Bringing Real-World Issues into Business Classrooms: An Innovative Multi-media Case Study Approach

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Abstract

Do you want to create a highly interactive learning environment for MIS and Operations Management students so that theory and practice are brought together in the classrooms? Then the instructional methodology and materials discussed in this paper will be of use to you. These materials have been produced as part of National Science Foundation grants budgeted at over a million dollar. Approximately 1,200 business and 1,500 engineering students at different Universities in the USA have used the materials. These materials have been also used to train approximately 150 engineering and 15 business faculty members. It has been used to train about 100 engineers and managers in industry. Evaluation of use of these materials in classrooms shows that students perceive improvement in their higher-level cognitive skills and increased learning from peers.

Introduction

This paper describes the details of a workshop that was conducted at Bentley College as part of the 2001 AMCIS Conference. The objective of the workshop was to provide a hands-on training to faculty members on innovative educational materials designed so that their students could:
- Integrate business skills with technical knowledge
- Enhance their decision-making skills
- Use principles of risk and cost management to solve problems
- Enhance teamwork thereby increasing productivity

The instructional materials and methodology used in this workshop were based on an innovative curriculum development effort funded by the National Science Foundation, DUE # 9752353 and 9950514. The materials are targeted for use in an undergraduate or graduate course in MIS, Information Technologies (IT), Operations Management, and Computer Information Systems programs. It provides students an opportunity to participate in decision-making scenarios involving technical and non-technical issues in companies by working with multimedia case studies. The objective is to “celebrate information technology” by showing how the decisions of the information technology personnel and managers impact the bottom-line of the company which, in turn, influences the growth of the economy. The students could apply the theories they had learned to solve a real-world problem. The material has been designed to develop the students’ ability to use techniques, skills, and modern IT tools necessary in business. In one of the case studies, we have incorporated an expert system software so that the students are provided a hands-on experience on working on a real-world problem. In addition, chapters on entrepreneurship, telecommunications, and operating systems provide valuable knowledge that students could use in the future. Using these materials in your classroom could fulfill the requirements for the ISCC-11 course that have been proposed by the ISCC’99 group.\(^1\)

The case studies and associated materials have been chosen so as to show that: (a) IT personnel make decisions on a continuing basis and their decisions have a major impact on the performance of companies, (b) the decisions made by IT personnel when they practice their profession have important entrepreneurial considerations and they need to champion

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their project, and (c) the decisions have to include consideration of technical and non-technical issues.

**How are these Instructional Materials different from Traditional Case Studies?**

The instructional materials created as part of the project are different than the traditional case studies. The major differences are:

- The case studies are developed for use in undergraduate classrooms, whereas most of the well-known business case studies are developed for use by MBA students.
- The students are not expected to have any industry experience, whereas, the traditional case studies expect the MBA students to have a good understanding of business practices.
- The emphasis is on providing an understanding of business and engineering topics and how they integrate in the real-world versus a stress on business strategies.
- Materials that explain the technologies, business concepts, and other fundamentals so that a student without a background in the topic might become proficient after the use of the case study supplement the case studies.
- Multimedia (Video, audio, and photos) is used extensively in order to explain the instructional materials.
- The case studies and competency materials are elaborate and take up to 150 double-spaced pages versus the 20 to 30 page case studies used traditionally.

**Target Audience and Innovative Features**

The instructional materials are designed for students taking a course in IT or MIS. The instructional materials provide technical knowledge that is needed to examine the case study and could be used by students without prior knowledge of IT and business fundamentals. All the materials are based on field-research conducted with companies. The three most important contributions of the instructional materials to IT/MIS education are:

(i) The case study and videos bring theory, practice, and IT issues together to the classroom and critically examine decision-making scenarios in industry. These case studies have been tested in business and engineering classrooms and have been improved substantially based on student feedback and responses. References to the textbooks that have been developed are provided (Sankar and Raju, 2001).
(ii) There are many possible solutions to the case study and different groups of students may recommend several options. This provides variety and stimulates the thinking skills of both the instructor and students. Students get involved in playing the roles of the IT personnel and managers in the case study and identify with the material in the case study. This leads to active problem solving where students become passionate in defending their option. It also provides an opportunity for students to apply theories and practices they have learned in other classes and internships to bear on the analysis of the case study.

(iii) The instructor’s manual provides a possible solution to the problem posed in the case study and provides step-by-step instructions to the instructor in administering the case study in the classroom. We provide guidelines to instructors on how the case studies could be effectively tailored for use in their curriculum. In addition, we provide videos that help explain the problem and solutions easily. It also provides forms that could be used in evaluation, suggestions on conducting the case studies, multiple-choice and essay questions and answers, and possible solutions to the problems provided in the textbook.

