: 1, 2, 3, 5, 7, 9, 11, 16, 18, 19, 20, 21 and 23.

Using the Sign test, statement 10 is only significant at the 0.001 level of significance, so was not included in the common set of thirteen statements showing the strongest effects. These thirteen statements may be further broken down as follows:

Statements showing the highest levels of agreement: {1, 3, 5, 9 and 11}.
Statements showing the highest levels of disagreement: {2, 7, 16, 18, 19, 20, 21, and 23}.

Ranking those statements with the strongest levels of agreement could be done by simply ranking the computed value of the t-test statistic. However, this approach would not be appropriate for the Wilcoxon Signed-Rank test (ranking by the computed values of the Wilcoxon statistic) or for the Sign test (ranking by the number of values above the median), because in both of these procedures the number of values equal to the median are not used. One approach is to calculate the appropriate Z-value for each computed value of the test statistic and then rank the Z-values.

For the Wilcoxon Signed-Rank test, the normal approximation formula is:

$$Z = [W - (n')(n' + 1)/4]/\text{sqrt}[(n')(n' + 1)(2n' + 1)/24]$$

where n' is the number of responses that differ.

These Z-values and their ranks are shown in Table 1.
For the Sign test, the normal approximation formula is:

$$Z = [\text{Above} - (n')/2]/\text{sqrt}[(n')/4].$$

These Z-values and their ranks and are shown in Table 2.

Both the Wilcoxon Signed-Rank test and the Sign test have the same rank order for the five statements for which the students showed the largest amount of agreement. This order was:

Highest agreement to lower (but still very significant) agreement 5, 3, 1, 11, 9.

However, the Wilcoxon Signed-Rank test and the Sign test have a slightly different rank order for the eight statements that the students showed the largest amount of disagreement. These orders were:

Wilcoxon Signed-Rank test
Highest disagreement to lower (but still very significant) disagreement 7, 2, 18, 16, 20, 21, 19, 23.

Sign test
Highest disagreement to lower (but still very significant) disagreement 2, 7, 18, 21, 19, 16, 20, 23.

The statements are marked: H for manual (hands on) and M for MINITAB.

				H&									
Positive	H	M	H	M	H	M	M	H	H	M	H	M	M
Statement	1	2	3	4	5	6	7	8	9	10	11	12	13
Negative	M	H					H	M					
Positive	M	M	M	M	M	M	M	M	M	M	M	M	
Statement	14	15	16	17	18	19	20	21	22	23	24	25	
Negative				H									

The most agreed with statements will be designated **A1, A2, A3, A4 and A5.**

Most Agreed With Statements

	A3		**A2**		**A1**				**A5**		**A4**		
				H&									
Positive	H	M	H	M	H	M	M	H	H	M	H	M	M
Statement:	1	2	3	4	5	6	7	8	9	10	11	12	13
Negative	M	H					H	M					
Positive	M	M	M	M	M	M	M	M	M	M	M	M	
Statement	14	15	16	17	18	19	20	21	22	23	24	25	
Negative				H									

In every statement where manual calculation is placed in a positive connotation (H above the statement number), it is in the set of statements with which the students' agreement was at the highest level. The most disagreed with statements will be designated **D1, D2, D3, D4, D5, D6, D7 and D8** and will be rank ordered determined by the Sign test.

Most Disagreed With Statements

	D1						**D2**						
				H&									
Positive	H	M	H	M	H	M	M	H	H	M	H	M	M
Statement:	1	2	3	4	5	6	7	8	9	10	11	12	13
Negative	M	H					H	M					

			D6		**D3**	**D5**	**D7**	**D4**		**D8**		
Positive	M	M	M	M	M	M	M	M	M	M	M	M
Statement	14	15	16	17	18	19	20	21	22	23	24	25
Negative				H								

In two of the three statements where manual calculation is placed in a negative connotation (H below the statement number), it is in the set of statements with which the students' disagreement was at the highest level. In fact, these two were the two statements with the highest level of disagreement. The other statement (17) where manual calculation is placed in a negative connotation (H below the statement number), that it is easier to learn to perform a hypothesis test with MINITAB than to learn to perform it manually was generally disagreed with by the students surveyed but not significantly so (Wilcoxon $p = 0.262$ and Sign $p = 0.5940$).

