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Examining Approaches to Effective Concept Delivery: One Professor's Approach in the MIS Survey Course¹

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ABSTRACT

As part of the introductory level, management information systems (MIS) course, some of the topics covered during the semester include software, Decision Support Systems (DSS), the hardware and software purchase process, and individual hardware components. Considering the characteristics of today's learner, these concepts are often best learned through projects and exercises. However, due to time restrictions, learning resources must be critically evaluated to determine their overall contribution to the learning process.

The author describes two approaches that were used, in a junior level MIS survey course, to address multiple MIS concepts and illustrate their interrelationships. In light of AACSB considerations, the University's University Studies Program learning goals and objectives were also examined to observe how well the intentions of the project addressed the Program's learning objectives. The question that this paper attempts to address is, "Considering the current generation of students, what approach to addressing MIS hardware and software concepts will be most effective?"

Keywords (Required)

Student learning approaches, teaching hardware and software concepts, MIS survey course.

INTRODUCTION

When developing new approaches to covering course material, faculty must consider several factors including the appropriateness of the approach, the anticipated improvement in learning, how well the approach contributes to learning objectives, and correlation with the students' learning styles. Old methods are often revised, replaced, and sometimes, even resurrected. In this paper, the author found that the quality of the students work improved when they integrated multiple concepts and were provided with general, non-descript guidance. When students were provided with a worksheet that provided more detailed guidance through the assignment, although the answers were more consistent across the entire group, the students' creativity was stifled and their work focused more upon answering the questions rather than integrating and personally applying the concepts. Thus, to improve learning and enhance concept integration and understanding, computer projects combining application of multiple concepts should be considered.

BACKGROUND

The current generation of college students was raised during a time of significant, and personally accessible, technical advancement. They are characterized as being technologically savvy multitaskers (Paul, 2001; Weiss, 2003), accustomed to personalization (Barone, 2003; Gardner & Eng, 2005; Oblinger, 2003), and oriented toward hands-on team work (Gardner and Eng, 2005). In regards to the workplace environment, they are noted for preferring interactivity and immediate supervisor feedback (Eisner, 2005), desiring direction, coaching, and instruction (Eisner, 2005), expecting immediate payoffs (Loughlin & Barlig, 2001), and expecting to make an immediate positive contribution to the workplace environment (Cordiner, 2001; Eisner, 2005).

With these characteristics in mind, some of the general concepts addressed in the introductory Management Information Systems (MIS) course may seem mundane, repetitive, and uninteresting. Sarkar (2006) noted that students find learning

¹ An earlier version of this paper was submitted to the International Academy of Business and Public Administration Disciplines Conference for comment and review in January 2007. Content has been added, changed and a third approach to the exercise has been included.

about computer hardware concepts to be "...rather dry and theoretical." To engage students in the process of learning about hardware and software concepts, faculty need to incorporate more activity-based techniques such as simulations, experiments, problem solving, and other practical demonstrations (Bonwell & Eison, 1991; Sarkar, 2006; Troboy, 2004; Tyckoson & Jacobson, 1993) Although many of the students are familiar with using technology for fulfilling personal needs, they have not approached the concepts from a profit-minded manager's perspective nor have they focused on how the underlying technology works.

This multi-concept activity-based project was developed to follow the University's learning goals and objectives and to teach the concepts to the students through their application to real-life scenarios. The project was administered in the introductory MIS course required of all business student majors at a regional institution in the Midwest. In order to take the course, students must have taken an introductory computer course or its equivalent and have attained junior-level standing. For this project, students select two of six scenarios and make a recommendation for the software and hardware solution that would best fit the skill, function, and budgetary requirements of the situation.

In an attempt to improve teaching effectiveness, the author implemented and examined two test approaches used to enhance students' understanding of hardware and software concepts in light of the University general studies learning goals and objectives. In the first approach, students were divided into test and control groups based upon sections. Both groups were taught hardware and software concepts and then asked to apply their knowledge by providing solutions for two scenarios. The control group conducted their analysis and presented their proposed solution using written memo format. The test group was asked to incorporate the development of an Excel Decision Support System (DSS) workbook with integrated worksheets to be used to assist in analyzing and comparing the multiple computer systems and software. The resulting solution was then to be proposed in written memo format. In the second approach, students were provided with a form that guided them through the process of looking at the requirements of the software and the specifications of the hardware, examining specific terms, and then justifying their purchase decision.