Description of Instructional Materials

The authors have developed the following case studies. A brief description of them follows:

1. Chick-fil-A Case Study: This case study illustrates the decision faced by Chick-fil-A, a fast food chain, as it moves from its current Point-of-Sale system to a choice between two operating systems, one based on Windows NT and the other on Windows CE (Sankar and Raju, 2001). Since the Chick-fil-A chain operates over 700 stores, this changeover has about a $3.2 million investment stemming from the differences in prices between implementing the two POS systems. Skills Developed: Operating Systems, Central Processing Units, Network design and layout, Telecommunications, Thin versus
fat client, System development cycle, Project management, Decision making, Cost/Benefit analysis.

2. AUCNET USA Case Study: This is an exciting and interesting case study that describes the E-Commerce initiatives of a B-to-B company that sells automobiles to dealers using a satellite network (Sankar and Raju, 2000). The company is faced with decreasing dealer participation and needs to reexamine its IT architecture. Skills Developed: Internet technology, Geosynchronous satellites, Low Earth Orbiting Satellites, On-line systems, Proprietary systems, Competition, New technologies, Cost of technologies, Marketing issues, Entrepreneurship, Cultural issues, Global issues.

3. Crist Power Plant Case Study: This is a fun and challenging real-world case study where students work with an expert system to refine their decision, choosing among multiple alternatives for maintaining a turbine-generator at a power plant (Sankar and Raju, 2000). The students assume the role of a plant manager in solving the $2 million problem. Skills Developed: Problem solving, Preventive maintenance, Phase relationship, Risk management, Decision Support Systems, Project management, Expert Choice software, and Deregulation.

4. Della Steam Plant Case Study: This case study examines the problem of a turbine-generator unit in a power plant that is vibrating heavily and shaking the building. Two engineers have recommended conflicting solutions, and the plant manager must make a decision that could cost the company millions of dollars. Skills Developed: Problem Solving, Preventive maintenance, Vibration, Risk management, Decision making, Credibility, Cross-disciplinary issues, and Active learning.

5. Design of Field Joint for STS 51-L Case Study: This case study shows the events leading to the decision to launch the space shuttle, STS 51-L. The case study provides the timelines and technical details about the design of the field joint. Skills Developed: Physics and design, Statistics, Project Management, Ethics, Risk, and Safety.
6. In Hot Water: A Cooling Tower Case Study: This case study shows the decision facing the plant manager and engineers when they are faced with two alternative methods for improving the performance of a counterflow natural draft cooling tower. The source of the tower underperformance seemed to be the water distribution across the tower’s area. The managers and engineers could either revert to the configuration that was known to produce a tower efficiency of 91% or modify the tower based on a consultant’s recommendation. Skills Developed: Thermodynamics, Waterflow, Risk management, Safety, and Financial details.

7. Wireless Cell Tower Selection at Powertel Case Study: With the introduction of Powertel’s new 3600 minutes for $40 rate plan, the growth of cellular subscribers jumped 40% in one month for Powertel. This growth put a tremendous strain on the existing cellular network structure. The amount of dropped calls and unavailable lines increased significantly. One area of concern was the intersection of Highway 280 and Interstate 459 in Birmingham, AL. Powertel needed to decide quickly where and how to place a cell site to handle the new demand in that location. The two different choices presented in the cell site location have a financial impact in the range of $150,000 to $700,000. Skills Developed: Telecommunications, Frequency reuse, Project management, Cell phone use, Time value of money.

Support Material for Instructors

We offer a wealth of supplementary material in a CD-ROM that helps the instructors teach the material in this textbook. They are:

(a) Instructor’s Manual: The manual contains chapter overviews, teaching suggestions, team assignment questions, possible answers to case study discussion, and a test bank of multiple-choice, short-answer, and essay questions.
(b) Videos: Videos supplement the presentation of the case studies so that the students can understand the problem fairly well. This material could be played in class when the case studies are assigned.

(c) Powerpoint presentation package: This package has most of the charts and photos from the textbook so that an instructor can use them in making the presentations in class.

(d) Suggestions for teaching: Suggestions to instructors is provided based on past research results. Forms that could be used to grade the course are also provided.

(e) Multiple-Choice and Essay Q&A: The questions at the end of each chapter are answered and multiple-choice questions have been created to help the instructor create exams and tests.

