Use of Multi-Media Courseware to Teach Real-World Decision Making Skills

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Abstract. We combined the case study approach and information technologies to create a multi-media courseware that brought real-world decision making from engineering industry into the classrooms. This paper describes the process of developing the CD-ROM courseware, details of classroom administration, and results of measuring the effectiveness of using the courseware in classes. This courseware was selected as the Premier Courseware of 1998 by NEEDS and John Wiley and Sons through a rigorous application and review process. Evaluation results of the use of the courseware in classrooms show that it enhanced classroom experience of students and helped them understand how decisions were made in the real-world. It also enhanced their higher-level cognitive skills. We expect that widespread use of multi-media courseware build on similar principles could lead to significant changes in the way students are educated.

Keywords: real-world, multi-media, CD-ROM, decision making, evaluation, Premier courseware

1. Introduction

Case studies have been traditionally used to show that real-world decisions need to be made so that financial goals, technical needs, safety factors and credibility issues are simultaneously considered and weighed [1,2]. They have been successful in bringing real-world issues from industry into the classrooms. Typical case studies use written material with a few charts and figures included at the end. Our classroom experience in administering written case studies showed that the students were not able to fully comprehend the complexity of technical problems and discussed the soft issues rather than the technical issues. In order to highlight the importance of technical material in the decision-making process, we had to include videos, photos, and competency materials (basic knowledge about the technologies needed to solve the problem) on an ad-hoc basis.

The availability of multi-media technologies made it possible for us to combine the case study approach with information technologies to create multi-media courseware to rectify this problem. The instructional objectives of this courseware were to enable the students to:

- Integrate business and engineering issues by understanding that good decisions require striking a balance between technical, financial, credibility, and management issues.
Use multimedia technologies to enhance learning.

Apply higher-level cognitive skills (e.g., reasoning, critical thinking, decision making, problem identification, and problem solving) to solve the problem stated in the courseware.

This paper describes the process of developing the CD-ROM courseware, instruction plan for use the courseware in classrooms, and results of measuring the effectiveness of using the courseware in classes.

2. Process of developing the courseware

2.1. Development of written case study

We worked with a power company and created a written case study entitled, "Della Steam Plant." The objective of the Della case study was to show that good decisions require that managers become involved in understanding unfamiliar technologies and strike a balance between technical, financial, and management issues. The case study discusses the heavy vibration when the 120,000 pound turbine-generator unit at Della Power Plant was taken up to a high speed during start-up. The unit started to vibrate and many employees were scared and started moving away from the unit. The unit was brought to a stop. The manufacturer's representative diagnosed the problem as due to possible breakage of some parts and recommended that, at a cost of $0.9 million, the unit be disassembled and retainer rings be inspected. The plant engineer diagnosed that the problem was due to an oil whip and recommended that the turbine-generator unit be restarted immediately. The cost would be nil if the unit functioned properly and could be as high as $19.5 million if the unit failed during a restart. The plant manager had to make a difficult choice between restarting the turbine-generator unit or shutting it down for maintenance considering the financial, technical, and safety issues.

An executive in charge of predictive maintenance at the central office sponsored this case study. This case study is real and happened in a power plant. The data for this case study was gathered by visiting the plant and interviewing the engineers at the plant. The transcripts of the interviews were typed out and formed the basis of the case study. The figures used in the case were obtained from the engineer in charge of predictive maintenance. We interpreted the technical, financial and risk information and wrote the case study. We administered the written case study in engineering and business classrooms. The engineer and manager from the power plant attended the classes when the case study was discussed. These visits provided the authors the information to revise the written case study. Theories about maintenance practices, oil whip, and oil whirl were added to the case study [3–7]. The case study was presented at conferences and published in a refereed journal [8,9]. The final published version of the case study was made as a basis for the courseware.
2.2. Addition of multi-media material

Even though the students enjoyed working on a real-world problem using the written case study, many of them expressed inability to visualize the consequences when a 120,000-pound turbine-generator vibrates. In addition, many of them had never visited a power plant and were not able to conceptualize the size and dimension of a turbine-generator.