For each of these statements the null hypothesis that student responses were essentially the same for all instructors was tested. Anderson-Darling test results precluded the assumption of normality for any statement, thus suggesting the inappropriateness of one-way ANOVA. Therefore a Kruskal-Wallis and a Mood's Median test were used for each statement to test there was no difference in responses based on instructor. No significant differences were found at the 0.05 level of significance. Statement 10 came the closest with a p-value of 0.062 using a Kruskal-Wallis test adjusted for ties.

DISCUSSION OF RESULTS

An analysis of the results indicates that students in advanced business statistics at MTSU exhibited a strong opinion and preference regarding the use of the manual (hand-held calculator) method of learning instead of the use of a computer software package. However, as the level of computational complexity increases the level of disagreement with MINITAB usage decreases.

SUMMARY AND CONCLUSION

A questionnaire was administered to students at MTSU who were enrolled in advanced statistics in the fall of 1998 in an effort to investigate their perceptions of the effectiveness of various methodologies of teaching, i.e., manual (hand-held calculator) or utilizing a computer software package. The students clearly preferred utilizing the manual method.

Further research is suggested to investigate possible difference in preferences in teaching methodologies between gender, instructor, age, and instructor, as well as ease of use between the different methodologies. Additionally, outcome assessment studies could be undertaken in order to analyze the relationship between students perception and performance.

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APPENDIX

Q.M. 362 CLASSES

Student Perception of Learning:

Comparing Manual Procedures with MINITAB

In many Q.M. 362 classes a statistical topic is introduced using manual techniques with hand-held calculators. Once the basic principles and procedures of the technique are presented MINITAB is then used to work the same or similar problems. In an effort to ascertain the benefits students obtain from the two approaches the following questionnaire has been devised.

Please circle your response to each of the following questions on a scale from 1 (strongly disagree) to 7 (strongly agree)

		Strongly Disagree						Strongly Agree
1.	I learn more from manual calculations than from problems solved with MINITAB	1	2	3	4	5	6	7
2.	I retain more knowledge of statistical techniques from problems worked with MINITAB than problems worked manually	1	2	3	4	5	6	7
3.	Introduction of statistical topics using manual procedures provide a good understanding of the rationale and techniques of the topics	1	2	3	4	5	6	7
4.	Reinforcement of statistical topics using MINITAB after manual techniques have been covered strengthens and enhances my understanding of the topics	1	2	3	4	5	6	7
5.	Manual exercises increased my knowledge of each statistical procedure	1	2	3	4	5	6	7
6.	MINITAB exercises increased my knowledge of each statistical procedure	1	2	3	4	5	6	7
7.	Manual computations distracted me in understanding and mastering concepts of statistical methodology	1	2	3	4	5	6	7
8.	MINITAB procedures distracted me in understanding and mastering concepts of statistical methodology	1	2	3	4	5	6	7
9.	I would prefer greater emphasis on manual calculations in the course	1	2	3	4	5	6	7
10.	MINITAB procedures were clear and understandable	1	2	3	4	5	6	7
11.	Manual procedures were clear and understandable	1	2	3	4	5	6	7
12.	MINITAB procedures challenge and encourage independent thought	1	2	3	4	5	6	7
13.	In the classroom MINITAB allows for better structure of content	1	2	3	4	5	6	7
14.	In the classroom MINITAB allows for standardized delivery of content	1	2	3	4	5	6	7
15.	In the classroom MINITAB allows for more interesting instruction	1	2	3	4	5	6	7
16.	In the classroom MINITAB allows for longer retention of course material	1	2	3	4	5	6	7
17.	It is easier to learn how to use MINITAB to perform a hypothesis than it is to learn how to perform the hypothesis test manually	1	2	3	4	5	6	7
18.	MINITAB was particularly helpful in understanding one-sample parametric tests such as the t-test	1	2	3	4	5	6	7
19.	MINITAB was particularly helpful in understanding one-sample	1	2	3	4	5	6	7