HANDS-ON LEARNING

According to research conducted regarding the characteristics of today's learners, they prefer team projects and hands-on learning opportunities (Gardner and Eng, 2005). Rather than simply lecturing to the students about the various aspects of hardware and software, the students got involved in the learning process through an exercise oriented to applying their knowledge to a common process, purchasing a computer and appropriate software. The goal of the exercise was to increase the students' understanding of the purpose of various elements of a computer system, how they worked together, and why they were important. A unit on Excel was incorporated to demonstrate to the students how they could create a decision support system using an integrated Excel workbook to compare multiple configurations and pull data from those configurations to build a dynamic cost projection tool.

GOALS

During the course of the semester, the class content addressed general technology topics including system categories, hardware, software, and spreadsheets. The material was normally covered in individual units; however, the concepts gained more value when students were able to see their interrelationships. The goals of this project were to:

- Improve students' understanding of the various elements of a computer system including different types of RAM, processors, cache, communication devices, input and output devices, operating systems, and software.
- Help students learn how to match user needs to technology capabilities.
- Further students' spreadsheet skills by developing an integrated Excel DSS workbook to compare the costs and characteristics of multiple configurations.
- Improve student learning by using actual technology purchase scenarios, found in both business and personal life, where students could see first-hand how they could apply the knowledge that they were gaining.

DECISION SUPPORT SYSTEM CONCEPT

Decision Support Systems, DSS, are technical tools that combine operational data with analytical models to assist operational and middle level managers in answering both structured and semi-structured decision problems. Although they are often used by managers on a regular basis to aid with normal decision-making processes, the concept is generally unfamiliar to undergraduate students.

The focus of the project was to develop a simple DSS using Microsoft Excel in order to provide the students with the opportunity to develop the underlying logic of the system, visualize the steps of the decision making process and, ultimately,

create a system that would generate a result consistent with the needs of the scenario. In order to develop the system, students had to gain a better understanding of the underlying technical components that would help to determine the outcome of their decisions.

UNIVERSITY STUDIES LEARNING OBJECTIVES

The project was developed in accordance with the learning objectives of the University Studies Program at the author's institution. With the increased emphasis in assurance of learning at AACSB accredited business colleges, it is important to consider how well classroom projects meet the learning goals set forth by the University. Although the course is part of the core business curriculum, the general learning requirements of the University Studies program provide a good general outline of quality learning objectives. The fundamental purpose of courses fulfilling the University's general education requirements is to "...equip students to integrate acquired knowledge in order to produce interconnections of thoughts and ideas." The underlying goal of the program is to "...provide students with the information, ideas and skills they need to have in order to live a happier and more intellectually rewarding life." (University Studies Handbook, 2005-2006). Based upon the stated purpose and goals, the University Studies program has developed a series of nine objectives for the courses in the program to address the skills to:

- Demonstrate the ability to locate and gather information
- Demonstrate capabilities for critical thinking, reasoning and analyzing
- Demonstrate effective communication skills
- Demonstrate an understanding of human experiences and the ability to relate them to the present
- Demonstrate an understanding of various cultures and their interrelationships
- Demonstrate the ability to integrate the breadth and diversity of knowledge and experience
- Demonstrate the ability to make informed, intelligent value decisions
- Demonstrate the ability to make informed, sensitive aesthetic responses
- Demonstrate the ability to function responsibly in one's natural, social and political environment

As the project was developed, consideration was made regarding the University Studies' learning goals and objectives. Once the project was finalized, several of the learning objectives had been addressed. The learning objectives that this project addressed included:

Demonstrate the Ability to Locate and Gather Information

Based upon the selected scenario, students had to research and select the appropriate software to match the parameters of the situation. Once the software was selected, the students then had to research possible hardware configurations based upon the hardware requirements necessary to efficiently run the software and handle any other needs of the situation.

Demonstrate Capabilities for Critical Thinking, Reasoning and Analyzing

Using clues and parameters provided by their selected scenarios, students had to research, analyze and then select the most appropriate software and hardware configuration to satisfy the situation. Students had to consider necessary RAM, storage, speed, Internet connectivity, period of use and peripherals. Situational parameters that they also had to factor in included: budget, purpose, user age and education level, and permanency of location. The solutions focused upon finding the best and most appropriate technology for the scenario within the specified budget.