Given the availability of new information technologies and the technical nature of the case study, we decided to enhance the written case study with additional multi-media material. We introduced the following elements of multimedia:

(a) Videos: Videos were used to enhance the classroom discussion, written case study, and help bring real-world problems into the classroom. For example, in the CD-ROM, an engineer demonstrates the severity of the vibration levels that occurred in the plant using a 10-pound rotor kit. The demonstration of the severity of vibration that occurs with the increase in speed of the rotor brings the reality of the problem to the students. This could not be achieved without a video presentation.

(b) Audios: Some of the discussions among the engineers and manager are long and involved. We taped students reading the debate among the engineers and inserted it in the CD-ROM. This provides students an alternate media to receive the information.

(c) Photographs: We inserted more that 100 photographs of the plant and turbine-generator. We were able to include photographs of the parts of the turbine-generator and maintenance practice. The photographs bring the details alive to the students even though they have never visited a power plant.

(d) PowerPoint Slide Presentations: Two PowerPoint presentations that explain the economics of power plant operations and maintenance technologies were included. These provided background material for the students.

(e) Charts and figures: The actual charts that were used in the plant were included in the CD-ROM. These provided the students an ability to zoom in and interpret the details of the charts.

The multi-media courseware included information that was otherwise difficult to provide in traditional written case studies. The following new materials were included in the multi-media version:

(a) Competency material: Most engineering students did not have the background on powerplant economics and business students did not have the technical background. Therefore, we created a tools section that included videos that described power production, slide shows that described the power plant economics and maintenance technologies, glossary of terms, and web references. For example, the material on power plant economics was obtained from current practitioner journals and included in the CD-ROM. Excerpts from industry experts and company executives were used to explain how deregulation is expected to tighten the budgets for operations and maintenance.
(b) Instructor’s Manual: We were able to create an instructor’s manual that showed a video of the solution adapted at the plant, examples of student presentations, and testimonials from the students on the use of the multimedia material.

2.3. Design and implementation of the CD-ROM courseware

Since a CD-ROM provides an ability for us to incorporate large amount of material, it was critical that we designed the courseware to match the following criteria specified by experts [10]:

- technical content (the content is accurate and error-free),
- technical reliability (all functions work),
- adaptability (adapt to suit different users),
- engagement (hold interest of the users),
- user interface and navigation (easy to navigate),
- interactivity (provide users’ ability to interact with the courseware).

In this section, we describe the menus used in the CD-ROM and show how the design of this specific courseware met the criteria specified above.

The main menu of the courseware was divided into five sections: Learning Objectives, Della Steam Plant Case Study, Tools for Analyzing the Case Study, Solution Manual, and Exit buttons. The learning objective section reiterated the objectives stated in section 1.

The Della Steam Plant Case Study had eleven menu buttons that provided further information about the case study (appendix A). The first item, Description of Della Steam Plant explains the technologies used in a steam power plant. The second item, Della President’s Mandate, shows a statement from the President who exhorts the plants to cut their budgets for maintenance (appendix B). The Maintenance Procedures menu explains the technologies used in predictive and preventive maintenance. The problem statement menu item shows a video of the plant engineer discussing the problem as it happened. The menu items, Lucy’s Recommendation, Steve’s Recommendation, and Sam Tower’s Dilemma discuss the dilemma facing the plant manager since the two engineers make conflicting recommendations. Your Assignment menu item describes the assignment to the students. The feedback questionnaire menu lists the questionnaire that students could use to provide feedback to the instructor.

