2006-1314: A DISTANCE EDUCATION GRADUATE COURSE IN ENGINEERING ECONOMICS: RESULTS AND LESSONS LEARNED

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A Distance Education Graduate Course in Engineering Economics: Results and Lessons Learned

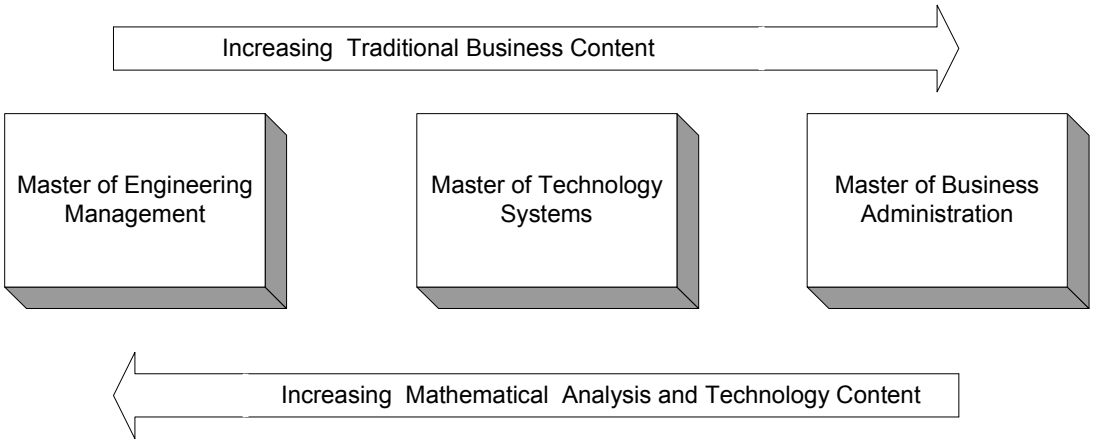
Abstract

This paper examines a core course in the Master of Science Technology Systems (MS TS) and Master of Science Occupational Safety (MS OS) programs at East Carolina University and examines lessons learned in critical areas. The course, Capital Project and Cost Analysis for Technology, covers the essentials of engineering economics focused to meet the needs of working technology managers. The paper reviews distance graduate student opinion on learning objectives and course content. It also examines the use of various distance education methodologies employed to deliver this course to online students.

Introduction

Engineering economics is an essential tool for undergraduate engineering and technology students, but is even more essential for graduate students in professional master's programs. East Carolina University (ECU) offers distance education (DE) graduate masters program (MS in Technology Systems and MS in Occupational Safety) for technology-based managers. The students in the program encompass backgrounds ranging from engineering and business, to networking and bio manufacturing. From a curricular content and focus perspective, these programs are positioned between the MBA and the master's in engineering management as shown in Exhibit 1. For example, a primary program goal of the MS in Technology Systems (MS TS) is the professional development of individuals in technology leadership positions. This may include individuals with undergraduate engineering degrees, but more often covers a range of technology and business undergraduate areas.

Exhibit 1: Content Comparison of Master's Programs



A core course in this MS TS and MS OS programs covers the essentials of engineering economics focused to meet the needs of working technology managers. This paper examines

three objectives involving the content and delivery quality of this course. The first area of this paper examines preliminary findings of an ongoing study of MS TS and MS OS students and the importance they assign to topics covered in the graduate engineering economy course. The objective of this analysis is curricular improvement through the identification of engineering economy topics deserving greater or reduced emphasis. A secondary objective is to contrast these results with a previous study that targeted the same questions for Master's in Engineering Management (MEM) students[1]. Finally, this paper examines the use of various DE methodologies and the importance or effectiveness that students in the MS TS and MS OS programs assigned to them.

Engineering Economy in Professional Master's Programs

Professional masters students such as those in MS TS, MS OS, and MEM programs offer a unique perspective to educators. Since most of these students are working professionals in the DE program, they have strong opinions regarding the value of course topics for the near term in the current job, and in the long term for their professional and personal development. As a result, they judge the quality of course content, in large part, based on the likelihood of application. For many students, these graduate programs will be the last formal educational step. Remaining career development will consist of non-credit and continuing education courses. Consequently, it becomes the instructor's challenge to provide topical emphasis and content that provides a solid long-term career foundation.

Since many technology-related professional graduate students select MEM or MS TS programs in lieu of alternative business degrees, MEM students have varied expectations related to financial analysis skills. Consequently, the MEM and MS TS programs must provide the "business sense" that is critical for climbing the organizational ladder and for personal investment decisions in an information and technology context. The level of success in meeting these expectations is based in part on the topics included in the graduate level engineering economics course. A number of studies have examined the engineering economy tools that corporation's employ[2, 3]. However, these studies did not track these tools into the technology management workplace at the operating manager (first level manager, second level manager, and program/project manager), nor the technologist / engineer level.