Demonstrate Effective Communication Skills

Once the students logically evaluated, researched and selected the appropriate technology to fit the situation, this information was then used to write a detailed report or, as was the case of the second approach, complete a form. In the first approach, the report was addressed to the scenario client recommending the type of hardware, software, and peripherals that the client should purchase as well as how that technology fit the parameters and requirements of his/her situation. The second approach was similar but used a structured form instead of a memo format.

Demonstrate the Ability to Make Informed, Intelligent Value Decisions

In building their computer system solutions, students had to make value judgments to determine the most appropriate software and hardware for the specified parameters and limited budget. Most of the budgets were set unreasonably low in

order to force the students to think about the possibility of alternative solutions such as refurbished equipment, as well as the necessity of each item, thus forcing them to prioritize the purchases.

SCENARIO EXAMPLE

The exercise consisted of six different scenarios that were based upon actual situations. The groups were asked to choose two of the six scenarios for which to provide a solution. All of the scenarios provided brief synopses of the intended use of the technology, the budget available for purchase, the intended time period of use and a situational background. The following example is indicative of the information provided in each scenario:

“Your friend, Bob, has just started a computer training firm and needs you to help decide what type of computer system to purchase. Bob accumulated a significant amount of student loans and feels that he can only afford to spend about \$1,400 per computer. (Dollar amount is the total amount he has available for software and hardware per machine.) He would like to teach students how to use a series of professional Web development tools that help users develop Web pages as well as static and motion graphics. He may not be able to purchase all of the software at one time. He wants the computers to last for at least 5 years. Also, suggest a printer that he might purchase. “

IMPLEMENTATION

The scenario project had been assigned in previous semesters' classes to emphasize hardware and software concepts. Scenarios were added, removed, and adjusted to correlate with improvements in technology and changing costs over time. Students had been told to write a memo to their scenarios' clients recommending the appropriate software and hardware to purchase for their clients' particular needs. In that memo, they were also expected to briefly explain the importance of the different specifications of their hardware recommendations, in light of the situation and needs, as a means of improving and displaying their understanding. Although there were some outstanding memos with depth and clarity of concepts, it seemed that the majority of students did not fully understand what the terms meant.

Thus, in an attempt to enhance the learning process, adjustments were made to material coverage and assigned exercises. Two different approaches were taken for having the students apply the concepts. The first approach was somewhat scientific in format with a pre/post test given to test and control groups. During the interim between the tests, the students completed the technology purchase project and the results of the projects and tests were compared. Due to weather associated canceled classes resulting in lost class time, the second approach did not adopt such a formalized approach. In the second approach, the students used a form that guided them through the process of looking at the requirements of the software and the specifications of the hardware, examining specific terms, and then justifying their purchase decision. The students' solutions generated using this approach were analyzed and compared to the results of the previous analysis. The results from the exam taken by the students after coverage of the hardware and software concepts were compared across all of the groups. In the future, pre and post tests will be applied to the group using the form.

APPROACH ONE

The first approach attempted to enhance the students' learning of the three concepts, hardware, software, and decision support systems using Excel, through integration and synthesis. Although decision support systems are also normally taught during the course of the semester, the project had never been used in conjunction with DSS concepts. During the Spring 2006 semester, the project was administered in two small late afternoon sections of the MIS survey course. One section, the control group, consisted of 9 students who solved the scenarios but did not create and use the Excel DSS to assist in the problem solving activity. The second section, the test group, consisted of 19 students who created and used an Excel DSS to solve the scenario problems. Both groups were compared in regard to pre/post test performance, exam performance, and scenario solution quality.

PRE-TEST / POST-TEST

A short test over software, hardware and peripheral components was administered both prior and subsequent to coverage of corresponding material. This pre/post-test had not been administered in prior semesters, so improvement could not be compared to earlier work. Comparison was made between the two groups, test and control, for the semester in which the test sequence was given. As indicated in Table 1, overall, greater improvement in the pre/post-test was noted in the group that did not implement the DSS; however, that improvement may be attributed to the higher number of MIS majors in the control class as well as to the size of the class.