	non-parametric tests such as the Wilcoxon Signed Ranks test							
20.	MINITAB was particularly helpful in understanding two-sample parametric tests such as two-sample t test with pooled variance	1	2	3	4	5	6	7
21.	MINITAB was particularly helpful in understanding two-sample non-parametric tests such as the Mann-Whitney test	1	2	3	4	5	6	7
22.	MINITAB was particularly helpful in understanding multiple-sample parametric tests such as ANOVA	1	2	3	4	5	6	7
23.	MINITAB was particularly helpful in understanding multiple-sample non-parametric tests such as the Kruskal-Wallis test	1	2	3	4	5	6	7
24.	MINITAB was particularly helpful in understanding simple linear correlation and regression	1	2	3	4	5	6	7
25.	MINITAB was particularly helpful in understanding multiple regression analysis	1	2	3	4	5	6	7

IMPACT OF MASTERY BASED LEARNING APPROACHES ON STUDENT PERFORMANCE IN AN UNDERGRADUATE MANAGEMENT SCIENCE COURSE

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ABSTRACT

Quantitative courses are usually found to be challenging by many if not most students in colleges of business. The typical student passes the course but usually does not develop adequate competence in the many techniques covered in the course. This lack of competence leads to a general lack of inclination to use such techniques in practice. The purpose of this article is to report on improvements observed in student competence when they were taught by use of a mastery based learning approach. In such an approach the objective is to make most of the students competent in a technique as compared to covering the technique. The average score on the problem taught by the mastery approach was 67% compared to 31% for the problem taught by the non-mastery approach. Improvements were significant even for academically weak students. The proportion of students who developed unsatisfactory competence when taught using the mastery approach was 25% compared to 67% in the non-mastery approach.

INTRODUCTION

In our experience, Management Science and other Quantitative courses are usually not popular with students in schools of business. Most students find the material difficult to comprehend. Many come into the course with the pre-set notion that they would do poorly in the course. As a consequence, their level of motivation is low and they refuse to put in the effort necessary to do well in the course. A passing grade is all that most students seek and a passing grade is all that they achieve.

We find this trend disturbing because of many negative implications. First, a student who has not done well in Management Science would generally develop low faith in these techniques. As a consequence, they will be hesitant to use such techniques in real life. Second, if students do not understand a technique properly, they may use it erroneously and inadvertently cause disastrous consequences in real life settings. Third, if students do not have a good grasp on applicability of techniques, they may not know when to turn to experts for help in problem scenarios amenable to these techniques.

In real life, use of Management Science techniques usually leads to improved decision making, proper utilization of resources and reduced wastage. As a consequence, it is in our

interest to ensure that most students understand the techniques, develop competence in the techniques and go out with an adequate grasp on applicability of the techniques. In other words, it is not sufficient to be satisfied with exposing students to these techniques. It is critical to make students competent in the techniques.

Such an approach is not new and is known as mastery based learning. The basic idea behind mastery based learning is that most students can attain a high level of capability in a subject matter if instruction is systematic, if needy students receive help when they fail to understand concepts or execute techniques, if they get sufficient time to achieve mastery and if they know what constitutes mastery (Bloom, 1968; Block, 1974). There is a large body of literature on the subject of mastery learning. For example, Guskey (1985) provides a good introduction to the subject and also lists over 100 references.

In this paper we describe our experience in implementing the approaches of mastery learning in an introductory Management Science course. While the basic approach of mastery learning is not new, there are many salient features that distinguish this work from those reported in the literature:

a) The usual academic level in which mastery based learning has been implemented successfully is that of kindergarten through the 12th grades. It is rare to implement mastery based approaches in a four year university setting.

b) We have not been able to find any report about successful implementation of mastery based learning strategies to teach quantitative courses to undergraduate business students.

c) The literature documents success of mastery based learning in teaching of skills that students may apply to familiar problems. There is little, if any, documentation of success of mastery based learning in situations where students are required to integrate their knowledge, extend their skills and develop appropriate strategies for unfamiliar problems. However, in the work reported in this article, students are required to integrate their knowledge, extend their skills and develop appropriate strategies for solving unfamiliar problems.

