

**New Technologies  
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# The Case Approach For Teaching Quantitative Decision Making

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The course that is to be discussed in this paper was developed as a core course for MBA students. However, any student pursuing a Master's Degree in Agribusiness has equal need for such a course. Both an MBA program and an Agribusiness program seek to achieve the same objective. We take students, process them through a series of courses, and the end result is fundamentally the same: a manager.

As faculty participating in the educational process, it is our charge to provide students with the skills and knowledge necessary to prepare them for their role as managers. It is this role that determines what skills and knowledge students will need. Managers' responsibilities include (but are not limited to): identifying and defining problems or opportunities for improvement within their organizations, providing data relating to the problems or opportunities, interpreting the results of data analysis, and formulating and implementing a plan of action based on data analysis. In short -- the manager's responsibilities involve decision making. And the manager must be prepared for decision making situations where the degree of complexity or uncertainty of the situation requires mathematical or statistical modeling.

We have found the Case Approach to be the most effective means of developing in our students the skills and knowledge necessary to prepare them to become effective users of quantitative decision making tools.

## Objectives in Teaching Quantitative Decision Making Using the Case Approach

To what degree do we wish to prepare our students to use quantitative decision making methods? If we view managers as *users* of quantitative decision making skills, then they should be able to carry out routine applications of standard models independently and to work effectively with analysts on more complicated projects. With this objective in mind, we can enumerate the skills and knowledge that the eventual manager needs to become an effective user of quantitative decision making methods.

**Problem Finding.** The manager should be able to recognize decision making situations that need mathematical or statistical analysis. This includes not only spotting problems as they arise, but also anticipating problems and identifying future opportunities.

**Model Specification.** The manager should be able to specify which aspects of a problem situation to include in the analysis. This includes selecting a measure of performance to be used, listing the specific decisions to be made, and identifying the factors which might have an impact on those decisions, including any constraints that apply and any assumptions that have been made.

**Model Selection.** The manager should be able to select an appropriate model for a given situation or determine that the situation does not fit any model with which he or she is familiar.

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In order to do this, the manager must be acquainted with the form, key features, and underlying assumptions of a number of standard mathematical models.

**Data Preparation.** The manager should be familiar with the data necessary to specify standard models as well as the usual sources of this data. The importance of this task and its potential difficulty is often underestimated and considered not worthy of the manager's attention. Therefore, managers need to be familiar with the consequences of inaccurate data.

**Model Solution.** The manager should be familiar with the calculation procedures necessary to solve a variety of quantitative decision making models. The manager should know how to solve small problems by hand in order to better understand how the computer solves larger problems as well as how the computer results are to be interpreted. Since quantitative decision making software is widely available at little cost, the manager should also have experience using such software.

**Model Validation.** The manager should be able to determine the degree to which a model accurately represents a decision making situation. This involves specific skills, such as using goodness-of-fit tests to determine whether a particular probability distribution is appropriate or recognizing when relevant aspects of a problem have been omitted from the model.

**Sensitivity Analysis.** Managers should be able to determine the impact of possible changes in the input data. They should realize that the analysis of a problem is not complete unless it is clear under what circumstances the conclusions would no longer be valid.

**Reporting of Results and Plans for Action.** Managers must be able to communicate clearly and convincingly to others in their organization the results of the analysis that has been performed and the conclusions which can be drawn from the analysis. They should have practice in preparing thorough but concise

written reports and in giving oral presentations, both individually and with a group.

Given these skills we wish to develop in our students, it seems only natural to expose them to cases where they are required to use each skill in arriving at a decision. However, the gradual building of a complex set of knowledge is needed before they are prepared to effectively analyze a case. As prerequisites for the course, we require experience in computer use, a course in statistical analysis, and a techniques-oriented course that surveys a variety of standard mathematical decision making models. In this latter course, we concentrate on simple solution techniques and introduce the use of computer software as a solution tool. We have had much success with the text by Anderson, Sweeny and Williams, *An Introduction to Management Science* and its accompanying software, *The Management Scientist*. Only after completion of these courses do we feel students are prepared for a course which uses case analysis for developing skills in quantitative decision making.