	Control (No DSS)	Test (DSS)
Usable Tests	8	17
Pre-Test Ave. Score	61.1%	61.5%
Post-Test Ave. Score	74.4%	73.9%
Improved % (#)	75% (6)	70% (12)
Declined % (#)	12.5% (1)	12% (2)
No change % (#)	12.5% (1)	18% (3)

Table 1. Pre / Post Test Comparison

APPROACH TWO

The second approach was applied to two morning/early afternoon sections of the MIS survey course being taught by the author. The classes contained a combined total of 77 students. Since the incorporation of the development of an Excel DSS into the hardware/software purchase scenarios did not result in significant improvements in the students' scores and memo solution quality, a different approach was taken. The approach being implemented during the Spring 2008 semester was developed to address the quality of the memos with consideration made for the current generation's preference for hands-on learning and specific direction (Eisner, 2005; Gardner and Eng, 2005). In place of the memo, a form was developed (Appendix A) that specifically guided the students through the evaluation process in hopes of directing them toward the information that they would need to provide an adequate solution.

The form first asked for the hardware requirements of three recommended applications for the situation. Once the students had determined the minimum specifications, they were then asked to look for and compare three computers that would run the recommended software. The specifications of the three computers were compared side-by-side. The students then indicated which computer they would recommend based upon the situation requirements of the software and the budget. To emphasize the meanings of some of the requirements, the students were then asked to provide definitions in their own words. After having searched for and compared the requirements of the software against the specifications of the computer, it was hoped that the students would have a better understanding of the technical concepts. Using information previously supplied, the form then requested justification behind the software and hardware recommendations. The last section asked students to prioritize their purchases for those to be made now and those to be made later since all of the scenario budgets were not meant to cover all of the expenses.

OVERALL SCENARIO SOLUTION QUALITY AND EXAM FOR BOTH APPROACHES

Table 2 illustrates a five point scale grading rubric that was created to evaluate the scenario solutions. Both Approaches' sets of solutions were graded based upon the appropriateness of the solutions for the selected scenario, the description and understanding of the technology components and the overall quality of the solution. The test group in Approach 1 was also graded upon their use of the Excel DSS to provide a solution and their understanding of DSS concepts.

Score	Description
0	Did not answer or answer completely incorrect
1	Answer provided, but mostly incorrect
2	Answer provided was partially incorrect
3	Answer correct but student did not seem to understand concept and/or concept not correctly applied
4	Answer correct, concept understood and applied correctly
5	Concept understood, applied correctly and student went above project expectations

Table 2. Five Point Scale

As Table 3 illustrates, the scores and standard deviations for both the test and control groups of Approach 1 were similar in regards to their appropriateness of the solution. The scores for the students who completed the form for Approach 2 were slightly lower, but had less fluctuation. The Approach 1 test group seemed to have a better overall understanding of the individual components of the computer systems. This improvement may be attributed to their having to think about the components more than the other two groups as they developed the Excel DSS. The overall quality of the solutions was also higher for the test group. This may be attributed to their having to dedicate more time to the project since it required the scenario solution, the Excel DSS, and the application of the Excel DSS to the provision of a solution. Some of the test group students went above and beyond the expectations of the assignment and extended the capabilities of their Excel DSS through additional collected data and functionality. Thus, one might infer that they could see the relevance of the Excel-based DSS to the decision-making process. The students who used the form for Approach 2 essentially answered the questions in a definitional format with little demonstration of concept integration.

	Approach 1				Approach 2	
	Control (No DSS)		Test (DSS)		Test (Form)	
	Average	σ	Average	σ	Average	σ
Appropriateness of solutions	4.25	1.0351	4.28	1.0178	4.15	0.5259
Description of technology components	3.5	2.2039	3.67	0.9075	3.60	1.095
Use of DSS to provide solution			4.22	1.3528		
Understanding of DSS			3.97	1.3555		
Overall quality of solution	3.875	1.3296	4.09	1.1835	3.74	0.7043
Exam questions	77.8%	11.43	92.5%	13.04	80.7%	12.80

Table 3. Scenario Solution Quality and Exam

The students in both approaches also answered questions on an exam covering computer hardware, software, DSS concepts and the purchase process. The results are provided in Table 3. Overall, the test group from Approach 1 scored higher (92.5%) on questions related to this material than the control group (77.8%) and the Approach 1 form group (80.7%)... This may be attributed to the greater amount of time invested and depth of study that they spent on hardware component characteristics as they used this information to develop their Excel DSS's.