d) We describe practical details about our implementation strategy that have not been documented elsewhere. We have found that it is usually very difficult to implement mastery based learning in a college setting. However, there are ingredients in our approach that increase the likelihood of success of such approaches in an undergraduate class. Details reported in this article are likely to provide useful tips to other instructors for devising their own unique approaches.

e) In other articles on use of mastery based learning, the usual emphasis has been on what has worked and in what context. We document what has worked and where and then go one step further. We provide evidence of failure of traditional teaching techniques in improving student performance in use of quantitative techniques. We provide evidence that most students who succeeded when mastery based learning was used, failed when it was not used. Thus, we believe we have been the first to provide evidence to support our contention that in teaching of

advanced techniques such as management science, the mastery based learning approach needs to be an important component of the overall pedagogical strategy.

f) The particular approach that has been used by us for over seven years has successfully improved student performance for students of diverse academic strengths. We have been able to provide evidence that it has worked for weak, middle of the road and strong students.

g) Undergraduate business students typically have weak quantitative skills. This is more true of students at regional schools. Business school faculty have a very difficult time devising strategies to ensure good understanding of quantitative techniques. As a consequence, student performance is at best unpredictable. The approach reported in this article works reliably and predictably to ensure good understanding of techniques and consequent strong student performance.

First, we present a brief description of the course and how mastery learning approaches were incorporated in teaching parts of the course. This is followed by analysis of comparative student performance on problems taught by mastery approaches and non-mastery approaches. Finally we summarize the findings and discuss issues pertaining to using such an approach.

COURSE DETAILS

A course on "Introduction to Management Science" is required of all Management and MIS majors in this AACSB accredited school of business at a regional university. The course has a "3000" number and is usually taken by students in their junior/senior years. The text book used is that by Anderson, Sweeney and Williams (1994). The list of topics usually covered in the semester long course is presented in Table 1.

Table 1
List of Topics Covered in Course

Chapter	Topic
1	Problem Solving using quantitative analysis
2	Linear Programming: The graphical method
3	Linear Programming - computer solution;
	Sensitivity Analysis; Simultaneous Change
4	Linear Programming Applications
7	Network Problems
8	Integer Linear Programming
11	

	Inventory Models

The teaching method consists of lectures, homework projects, class work, quizzes and tests. The homework projects are to be individually performed and are graded. In addition, a number of problems are suggested for additional practice. These practice problems are not graded. The midterm (final) accounts for 25% (35%) of the total grade while quizzes, homework and class work account for the remaining 40%. The focus of the course is on applications. In other words, most of the emphasis is on being able to formulate models, solve on the computer, interpret output and make recommendations. The algebra is not emphasized. However some understanding of the technique is developed through discussions of the graphical method.

MASTERY BASED LEARNING

In this section we describe how the approach of mastery based learning was implemented in teaching a particular technique. In over 7 years of experience in teaching introductory Management Science courses at two universities, this instructor found that students had great difficulty with "blending" problems and "set covering" problems. In the Spring 1996 semester, the "blending" problem was chosen to be taught using mastery based approaches while the "set covering" problem was chosen to be taught using the usual non-mastery approach.

The mastery approach implemented consisted of 5 distinct steps depicted in Appendix 1 and discussed below. In the first step the instructor would cover the basic principles of a technique and solve three problems in class. In the second step, a blending problem is assigned for homework. The homework is graded and returned to the students in step 3. In step 4 the instructor discusses weaknesses identified in the homework. This is followed by solving one of the problems of step 1 one more time in class. In step 5, the students are given the option to re-work and re-submit the homework problem. Their reward is an upward adjustment of the homework score by 75% of the improvement made in the 2nd attempt. They are also urged to discuss their difficulties with the instructor. Around 90% of students opted to re-work and re-submit. Around 20% of the class discussed their difficulties with the instructor.

In the usual non-mastery approach, two set covering problems were covered in class.