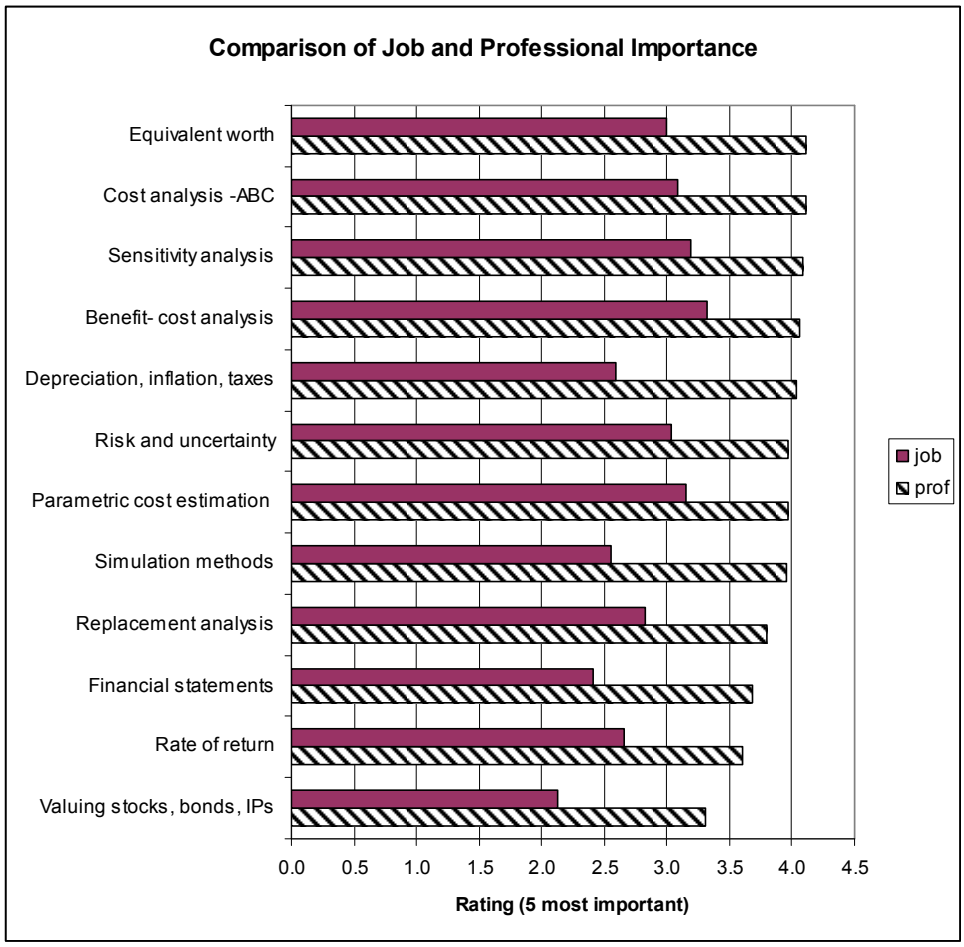
On a macro scale, the goal is to answer the following questions for both engineering and technology managers:

- What engineering economy topics are useful in their current job?
- What engineering economy topics are useful for their personal and professional development?
- Are there differences in the answers to the previous questions and do these answers differ based on job related characteristics?

The original study[1] asked students in an MEM program to evaluate the usefulness of eleven engineering economy areas from two perspectives. These were primarily part-time students who were employed during their graduate studies. First, students assessed importance from a direct application on the job view point, and second from the vantage point of usefulness for long-term professional development. Results from the MEM study are summarized in Exhibit 2 below for

reference. Using a 1-5 scale, students first responded on immediate use of the course materials in the current job environment (solid segment). Next, student participants evaluated topical areas as useful for longer-term applications, either personally or as a tool for professional development (cross line segment).