#### **Choice of Topic Areas Covered in the Case Studies**

The topic areas to be covered in the course should be chosen not just for their individual usefulness and importance, but also to facilitate development of the more generalizable skills outlined in the previous section. We have chosen forecasting and regression models, linear programming, simulation, queueing analysis, project management, and quality improvement as topics to be covered in the class.

Linear programming, for example, was chosen as a topic not because we believe all managers will use linear programming (they won't), but because the study of linear programming helps students develop their ability to describe a decision situation mathematically and to make fairly extensive use of sensitivity analysis. Similarly, the study of quality improvement emphasizes problem identification, while the study of simulation and queueing models serves as an ideal context for the development of model validation skills.

### Case Analysis as the Primary Learning Experience

Developing generalizable skills in quantitative decision making requires the students to be exposed to a variety of learning experiences. We have found that analysis of case studies is an ideal mechanism for developing the skills that the eventual manager will need to function effectively in their organizations. For that reason, we rely on a variety of case analysis experiences as our primary source of imparting the desired knowledge and skills. Other learning experiences are also employed, but to a much lesser degree than the case studies.

**Case Studies in the Lecture/Discussion Format.** Presentation of basic information takes place in a lecture/discussion format. Approximately 20 percent of the lecture/discussion format consists of reviewing the general features of the model or technique, reiterating the underlying assumptions, examining the data requirements, and identifying the situations for which the model or technique is suitable for application. The remaining 80 percent of the lecture/discussion format is left for analysis of case studies, which often include topics that go beyond the introductory level.

In covering case analysis during a lecture/discussion format, the *process* of quantitative decision making is stressed. Each aspect of the process, from problem finding to implementation of a plan for action is discussed. In this manner, the students become acquainted with the appropriate steps for case analysis, which should carry over into their eventual role as a manager who is faced with a need to make a decision using quantitative techniques.

**Group Solutions to Case Problems.** The students are assigned case problems to solve as a team. There is class limit of 32 students and they are divided into 8 teams consisting of 4 individuals each. Each team solves 8 identical cases during the semester and prepares a one page written summary (with addenda) on each case. In addition to the written analysis, each team is required to present one of the case solutions to the class.

Since each team has solved each case, there is often a lively discussion that follows the presentation of the case solution. Although different teams will obtain the same results to identically specified models, they will often disagree on the conclusions and plans for action based on the results. On other occasions, entirely different model specifications will be made, which also sparks a debate. The students learn a great deal in these debates. If facilitated correctly, the instructor is in a position to guide the debate towards the correct analysis, while pointing out the errors in logic that lead to the incorrect analysis.

**Individual Projects.** Each student is required to find a problem or opportunity for improvement at their place of work and thoroughly analysis the situation using the skills they have developed in the course. To emphasize the *process* of quantitative decision making, we begin by requiring the students to submit a proposal for their project about one month into the course. The proposal must contain a statement of the problem or opportunity, a review of relevant literature, a model statement, and a plan for data collection. Conferences are then set up with the instructor to provide feedback on the proposal. The students will have approximately three weeks to revise their proposals before they are asked to present their proposals to the class. By presenting their proposals, we hope to build communication skills, while at the same time give them additional opportunities for feedback from their classmates. Students are encouraged to meet with their instructor on a periodic basis for additional feedback. This is especially important after the data has been collected and an initial solution to the model(s) has been obtained. A final written analysis is turned in at the end of the semester.

In doing these individual projects, the students are forced to experience the steps involved in quantitative decision making. From our experience, we have found the individual project to be the most effective tool in teaching quantitative decision making. For many students, it is their first experience in collecting and working with raw data and they are often intimidated by the efforts involved in preparing

the data for analysis. Many of them have also never experienced model validation and the problems involved when their situations do not fit the model they had initially planned to use. As such, the individual project becomes an excellent learning experience for developing all of the skills needed to be an effective user of quantitative decision making tools.