ANALYSIS OF STUDENT PERFORMANCE

The final exam in the course included a blending problem and a set covering problem. Student scores in these two problems were normalized to a scale of 100 for the purposes of comparison. Both the problems were unknown problems. However, the degree of unfamiliarity was similar for both problems. In addition, the grade point averages (G.P.A) of the students were also collected to facilitate deeper understanding of comparative performance.

Descriptive statistics on scores in the blending and set covering problems are summarized in Table 2.

Table 2
Descriptive Statistics on Scores in the Blending and Set Covering Problems.

Problem	N	Mean	St Dev	C.V.
Blending	43	67.44	31.06	0.46
Set Covering	43	31.44	29.31	0.93

C.V.=Coefficient of Variation

The students scored 67 points on an average on the blending problem. In contrast they scored only 31 points on average in the set covering problem. The standard deviations were practically identical; however, the coefficients of variation (c.v.) tell a different story. The scores on the blending problem had a c.v. of 0.46 compared to 0.93 on the set covering problem. Thus the variation around the mean was much lower for the blending problem. Student performance is expected to show less variation when taught by mastery learning approaches (Bloom, 1968). The above observations confirm this expectation.

Our first concern was whether there was a difference in performance of the students in the blending problem vis-a-vis the set covering problem. If it is found that students performed significantly better on the blending problem, it would imply that the mastery based approach had yielded desirable results.

Accordingly we tested the following null hypothesis:

H_1: There is no difference in student scores in the blending problem and the set covering problem.

A one-sample T-test was performed on the difference between scores on the blending and set covering problems. The results are shown in Table 3.

Table 3
Results of one sample T-test on the difference between scores on the blending and set covering problems

T-test of the mean
Test of $\mu = 0.00$ versus μ =/= 0.00

Variable	N	Mean	St. Dev.	T	p-value
DIFF*1	43	36	30.91	7.64	0.0000

*1 Note: DIFF = Blending Score - Set Covering Score

The variable DIFF had a mean value of 36. In other words, on average, students scored 36% more on the blending problem. The T is 7.64 with a p value of 0.0000. Thus, we may reject the null hypothesis that the variable DIFF has a mean of 0.00. In other words, there is a significant difference in the scores on the two problems.

Our second concern was about difference in relative performance of students of differing academic strengths. For example, do students in lower G.P.A. brackets exhibit the same difference in scores as those in higher G.P.A. brackets? If students of all G.P.A. brackets exhibit relatively stronger performance in the blending problem, it would imply that the mastery based approaches are effective across all G.P.A. groups. Accordingly we tested the following null hypothesis:

H_2:	There is no difference in student scores in the blending problem and the set covering problem across the 3 G.P.A. groups. (G.P.A $\leq$ 2.3; 2.3 < G.P.A. $\leq$ 3.2; 3.2 < G.P.A.)

A one way analysis of variance (ANOVA) on the difference between blending and set covering scores by G.P.A. group was performed and the results are shown in Table 4.

Table 4
Results of ANOVA on the difference between Blending and Set Covering Scores by G.P.A Group

Analysis of Variance on DIFF

Source	DF	SS	MS	F	p
GPAGRP	2	2013	1006	1.06	0.357
Error	40	38113	953		
Total	42	40126			

GPAGRP	GPA range	N	Mean	St. Dev.
1	<= 2.3	11	28.64	27.00
2	2.31 - 3.2	24	42.08	32.50
3	> 3.2	8	27.88	30.54

Pooled St. Dev. = 30.87

*1: DIFF = Blending Score - Set covering Score

The second GPA group (2.3< GPA $\leq$ 3.2) had a mean difference of 42.08 between the blending and set covering scores. In contrast, the weakest GPA group (GPA $\leq$ 2.3), had a mean difference of 27.88 between the blending and set covering scores. This would suggest that the academically middle-of-the-road students were helped the most by the mastery based approaches. The F statistic of 1.06 had a p of 0.357. Thus, we are unable to reject the null

hypothesis that all means are equal. This implies that the better performance on the blending problem is equally prevalent in each of the 3 G.P.A. groups. In other words, weak, strong and intermediate students are benefitted similarly by the mastery approach.