The tools for analyzing the case study menu item has six sub-menu items, as shown in appendix C. The power generation menu shows two videos that could be used to learn about power production and distribution. The power industry overview menu is a 33-slide PowerPoint presentation that provides statistics about the power industry and comments from experts on the deregulation issues facing the power industry. The plant maintenance overview menu item is a 23-slide PowerPoint presentation that displays the maintenance technologies used in power plant maintenance. The glossary of terms defines the technical terms encountered in the case study. The references menu takes the students to on-line and library reference resources.
Separate CDs have been created, one for the students with the above menu items, and another one with the solution manual intended for the instructors. The solution manual menu is accessible only if the user provides a user name and password. The solution manual menu has eight menu items (appendix D). The first item, Achievement of Learning Objectives shows in a table form how the goals and objectives of the courseware have been achieved. The summary of presentation menu item provides a summary of the presentation by the four student groups. The detailed presentation menu item has four video clips that could be played. These are actual presentations made by a group of business and engineering students. The next item, final decision, has a video where the plant engineer describes the solution adopted by the plant. The quantitative evaluation menu provides details of the evaluation results. The comments menu includes video clips and written statements from students, plant engineers, plant managers, and academicians who have participated in creating and using this case study (appendix E). The publication menu item provides a listing of the journal, and conference publications by the authors related to this courseware. This shows that there are ample publishing opportunities when we develop, administer, and test such courseware in classrooms. The exit menu acknowledges the developers of the CD-ROM and provides links to the home page of the research team.

The menus were designed to meet the design criteria established at the start of this section. Table 1 provides the details of the instructional materials that were included in order to meet the criteria.

3. Instruction plan for use of multi-media courseware

The CD-ROM was distributed to the students a week before the classroom discussion. The students were divided into four teams. Two groups assumed the roles of Lucy and Steve and debated their recommendations. A jury group assumed the role of Sam Towers and provided the final decision that needed to be implemented. A future technologies group proposed new technologies. The task expected of each group is shown below:

Group 1: Assume role of Lucy and defend recommendation 1 – Stop the turbine-generator unit and fix problems. Include technical, financial, safety, and credibility issues.

Group 2: Assume role of Steve and defend recommendation 2 – Restart the unit the same day. Include technical, financial, safety, and credibility issues.

Group 3: Assume the role of Sam Towers, the plant manager, and decide between the two recommendations. Defend your answer and state how you used the information provided by the earlier groups.

Group 4: Assume the role of new technology group and discuss technologies that could be used in the future to solve such problems. Include measurement, data collection, information presentation, and communication issues.
Table 1

Instructional design criteria met by the courseware.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>How is this met by the courseware?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical content</td>
<td>The content is reliable since the case study was approved by the company and published in a peer-reviewed journal.</td>
</tr>
<tr>
<td>Technical reliability</td>
<td>All the buttons functioned and the software was been tested with Netscape Communicator and Internet Explorer. Since the interface was designed to work with popular browsers, it provides an ability for the courseware to evolve easily.</td>
</tr>
<tr>
<td>Adaptability</td>
<td>The courseware had been used by both business and engineering students in multiple institutions.</td>
</tr>
<tr>
<td>Engagement</td>
<td>The material has been designed to hold interest of the students for a length of time. Students developed the interface design and debated the screen layouts and menu choices with the faculty members throughout the design.</td>
</tr>
<tr>
<td>User interface and navigation</td>
<td>The design is based on a popular browser’s (Microsoft Internet Explorer or Netscape Communicator) user interface. Thereby, it provides user-tailorable interface settings. There are only limited menus and sub-menu items and the users could go back to the main menu at any time.</td>
</tr>
<tr>
<td>Interactivity</td>
<td>The software plays a video sometimes, plays an audio clip at other times, depicts photographs of the parts, and connects to power point slides made by the developers about the industry. The students are provided background information and they can choose what they want whenever they want it leading to asynchronous learning opportunities. In addition, the instructor can use the CD-ROM to show the solution to the problem and how other students debated the solutions.</td>
</tr>
</tbody>
</table>

3.1. Case study assignment

The case study was assigned a week before the classroom discussion: The instructor used the CD-ROM and projection equipment to provide an overview of the power industry and maintenance procedures. Then, the instructor showed the problem statement and asked the students to perform the assignment. Individual CD-ROMs were given to the students so that they could learn the details of the problem and go through the competency material at their own time and convenience. The students got together in teams and came to an agreement as to the reasons why the option assigned to them was the best one. The students interacted with each other, learned from the CD-ROM during the analysis, and used the reference links provided in the CD-ROM. The ability to view the CD-ROM on their own provided the students ability to learn in an asynchronous mode.