Exhibit 2 Results of MEM Survey



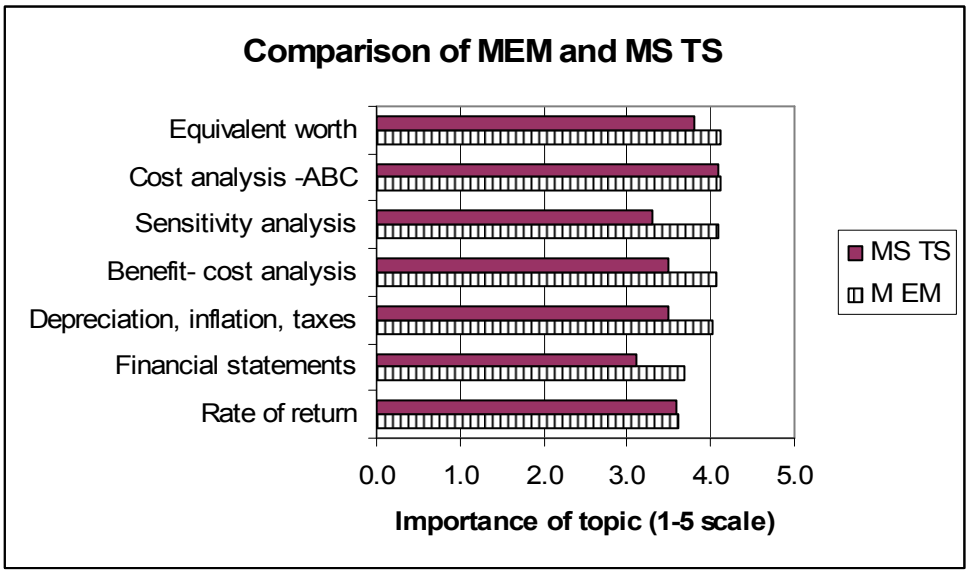
In general, the MEM students rated the topics more important for long-term development than for direct application in their current position. This implies that many MEM students are not expected by their employers to apply and use engineering economy tools in their current positions. However, students appear to recognize the importance of this body of knowledge for career advancement.

Using a similar survey structure, technology management students were questioned on seven topical areas paralleling the MEM students. Again the students appear to appreciate the long term value of the topical areas. Exhibit 3 shows the responses and highlights the following points when compared with the results of Exhibit 2 (cross hatched on Exhibit 3).

- In general, technology management students did not assign as high a level of importance to topics as MEM students. This is particularly pronounced in sensitivity analysis.

- The exception areas are cost analysis, equivalent worth, and rate of return methods.

Exhibit 3. Comparison of MEM and Technology Management Topical Ratings



Although the results need to be expanded with a larger population size, it appears that MEM students take a broader view of the need for engineering economy topical information. Tying this into the discussion on Exhibit 2, this may relate to a more comprehensive long-term view by MEM students on topical information needed for long term professional development.

Preferences for Distance Education Methodologies

Distance education is the primary means of pursuing graduate studies related to career development for many technology professionals. There are a number of factors that have influenced this development. First, the opportunity cost of pursuing full-time studies is a major factor in the emergence of this paradigm over the past 5-10 years. Another factor in the growth of distance education is that many individuals are place-bound due to family or job commitments. Finally, many small cities and rural communities do not have professional development oriented university programs that specifically target the needs of technology or engineering managers within a reasonable commuting distance. The net result of these factors is an explosive growth in distance education related to technology professionals. This section examines the use of various distance education approaches in technology management programs and analyzes feedback from students on their effectiveness.

Exhibit 4 shows student responses on the effectiveness of various distance education approaches. In summary, the following items were rated highly:

- Importance of some level of live interaction with the instructor.
- Use of streamed, archived lectures and chat sessions. Students in this course primarily received recorded lectures using PowerPoint Producer that is shown in Exhibit 5. The version used included the pictorial of the lecturer in the black area of Exhibit 5 during streaming.

- Timely use of email to answer questions.

Students did not rate highly the following areas:

- Use of proctors and closed book exams. In distance education, it is important to have a level of assessment that is clearly tied to individual student performance. This response indicates that technology management students see this as an onerous requirement.
- Multiple choice question tests. Working professionals appear to dislike testing approaches that reflect simple questions and limit the opportunity to award partial credit.