Our third concern was about the extent of mastery achieved by use of the two different approaches. The extent of mastery may be measured in two different ways. A student is said to have mastered a problem absolutely if the final exam score is 100%. A student is said to have achieved relative mastery if the final exam score is 70% or more. Note that in this definition, absolute mastery is a subset of relative mastery. Thus the extent of absolute mastery is indicated by the proportion of students who got perfect scores on the final. Similarly, the extent of relative mastery is indicated by the proportion of students who got 70% or more on the finals. If a greater proportion of students become competent by use of the mastery learning approach, greater reliance can be put on such an approach. Accordingly we tested the following two null hypothesis:

H_{3A}:	The proportion of students who obtained scores of 100% will be the same in the blending and set covering problems.
H_{3B}:	The proportion of students who obtained scores of 70% or more will be the same in the blending and set covering problems.

Results of Chi-square tests are summarized in Tables 5 and 6.

From Table 5, it is seen that 13 out of 43 students (30%) obtained perfect scores on the blending problem. In contrast, only 3 out of 43 students (7%) achieved perfect scores on the set covering problem. The Chi-Square of 7.679 had a p of 0.0055. This suggests that the proportion of perfect scores in the blending problem is significantly higher than in the set covering problem.

Table 5
Results of Chi-Square tests on proportion of students who obtained scores of 100%.

	Score: 0 - 99	Score: 100	
	N	N	
Problem	(Exp Freq)	(Exp Freq)	All
Blending	30	13	43
	(35.00)	(8.00)	(43.00)
Set Covering	40	3	43
	(35.00)	(8.00)	(43.00)
All	70	16	86
	(70.00)	(16.00)	(86.00)

Chi-Square = 7.679; D.F. = 1; p = 0.0055

From Table 6, it is seen that 24 out of 43 students (56%) achieved scores between 70 and 100 in the blending problem compared to 5 out of 43 students (12%) in the set covering problem. The Chi-square of 18.782 had a p of 0.000001. This suggests that the proportion of students who attained 70% or more in the blending problem was significantly higher than in the set covering problem. This result can be expressed in one other way. The proportion of students who got 70% or more under the mastery approach of learning was around 4.5 times that in the non-mastery approach.

Table 6
Results of Chi-Square tests on proportion of students who got scores of 70% or more.

	Score: 0 - 69	Score: 70-100	
	N	N	
Problem	(Exp Freq)	(Exp Freq)	All
Blending	19	24	43
	(28.50)	(14.50)	(43.00)
Set Covering	38	5	43
	(28.50)	(14.50)	(43.00)
All	57	29	86
	(57.00)	(29.00)	(86.00)

Chi-Square = 18.782; D.F. = 1; p = 0.00001

Our fourth concern was with the extent of unacceptable performance by the use of the two approaches as measured by the proportion of students who scored below 40% in the final exam. If the two approaches produced the same proportion of "non acceptables" (i.e., "defectives"), then they are equally unreliable. This led us to test the following null hypothesis:

H_4: The proportion of students who obtained scores below 40% will be the same in the blending and set covering problems.

The results of a Chi-square test are summarized in Table 7.

A total of 11 out of 43 students (25%) obtained fewer than 40 points in the blending problem. In contrast, a total of 29 students (67%) scored below 40 on the set covering problem. Expressed in another way, for every 1 student who scored below 40 in the blending problem, there were 2.6 students who scored below 40 in the set covering problem. The Chi-Square of

15.143 had a p of 0.00009 suggesting that the proportion of students who obtained scores below 40 was significantly lower for the blending problem.

Table 7
Results of Chi-Square tests on proportion of students who got scores below 40%

	Score: 0 - 39	Score: 40-100	
	N	N	
Problem	(Exp Freq)	(Exp Freq)	All
Blending	11	32	43
	(20.00)	(23.00)	(43.00)
Set Covering	29	14	43
	(20.00)	(23.00)	(43.00)
All	40	46	86
	(40.00)	(46.00)	(86.00)
Chi-square = 15.143; D.F. = 1; p = 0.00009			

Our fifth and final concern was about difference in relative performance between males and females. We wanted to know whether gender differences existed in the benefits obtained from use of the mastery approach to learning. Accordingly, we tested the following null hypothesis:

H_5: There is no difference in student scores in the blending and Set covering problems across the two gender groups.