3.2. Classroom presentation

On the day of the case study assignment, the students worked together in teams and presented their recommendations. Many of them were able to cut and paste graphs, photographs, and videos from the CD-ROM in order to make their presentations more interesting. The members of the jury group asked questions of the other groups thereby making it possible for synchronous learning experiences to happen in the classroom.
USE OF MULTI-MEDIA COURSEWARE TO TEACH DECISION MAKING SKILLS

Table 2
Learning experiences addressed by the project.

<table>
<thead>
<tr>
<th>Asynchronous learning experiences from working on the courseware</th>
<th>Synchronous learning experiences in the classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn about the decision-making options faced by managers in a real-world power plant shutdown scenario.</td>
<td>Form teams to analyze the problem and develop interpersonal skills.</td>
</tr>
<tr>
<td>Obtain the assignment for the team.</td>
<td>Work with team members in analyzing the problem.</td>
</tr>
<tr>
<td>View the problem as it occurred in the real-world using the video segment.</td>
<td>Visualize the parts and pieces of a turbine-generator.</td>
</tr>
<tr>
<td>Research using links provided.</td>
<td>Use research to create the knowledge base required for classroom presentation and write-up.</td>
</tr>
<tr>
<td>Obtain information about power industry, maintenance strategies, and power generation and utilization.</td>
<td>Use the background information to create strong arguments for favoring the team’s position.</td>
</tr>
<tr>
<td>Learn about the solution from the video segment.</td>
<td>Debate the options in the class.</td>
</tr>
<tr>
<td>View discussions made by other student groups.</td>
<td>Jury group makes the final choice acting for the plant manager.</td>
</tr>
<tr>
<td>Provide feedback on the comprehensive learning experience using the feedback questionnaire.</td>
<td>Reinforce the need for oral communications for managers and engineers.</td>
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<tr>
<td></td>
<td>Discuss the relevance of case study learning experience for managers and engineers.</td>
</tr>
</tbody>
</table>

As summarized in table 2, the comprehensive learning experience consisted of students working with the courseware independently (asynchronous learning) and working in the classroom as groups (synchronous learning).

3.3. Case study grading and summary by instructor

The instructor evaluated the presentations and reports and provided grades to the students. In order to assist the instructor in this task, a solution manual was provided in the CD-ROM. This showed the decision adopted by the company, a brief summary of the responses provided by earlier student teams, detailed responses provided by student teams, and videos of each group presenting their presentations. These materials provided the instructor a standard with which he/she can compare the classroom performance of the students. The instructor also showed some of these videos in class when providing feedback to the students.

3.4. External evaluation of the multi-media courseware

The courseware was submitted to a competition held by the National Engineering Education Delivery Systems (www.needs.org). The competition winners were chosen
through a rigorous application and review process and represent excellence in the use of computer-based instruction to enhance engineering education. The courseware was selected as the Premier Courseware of 1998 due to its ability to present an engaging, real-life engineering case study requiring active participation and teaming by engineering students. The reviewers stated that the students would develop higher-level cognitive skills due to working on the case study and associated classwork.

4. Evaluation results

4.1. Subjects

The CD-ROM courseware was used in undergraduate operations management and engineering classes. The CD-ROM courseware was used by 23 engineering students and 10 operations management students during Fall 1998.

4.2. Effectiveness and specific benefits

As part of evaluation of the effectiveness of this project, students were given two separate evaluation forms at the end of the case study. These evaluation forms were based on instruments used in earlier research [11]. In addition, the students completed an electronic journal that provided answers to specific questions on their learning strategies, teamwork, and effectiveness of the project. Evaluation I consisted of 24 bipolar descriptors. In other words, an item on the evaluation form would represent the concept of clarity on a 5-point continuum from unclear to clear, or the case study’s relevance on a continuum from irrelevant to relevant. Because the four constructs derived from Evaluation I yielded substantial reliability levels (with anything above 0.60 considered acceptable), the 24 separate questions within the survey could be meaningfully organized and reported by these four distinct descriptors of the case study. Table 3 shows the medians for responses on the four separate constructs.