**Workshop Conducted at Bentley College, Aug. 2001**

The workshop was conducted at Bentley College in one of their state-of-the art teamwork rooms. We were able to control and display the case studies from a central panel and the participants sat around work desks that had a large flat screen. In addition, they had the ability to work on the CD-ROMs from their desk. The layout the room made it essential that the faculty members work as a team. The Chick-fil-A case study was distributed to all the faculty members (14 of them) and they were given about an hour to work on the case study. They were split into three teams, one defending the choice of Windows NT, another defending the choice of Windows CE, the third being a consultant providing advice, and the fourth team being the managers making the final choice. The hands-on experience was lively and interesting. Many of the faculty members were excited to work with the case study and enjoyed the experience.

**Evaluation of the Benefits of a Course taught using these Materials**

These case studies have been used with about 1,200 business and 1,500 engineering students during the past four years. An external evaluation team composed of Drs. Gerald
Halpin and Glennelle Halpin, Professors in the Educational Foundations, Leadership, and Technology at Auburn University, evaluated the course where these case studies were used (Halpin, Halpin, and Good, 1999).

The students in the case study class reported greater use of mapping, outlining, and planning; solving problems, reaching decisions, and making critical evaluations; and using other students within the class as a resource and support systems. The student journals, which were completed for each case study, demonstrated the use and development of higher order thinking skills - one of the course’s primary objectives. Specifically, the students’ comments in the journals indicated that they were engaging in sophisticated and complex levels of cognitive activity - defining, analyzing, evaluating reflecting, and assessing. The students not only employed these skills, but also applied these same skills to assess their own thinking processes and gained self-insights. The student comments in the journals also indicated that they were making the necessary connections between the theories they studied and the practice they would assume. Perceived skill development, self-reported learning, and ability to learn from fellow students (all yielding medians of 3.9 or above) were highly rated by the students.

The students commented: “It brings a practical situation in to train us to think in a professional manner.” One student noted that this case study possessed “more alternatives with each having strengths, making the decision- making process more of a learning experience.” Others found the case study “informative” and “well organized.” One student commented the following: “The strengths were the fact it allowed us to look at a real business and put this information learned in class to use.” Another student noted that the “case study helped relate textbook materials to real world situations.” And yet another student stated that the case study was “a real world example of class work.” From other surveys given on other case studies, this connection of theory and real-world practice tends to be the major theme emphasized by students as a strength of the case study method of instruction.
The students commented that skills in researching, critical thinking, and business planning all developed as a result of the involvement in the case studies. These comments seem consistent with the high median rating for self-reported learning. For example, one student noted that he gained “experience in researching” as did another student who stated “the research provided insight into the company’s current position.” Another student stated that the case study “allows for students to improve their critical thinking skills.”

Another theme which occurred in the response to the case study’s strengths (approximately 1/5 of the responses) was the students’ enhanced understanding and interest in technology. For instance, one student stated that the “strengths were the technology aspects” and another student appreciated “the opportunity to mix the technological side of the class with the business principles that we have learned in other classes.” Still another student stated that the case study “strengthened knowledge of different technologies.” Finally, students described the case study itself as “informative,” “interesting,” and “easy to comprehend.”

Drs. Halpin and Halpin conclude, “The data from the various aspects of the evaluation indicated that the case study method of instruction is a worthwhile and beneficial method of instruction for teaching an engineering design course. The students in the case study course indicated their favorable responses to this particular teaching approach, and comparative data also suggested that the approach is particularly worthwhile and beneficial to the students. The case study method of instruction appeared to combine theory with practice as well as encourage the use of higher-order thinking skills within the students - the two primary goals of this particular class.”

**Research Performed to Study Impact of Multimedia Instructional Materials**

Research has been conducted to study the impact of multimedia educational materials on perceived skill development (Mbarika et al., 2001, Raju and Sankar, 1999). An experiment
was conducted in which 39 students worked on a case study using both paper-based and multimedia based technologies. An exploratory factor analysis design employing a structural equation model was utilized to analyze the data. The findings from this study suggest a strong indirect relationship between multimedia and perceived skill development with learning-driven constructs (challenging, learning interest, self-reported learning, and learned from others). The study concludes that it is critical to consider these factors in developing multi-media instructional materials.

Additional research was performed to identify how students belonging to different gender (male and female) and majors (engineering versus non-engineering) perceived improvement to their higher-order cognitive skills and the factors that were responsible for their rating. These research activities are summarized below.