Exhibit 4. Response to Instructional Approaches

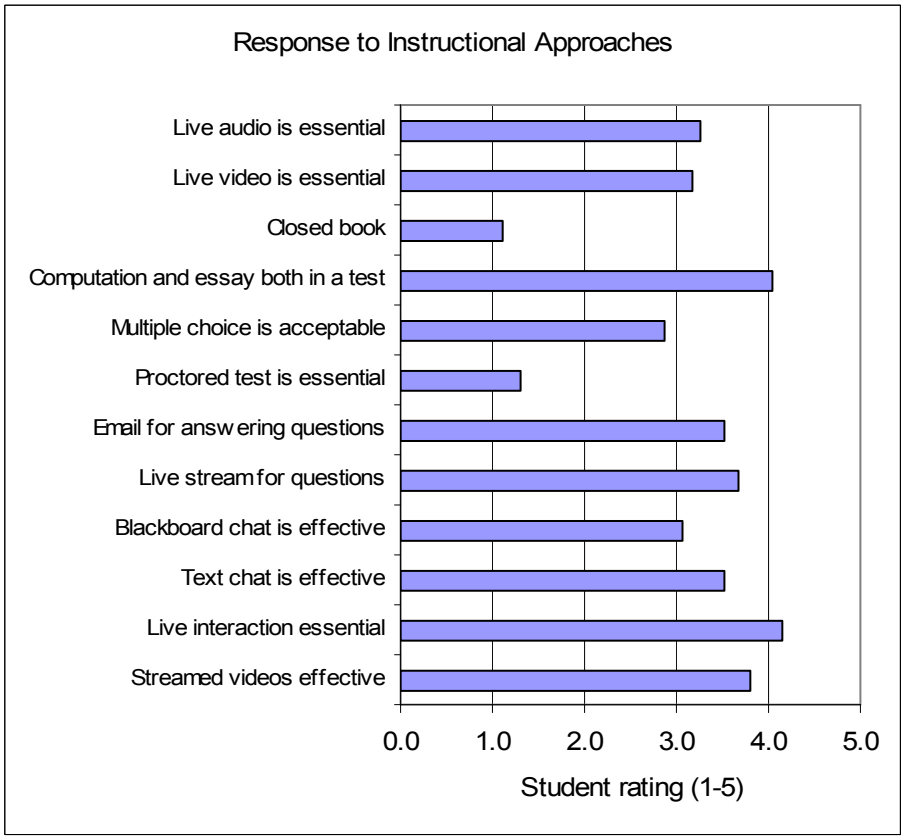
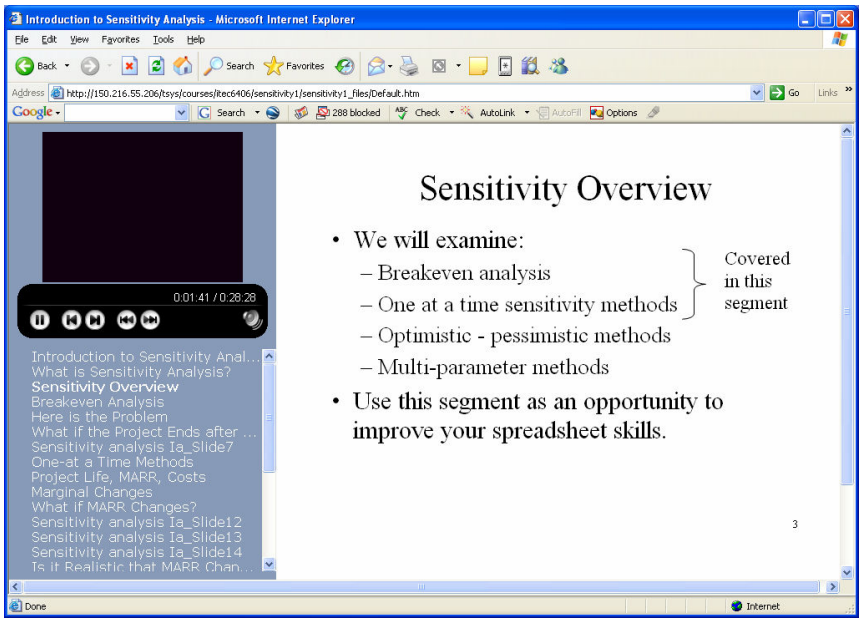


Exhibit 5. Example of Streaming Video



Summary and Conclusions

The combination of a diverse and changing workplace coupled with high student expectations necessitates inclusion of topics and emphasis levels that provide the engineering economy coverage that meets both the current and long-term career needs of the traditional and DE MEM and MS TS/ OS student populations. In addition, distance education is now and will continue to be the primary vehicle for professional development of technology and engineering management students. This paper provides preliminary results of a study to enhance understanding of engineering economy curricular needs and the distance education tools that support improved learning.

In general, MEM and MS TS students agree on the importance of engineering economy topics but the level of importance is less pronounced with MS TS students. Cost analysis and equivalent worth methods were the highest and most consistently selected areas. As far as distance education approaches, students prefer use of streamed lectures coupled with some form of instructor interaction to answer questions. In addition, students prefer testing approaches that allow more diverse expression as contrasted to multiple choice tests.

The authors plan to continue these surveys and analytical studies for several more years and solicit increased involvement from MEM and MS TS programs throughout the country. Additionally, the authors will collect longitudinal data to see how and if recommendations change after a number of years pass. We hope that this study may also be a model for increased collaboration in other subject matter areas that are critical to MEM and MS TS programs.

Bibliography

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