Indeed, the medians for all four constructs are well above a rating of 3, indicating that students rated the case study on the positive side of the continuum. In fact, as demonstrated by the two constructs with medians of 4.0, the students found the case study particularly important and valuable as well as relevant and useful—important elements in effective learning.

Evaluation II asked the respondents to indicate the extent of their agreement with 16 evaluatory statements on a 5-point Likert scale. Some sample items include statements such as “I improved my ability to evaluate critically technical and managerial alternatives” or “I learned to design.” The response scale progressed from a rating of 1

<table>
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<th>Table 3</th>
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<tbody>
<tr>
<td>Medians for constructs from Evaluation I.</td>
</tr>
<tr>
<td>Interesting and exciting</td>
</tr>
<tr>
<td>3.4</td>
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</table>
that represented the least positive or least favorable response of "Strongly Disagree" to a rating of 5 that represented the most positive or favorable response of "Strongly Agree". In addition, Evaluation II ended with three open-ended questions that asked the students to provide written responses concerning the strengths and weaknesses of the Della Steam Plant Case Study as well. Substantial reliabilities for Evaluation II suggested specific constructs, which made an analysis of the data manageable and meaningful. The reliabilities are above the established criteria of 0.60 for all the constructs. The medians for these five constructs derived from Evaluation II are reported in Table 4.

With the exception of communication skills, Table 4 illustrates that the reactions of the students to these various aspects of the Della Steam Plant Case Study were favorable. In other words, the Della Steam Plant Case Study appeared to be well received and educationally advantageous to the students. The median rating of 2.5 for Communication Skills is not problematic, because the instruction associated with the case study did not directly address communication skills, it seems logical that students would not report a change or improvement on this particular construct.

After the students had received an evaluation on the case study, the students submitted an electronic journal to the instructor that asked questions on learning strategies, learning methods adopted, difficulties in learning, and impact on their chosen career.

The instructors of the operations management class where the courseware were used wrote written comments on the use of the material. A faculty member who used this case study in his class stated:

I wanted my students to face a real life decision situation familiar to OM, that is, an expensive maintenance dilemma. I also wanted them to deal with a highly technical problem which requires the interpretation of mechanical engineering data but requires the students to play the role of a manager, and make a critical decision after evaluating and judging the opinions of two engineers who mutually disagree.

The two goals that I devised for the case were met completely to my satisfaction. I will use this case again in similar courses. Students were not intimidated by the technical content but attempted to draw their conclusions as managers ought to under the circumstances. The case has a balance of engineering and OM issues that promoted learning among the students. The students enjoyed the case and had positive informal comments. A formal feedback from the students is extremely positive. I have never seen such positive response for a case that I used for the first time. Overall, an excellent case.

Another Operations Management faculty member who participated in the class discussions stated:

<table>
<thead>
<tr>
<th>Table 4</th>
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</thead>
<tbody>
<tr>
<td>Medians for constructs from Evaluation II.</td>
</tr>
<tr>
<td>Perceived skill development</td>
</tr>
<tr>
<td>3.8</td>
</tr>
</tbody>
</table>
The students evidently enjoyed the case: it was an exercise in decision making. They assumed the roles of the key characters, which encouraged lively debate. The video clips included in the Instructor’s edition give a good impression of how students can bring engineering and business issues together in their case evaluations. The case is not entirely technical: our group of students showed perception in pinpointing some likely personal motives underlying the opinions of Lucy and Steve, and the financial implications for the company.

Students provided written comments about the value of the CD-ROM courseware. Excerpts from their feedback are provided below. The students commented on how they achieved goal 1, bringing real-world issues to classroom:

- The case study is a good use of a real problem for learning.
- It showed me a real-world situation and was exciting to see if we made the same decision as the real engineers.
- It’s a good concept and a valuable tool for exposing students to real life engineering issues.
- It really happened. That fact that it wasn’t made up and that I might be in Steve, Lucy, or Sam’s place one day.
- I have enjoyed working on an actual problem. This really keeps me interested because I see the theories that I learn in school applied in a practical environment.
- I learned about the many different risks that are involved in making decisions. It is helpful information to use when making any kind of engineering decision.
- I enjoyed finally seeing all of what we have been studying put to practical use. Spending too much time in the theoretical area makes me feel like a scientist and out of the world I am living in. I’m not a scientist, I’m an engineer, and I’m concerned with real-world situations and practical application.