**Research on the Impact of Multimedia Instructional Materials on Female Students**

Past research has shown that female students tend to have more negative attitudes toward technology than male students. These negative attitudes may explain the decreasing number of females in technical careers. Past studies have shown that a change in the instructional materials might foster a change in the attitude of female students. Multimedia instructional materials have been suggested as a possible solution. Therefore, this research investigates the perceptions of female versus male students regarding the improvement of their higher-level cognitive skills when they participated in a multimedia case study that used an expert system to model a complex engineering and technical problem.

Two questionnaires measured their perceptions on the improvements achieved on learning and content constructs. A structural equations model was developed to test the research hypotheses, with female students being the experimental group and male students as the control group. The major findings were: no significant relationship between gender and higher order cognitive skills improvement was revealed, female students perceived better
higher-order skills improvement compared to male students, both groups perceived an improvement in the learning-driven factor, and female students valued learning-driven factors more highly than male students. These results show that multimedia instructional materials were found to be very helpful in teaching engineering and technical decisions. In particular, they were more effective for female students since they challenged the participants, provided self-learning opportunities, and made it possible to learn from others.

**Research on the Impact of Multimedia Instructional Materials on Majors (Engineering Versus Business)**

This research investigates the perceptions of business versus engineering students on improvements in their higher-level cognitive skills when they participated in a multimedia based case study that depicted a complex engineering and technical problem (Mbarika et al., 2001). The case study provided the students with an opportunity to analyze the sensitivity of their recommendations to management using Expert Choice Software (Saaty, 1994). The research questions were:

- Is there a direct relationship between the student major (Business versus Engineering) and higher order cognitive skills improvement?
- Is there an indirect relationship between the student major (Business versus Engineering) and higher order cognitive skills improvement with any intervening variables?

Two questionnaires solicited the perception of the students and a structural equation model was developed in order to use the information gathered to answer the research questions. The results show that the business students perceived a greater improvement in higher-order skills compared to engineering students. The results show that multimedia instructional materials were more effective for the students if the materials challenged the participants, provided self-learning opportunities, made it possible to learn from others, and enhanced learning interest.
Research on the Impact of Multimedia Instructional Materials on Ethnic Background

Students (N = 23 whites) in the Concepts of Engineering Design course at Auburn University were given two separate evaluation forms, one at the completion of each case study, during Fall 1998 by the evaluators. In addition, students (N = 17 African American) in a class at Alabama A & M university were given the same evaluation forms at the completion of the Della Steam Plant case study in Spring 1999. The medians for constructs at both Universities are provided in Tables 2 and 3. A study of the data shows that the African American students responded very favorably to the multimedia case study methodology.

Table 2
Medians for Constructs in Questionnaire I with Different University Students

<table>
<thead>
<tr>
<th>University</th>
<th>Interesting and exciting</th>
<th>Important and valuable</th>
<th>Instructionally helpful</th>
<th>Relevant and useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn</td>
<td>3.3</td>
<td>3.5</td>
<td>3.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Alabama A&amp;M</td>
<td>4.0</td>
<td>4.2</td>
<td>4.3</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 3
Medians for Constructs in Questionnaire II with Different University Students

<table>
<thead>
<tr>
<th>University</th>
<th>Perceived skill development</th>
<th>Self-reported learning</th>
<th>Intrinsic learning and motivation</th>
<th>Learn from fellow students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn</td>
<td>3.8</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Alabama A&amp;M</td>
<td>3.8</td>
<td>4.0</td>
<td>3.7</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Summary of the Past Research Studies

The above research studies show that non-engineering, female, and African-American students perceived the multimedia instructional materials to be more effective than the White students, even though all of them rated most of the constructs to be above 3 on a scale of 1 (low) to 5 (high) showing that they enjoyed the use of the multimedia materials. All of them perceived that the methodology provides better opportunities for active learning and improvement of higher-level cognitive skills. The major limitations of these studies are that the sample size was small and the results were based on perceptions rather than on objective measures that quantify the improvement in learning of the students.

Conclusions

The instructional materials discussed in this paper have shown to improve the higher-level cognitive skills of students. Use of these materials in a MIS undergraduate course at Auburn University and other Universities has elicited very positive comments. The multimedia supplements have provided very effective in improving the higher-level cognitive skills of the students and promote their ability to learn from each other and be challenged. The workshop at Bentley College was well received and the availability of a state-of-the art multimedia room added significantly to the learning experience. We would be delighted if instructors in other Universities adopt these materials for use in their classrooms and work with us to evaluate the effectiveness of these materials in their classrooms. Funding opportunities are available from the NSF for adoption and implementation of these instructional materials in other Universities.

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opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF. Please look for further information at the website: litee.auburn.edu

References


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