### Effectiveness of the Case Approach

Measuring effectiveness of any teaching method is difficult at best. We know what we wish to impart with regards to skills and knowledge and typically use quizzes to gauge what the students are learning from the course. We can observe the evolution of their analytical skills as they progress through the group case analyses and their own individual projects. However, these measures are subjective -- what would be considered progression by one instructor might not be viewed as such by another instructor.

Student evaluations are another measure of effectiveness. We use a quality improvement approach to measuring effectiveness from student evaluations. Each student is asked to identify those experiences that enhanced learning and to place a subjective weight on the importance of those experiences. By in far the most popularly cited experiences are the group cases and the individual projects.

Another measure of effectiveness (arguably the *best* measure) looks to graduates of the program who use quantitative decision making in their role as managers. Are they capable of performing standard quantitative analysis on their own and can they work effectively with analysts on more complicated projects? Although we have not undertaken a formal study of our graduates, informal feedback has indicated that our managers *are* using the skills they developed in the course to the benefit of their organizations as well as their careers.

### Transferability of the Proposed Case Approach For Teaching Quantitative Decision Making

Use of case studies in a lecture/discussion format, as well as having students work in teams to solve case problems will transfer to any program. We are at an advantage with respect to the individual projects in that approximately 98% of our student body is employed full-time. Therefore, it is very easy for them to find problems and opportunities for improvement to analyze. In addition, the student's individual projects are used as case studies in subsequent semesters for both the lecture and group case analysis parts of the course.

A program consisting of primarily full-time students would initially require a case text in quantitative decision making, such as Render, Stair and Greenberg's *Cases and Readings in Management Science*. Cases from a text are often limiting, but provide an excellent beginning as a source for lecture and group case analyses. The instructors will need to find organizations willing to participate in the individual projects. However, once successes have been attained through the individual projects and the organizations properly credited for their participation, it should not take long for other organizations to volunteer their data and resources for individual projects. Eventually, a rich source of students' projects will develop.

Association meetings are another excellent source for building a library of case studies. The Decision Sciences Institute (DSI), an organization that promotes the development and application of quantitative methodology to functional and behavioral problems, has for years provided a workshop on case writing and analysis at its annual meeting. Many case studies can be found in the annual proceedings of the DSI meetings. In addition, contributions on the use of case studies in teaching decision making are often topics in the innovative education track at the DSI meetings (Cunningham and Ruwe).

As a final comment on transferability, we stress that the case approach is very time-consuming for the instructors as well as the students. Different cases must be developed each semester to avoid solutions getting around in the student body. Computer software changes occur at an overwhelming pace, requiring the instructor to spend a great deal of time just to stay current with the latest advances. Finally, the student contact hours are above average since the students need guidance in their group analyses as well as their individual projects. Thus it is imperative to have an administration that rewards teaching excellence.

### Summary

Once we understand the skills our students will need to become effective users of quantitative decision making methods, it seems only natural to teach these skills using a case approach. By forcing the students to experience each aspect of the quantitative decision making process, we build generalizable skills that they can use in their eventual role as managers. Remember, *Real Managers Don't Pivot ...* they make decisions. And they need to be taught how to do so.

### References

Anderson, David, Dennis Sweeny and Thomas Williams, *An Introduction to Management Science: Quantitative Approaches to Decision Making*, 6th Ed., West Pub. Co., New York, 1991.

Anderson, David, Dennis Sweeny, Thomas Williams, and Daniel Joseph, *The Management Scientist*, Ver 2.0, West Pub. Co., 1991.

Cunningham, Margaret and Marcia Ruwe, "Real Managers Don't Pivot", Proceedings of the 1990 DSI meetings, San Diego, November 1990, Vol. 1, pp. 642-644.

Render, Barry, Ralph Stair and Irwin Greenberg, *Cases and Readings in Management Science*, 2nd Ed., Allyn and Bacon, Boston, 1990.