They commented as follows on achieving goal 2, use of multi-media technologies to enhance learning:

- The CD-ROM was very helpful in developing an understanding of the problem.
- We use a method of analyzing all the given information, then taking that information and interpreting it further to get the most comprehensive information possible. We also looked at other sources of information such as the WWW.
- I was also very impressed with the interface of the CD-ROM. It was very user-friendly and contained virtually all the information necessary to complete this Case Study.
- The CD-ROM facilitated my understanding of the case study immensely. The use of the different multimedia grabbed my attention and allowed for greater information retention.

Their comments on achieving goal 3, development of higher-level cognitive skills is as follows:
• I was allowed to think, analyze and make a decision on my own and within a group.
• It discusses many different aspects about decision-making such as financial, technical, and safety issues.
• I think that I am better thinker, planner, and problem solver because of these case studies.
• Each person had various views as to which decision should be best. The views were presented and we considered their pros and cons. We engaged in valuable discussions where significant points were mentioned that I did not know.
• I noticed that this one case actually helped me analyze my thought processes. I feel that my problem-solving methods have become keener. I was assigned a task and concentrated on that one particular aspect and its effects on the other components of the problem. This problem interested me and therefore I gave it all of my undivided attention.

Table 5 summarizes how the courseware met the goals and educational objectives discussed earlier taking into consideration the quantitative results, comments from the students, and comments from operations management instructors who used the courseware.

<table>
<thead>
<tr>
<th>Goals and objectives</th>
<th>Methods used in courseware</th>
<th>How this courseware achieved these educational objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>The courseware needs to connect theories to real-world decision-making</td>
<td>• Problem statement and solution on video</td>
<td>• Quantitative analysis (significant scores on constructs of interesting and exciting, important and valuable, relevant and useful)</td>
</tr>
<tr>
<td></td>
<td>• Videos of plant personnel</td>
<td>• Supporting statements from students.</td>
</tr>
<tr>
<td></td>
<td>• Audio clips of discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Photographs of machinery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Figures/charts used in the plant</td>
<td></td>
</tr>
<tr>
<td>The courseware needs to use multi-media technologies to enhance learning</td>
<td>• Use of menus</td>
<td>• Quantitative analysis (significant scores on constructs of instructionally helpful).</td>
</tr>
<tr>
<td></td>
<td>• Use of popular browser</td>
<td>• Supporting statements from students.</td>
</tr>
<tr>
<td></td>
<td>• Targets in various files</td>
<td>• Operations management instructors who used the CD-ROM perceived that students were motivated.</td>
</tr>
<tr>
<td></td>
<td>• Links to research sites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Facilitates non-sequential access to information</td>
<td></td>
</tr>
<tr>
<td>The courseware needs to provide students an opportunity to improve higher-level cognitive skills</td>
<td>• Availability of competency material</td>
<td>• Quantitative analysis (significant scores on constructs of perceived skill development, intrinsic learning, self-reported learning, and learn from fellow students).</td>
</tr>
<tr>
<td></td>
<td>• On-line references</td>
<td>• Supporting statements from students.</td>
</tr>
<tr>
<td></td>
<td>• Audio, Videos</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Challenge in using the courseware</td>
<td></td>
</tr>
</tbody>
</table>
5. Innovative features of this project

The innovative and unique features of the project are that:

- It brings real-world situations into the classroom through videos, audio clips, and photographs. The students are provided an opportunity to experience the problem as though they were in the plant. The use of multi-media courseware in addition to the written case study enhances the multi-sensory perceptions of the students by engaging their audio and visual perceptions.