Outcome

The goals of the projects were to improve students' understanding of: hardware components, DSS's, advanced Excel features, development of an Excel-based DSS, and the technology purchase process as well as the roles that intentions for use and software requirements play in the purchase process. The author had also wanted students to see what a DSS was and how they could create one using Excel while, at the same time, including some additional Excel functionality. Overall, most of the

goals were achieved in the Approach 1 test group; however, the pre/post test results did not indicate a significant difference in favor of the group that created the Excel DSS.

The Approach 1 test group did seem to understand hardware components such as RAM, storage size, processor speed, etc. better than the other groups. The test group also seemed to have a better grasp on the concept of DSS's and their value to the business environment. In the past, students appeared disengaged when the various types of systems, including DSS's, were discussed. For this project, the test students seemed to be more interested in Excel DSS's as evidenced by the enhancement of their projects beyond the requirements of the exercise.

One unexpected outcome from this project was the realization that one exercise that was normally assigned to the students to complete was not as valuable as had originally been thought. Normally, when the units on hardware and software were addressed in class, students received a lecture, lecture notes and examined a virtual computer. Due to time considerations and the incorporation of the DSS concepts, the virtual computer exercise was not assigned. Based upon the quality of the scenario solutions for both classes, the author found that the virtual computer exercise did not significantly enhance the students' understanding of the roles and interrelationships of individual hardware components.

FUTURE RESEARCH

After examining the results from Approach 2 in light of the results from Approach 1, the form did not seem to enhance learning as much as the development of an Excel-based purchasing DSS. In addition, based upon students' questions, and early solution submissions, the author expected there to be a difference between the two sections of Approach 2 with the early morning section expected to provide higher quality work than the early afternoon section. Although, as indicated in Table 4, this was not the case in this situation, it would be interesting to examine the quality of work over time across scheduled course offerings such as morning classes versus afternoon classes, especially using a less restrictive approach such as the Excel-based DSS. This could then be taken one step further by including the results of online courses as an additional group.

	Approach 2			
	Morning		Afternoon	
	Average	σ	Average	σ
Appropriateness of solutions	4.06	0.62	4.22	0.42
Description of technology components	3.31	1.15	3.86	0.99
Overall quality of solution	3.56	0.76	3.89	0.62
Exam questions	80.86%	13.36	80.56%	12.39

Table 4. Comparison of Approach 2 Groups

CONCLUSION

When developing exercises to enhance classroom learning, it is important to keep in mind the learning goals and objectives of the university as well as those of the project. As indicated by the characterization provided by research, today's students desire hands-on projects and teamwork rather than lecture. Students become more engaged in the learning process when they see a correlation between the concepts that they are learning and their application to real-life circumstances. Students are also better able to understand technical concepts when they see how these ideas overlap and interrelate. Finding ways to integrate DSS, Excel and computer hardware/software concepts in a course module will enhance students' understanding of those topics both individually and collectively. However, faculty must regularly examine their approaches to determine the effectiveness of specific projects and exercises in the learning process.

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Appendix A

Computer Purchase Exercise – Complete One for Each Selected Scenario

Team Member Names: _____

Scenario Selected: _____

Recommended Software (Enter the specifications of the recommended application for your scenario in the table below. Place any additional characteristics that you think are important in the two empty rows.)

	Recommendation 1	Recommendation 2	Recommendation 3
Application Name			
Speed			
RAM			
Hard drive			
Operating System			
Recommended Age			
Cost			

Compared Models (Compare three different computers and enter the specifications of the three models examined in the table below. Place an “X” at the bottom of the column of the model that you would recommend. Place any additional characteristics that you think are important in the three empty rows.)

	Computer Model 1	Computer Model 1	Computer Model 1
Brand (Dell, HP, etc.)			
Model			
Processor Type			
Processing Speed			
Cache			
Hard Drive Size			
RAM			
DVD/CDRW/CD			
Monitor Size			
Operating System			
Warranty			
Networking			
Cost			
Recommendation (X)			

The following characteristic is important because:

Processor type: _____

Processing speed: _____

Cache: _____

Hard drive size: _____

RAM: _____

Explain why the computer you are recommending is better than the other two models.

Explain why you selected the software you are recommending.

Budget: Depending upon the scenario and the amount of money available, you may need to recommend that some items be purchased now and some items be purchased later. Indicate this information in the table below and provide a total for the items to be purchased now and later.

Purchase Now		Purchase Later	
Item	Cost	Item	Cost
Total		Total	