A 2 sample t-test on difference between blending and set covering scores by gender was performed and the results are shown in Table 8.

Table 8
Results of 2 Sample T-test on DIFF
(difference between blending and set covering scores) by gender.

Gender	N	Mean	St.Dev.
Male	20	33.6	30.5
Female	23	38.1	31.8
T = -0.47; p = 0.64; D.F. = 40			

The mean female difference between blending and set covering scores was 38.1 compared to 33.6 for males. In other words, the mastery approach worked a little bit better for females. However, the T of -0.47 had a probability = 0.64. Thus we are unable to reject the null and the difference is not statistically significant.

DISCUSSION

Society at large is very concerned about student learning. Higher education has responded by bringing the issue of student performance to the very top of its priorities. In this article, we have reported on implementation of mastery based learning approaches in a Management Science course. As measured by final exam scores, student performance was significantly better in the problem type taught by using the mastery approach. Variation in performance was also reduced. It was found that the mastery approach was equally effective in improving the performance of students at low, medium, and high G.P.A. levels. Four times more students were found to have achieved relative mastery when taught by use of this approach. The percentage of students whose performance was completely unacceptable in the mastery approach was around 40% that in the non-mastery approach. The mastery approach was equally effective for males and females.

It is clear that student performance is significantly better using the mastery approach, but the approach has several disadvantages. First, it takes more instructor time to implement. The same problem is graded twice. Further, when students are encouraged to seek help from the instructor, a greater proportion actually do so. This extra time implies that the instructor has to make sacrifices in other areas. Second, this approach demands that a greater portion of class room time be allocated to each technique/topic. As a consequence, the number of techniques/topics that can be covered in a semester is reduced. This appears to be a drawback, but in the long run may turn out to be an advantage. If fewer techniques are covered, but many more students become competent in them, there is a greater likelihood of general acceptance and use of the techniques. It is this author's belief that such a strategy may lead to wider acceptance of quantitative techniques.

Several limitations of this analysis should be noted. First, it is not known for sure that blending problems, in general, are found by students to be as difficult as set covering problems. Second, there is no way of knowing whether the particular problems used on the final exam were equally difficult from the student's perspective. Third, the students were not assigned a set covering problem to be done as a graded homework. Finally, many students did not recognize the specific final exam problem as a set covering problem. Instead, many formulated it as a transportation problem. This caused their scores to be very low. In contrast, in the blending case, even if they got the problem partly correct, they made a reasonable score because they had correctly recognized it to be a blending problem and knew how to approach it.

CONCLUDING REMARKS

In this article we have reported on findings about use of mastery based learning approaches in an undergraduate Management Science course. Two quantitative techniques were identified and two different approaches were used to teach the techniques. Unfamiliar instances of the problems were used on the final exam to measure the students' competence in using the techniques. The data suggests that student performance is significantly better under the mastery approach. The improvement in performance is equally prevalent among academically strong, medium and weak students. The proportion of students who achieve mastery of the technique is significantly higher when using the mastery approach. Further, the proportion of students who fail to achieve minimal understanding is significantly lower when using such an approach.

However, as with all good things, there are important trade-offs. The mastery approach requires more time from the instructor. Also, fewer techniques can be 'covered'. These disadvantages are offset by the fact that students achieve greater confidence in their abilities to execute specific quantitative techniques. This, in turn, is expected to lead to a greater likelihood that such techniques will be used in practice.

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Appendix-1: Steps in the Mastery Approach

1. Discuss technique and solve three problems in class.
2. Assign one new problem for home work.

3. Grade and return home work to students.
4. Discuss weaknesses found in the student work. Solve any one problem of step 1 again in class.
5. Assign the previous home work problem for re-work. Urge students to discuss difficulty with instructor. Grade re-work. Reward students for improvements made.

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