- Its use of multi-media technologies facilitates non-sequential processing of information by the students. It provides both asynchronous and synchronous learning opportunity [12].

- Combination of CD-ROM courseware technology with a sound pedagogical approach (case studies) has resulted in an interesting and innovative technique.

6. Conclusions

The multimedia courseware used in this project supplements an instructor’s capability to bring real-world decision-making to the classroom. The instructional design of the courseware is designed to make it as a friendly, interactive media that enhances the classroom experience. The instructor is provided a full menu of information that could be used to supplement the classroom discussion of the case study.

This courseware enhances classroom experience of students and helps them understand how decisions are made in the real-world. It is also designed to enhance their higher-level cognitive skills. We expect that widespread use of courseware build on similar principles could lead to significant changes in the way students are educated. These students would be better able to realize that solving problems in industry requires balancing the technical, managerial, financial, and credibility issues. Given the increased attention paid to use of information technologies in classrooms, it is essential that similar courseware need to be developed for use in classes that emphasize manufacturing, information, operations, and engineering technologies, statistical methods, engineering principles, and decision science principles. This paper shows that multimedia technologies provide us, the instructors, an ability to bring real-world decision making issues to the classrooms as has never been done before.

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Appendix A. Della Steam Plant menu options

Description of Della Steam Plant
Della President’s Mandate
Maintenance Procedures
Problem Statement
Lucy’s Recommendation
Steve’s Recommendation
Sam Towers’s Dilemma
Your Assignment
Feedback Questionnaire
Tools for Analyzing the Case Study
Back to Main Menu

Appendix B. Della President’s Mandate page

Della President’s Mandate

No one really knows what the industry will look like and who its players will be in the next century. To be competitive in the future, we’ve got to reduce the real price of the company’s electricity at least 10 percent. All of us would be asked to do this without reducing or sacrificing customer service or investor value. Therefore, freezing the operations and management budget and reducing the capital budget is just one more step in the effort to identify what the company’s targets have to be for success beyond year 2000.

The company’s strategic leadership council had announced that operating and maintenance (O&M) budget forecasted for the year 2000 must be reduced by $50 million. To do this, the company was freezing its O&M budget at the 1995 level through 2000. In addition, projected capital expenditures were expected to be reduced by $250 million between 1995 and 2000. The deregulation of the utility industry had forced this company to find innovative tools and processes to improve productivity and extend the useful life of existing facilities.
Appendix C. Tools for analyzing case study

- Power Generation
- Power Industry Overview
- Plant Maintenance Overview
- Glossary of Terms
- References
- Back to Main Menu

Appendix D. Solutions manual menu

- Achievement of Learning Objectives
- Summary of Presentations
- Detailed Presentations
- Final Decision
- Quantitative Evaluation
  - Balancing Engineering and Business Issues
  - Improving Higher Level Cognitive Skills
- Comments
  - Students
  - Engineers
  - Managers
  - Management Faculty
- Publications
- Back to Main Menu

Appendix E. Comments by engineers

Comments by Engineers
View Comments by Plant Engineer Video

The engineering manager who sponsored the case study was enthusiastic about developing the case study. He stated,

"A good case study gives the students business aspects that you don’t normally cover in engineering undergraduate classrooms. This experience is difficult for an average undergraduate engineering student because he or she doesn’t have an equation to solve; there may not be one right answer in the case study. The value comes from evaluating the options presented in the case study, not from obtaining the 'correct' solution. It gives the students a real-world feel of utilization of all the technologies. It gets the students excited and interested about learning engineering subjects."

The engineers and managers at the power plant were enthusiastic in developing the case study for use in the classroom. They stated that they lacked such exposure to real-life problems while they were at school. An engineer stated:
“When I went to school, I had never seen large machinery. I was surprised to see the size of a turbine-generator when I joined this power company. The use of case studies could provide the students a better understanding of the technologies used in our company.”

The engineers and managers from the Power Plant were also eager to participate in the classroom discussions. The engineer responsible for solving the problem came to the class twice and told the authors that he enjoyed being able to talk to students about problems faced in industry.

References