Facilitating Student Learning in Engineering Economy Classes Through Context: “Making Horses Thirsty While You Lead Them To Water”

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Abstract

It is absolutely essential that students acquire a fundamental understanding of the basic concepts of engineering economics early in the semester. If they fail to do so they become frustrated and disheartened with the course. This in turn seriously impedes their learning of the more complex material encountered later in the term. This scenario poses one of the most significant challenges facing any faculty member. Early in the course a learning environment must be developed which fosters both comprehension of and competence in the basic concepts subsequently used throughout the remainder of the semester.

One essential element in helping students learn the basic concepts of Engineering Economics focuses on “relevance”. When students deem course material “relevant” they inherently become more receptive and interested in the subject material. Relevance implies a connection to one’s personal life with the material having some definite personal value and impact on them as seen from their perspective. Once established, “relevance” leads naturally to motivation which represents the internal manifestation of a deep personal interest in the subject. One of the best ways to develop relevance and motivation involves presenting students with a series of personal financing “exercises” simulating actual financial situations they will encounter throughout their lives.

This exercise series, called “Life Long Learning Experiences”, administered during the first month of class establishes the relevance noted above. The “Life Long Learning Experiences” series focuses specifically on a multitude of subjects such as purchasing automobiles, mutual fund analysis, retirement planning strategies and establishing personal financial goals to meet specific objectives. Each of these subjects are of inherent interest to the students who will eventually encounter them in their lifetime.

This paper will examine and present the “Life Long Learning Experiences” series. It will explain how the series establishes relevance thereby increasing the student’s awareness and understanding of the basic concepts of engineering economics. The series illustrates personal financial decisions each individual must make and how the use of the basic concepts of Engineering Economics will help them to make these decisions as judicious as possible.

I. Introduction

Two things about learning and teaching have emerged recently that should impact the way all teachers approach their jobs. First, is the notion that the role of the classroom instructor is not one of teacher, rather it is one of facilitator of the learning process. Second are the results of research indicating learning is accelerated and more effective when instruction is interactive, paced correctly.
and has contextual meaning to the learner. This paper describes an instructional perspective that can be used in engineering economy classes to provide a basis of the facilitation of learning within meaningful contexts. An old idiom relates that: “You can lead a horse to water but you can’t make it drink.” This is analogous to the instructor saying: “I can present the material to the students but I can’t make them learn.” Using ideas presented in this paper the instructor is encouraged to evaluate their role in the learning process. Their attitude should become one of “I am going to make the horses so thirsty while I lead them to water that they will be very excited and delighted when they see it”. By illustrating the mechanics of engineering economic analysis in a learning context important to them, students become more interested in the subject. Students also realize they are a responsible party in the learning process — both during their time in school and then after graduation as a lifelong learner.

II. Concept Development

The concept development began by trying to establish a “link” or “connection” with the students and the things of interest to them. Over the years candid conversation with students revealed their desire to use the course material to their personal benefit. They knew life would require them to make numerous important decisions with deep economic implications and ramifications. They wanted to be prepared to address and solve these situations using the engineering problem solving methodology learned in their technical undergraduate education. Once they learned the elementary concepts the students began using them to address problems of a personal nature. Many times the instructors were approach by an inquisitive student attempting to apply the basic concepts to their personal situation. Over several years it became apparent students had similar types of personal financial concerns. They had much in common with each other and the process began to specifically define the “common thread” of interest in the students. In general the students’ concern involved the broad category of “personal finances”. Within this domain both short and long range finances were expressed in one form or another. Table 1 represents the breakdown of personal financing in terms of short, intermediate and long range planning.

<table>
<thead>
<tr>
<th>TIME RANGE</th>
<th>AREAS OF INTEREST</th>
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<tbody>
<tr>
<td>SHORT</td>
<td>Initial automobile purchases, saving for down payments on a house</td>
</tr>
<tr>
<td>INTERMEDIATE</td>
<td>Vacations, replacements of vehicles, appliances</td>
</tr>
<tr>
<td>LONG</td>
<td>Children’s education, Retirement, long term health care</td>
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It became obvious to the instructors the students were interested in “financial planning”. With this in mind the instructors began to contemplate the development of a personal financial planning model to establish “relevance” of the material to the student’s interest. Thinking about how the introductory material in the Engineering Economics course could be presented to complement the
student’s desires subsequently led to the development of the “Life Long Learning Experiences” series. The problems and projects selected for the series incorporated learning how to use the engineering economics factors along with some preliminary methods for comparing options or alternatives.

The problems focused on real life situations covering major purchases, educational options, retirement planning, asset allocation and establishing sinking funds to accomplish specific goals.

III. Concept Implementation

During the first class of the term students are asked to state their expectations for the class. Students, who are not often asked for their opinion in the classroom, are not sure what to expect from this question. This leaves the instructor open to facilitate answers to this question and set the stage for discussions on “learning” and “life long learning”. It allows the instructor to open up the possibility to students that they are responsible for getting everything they can out of this class and all learning experiences. It also allows the instructor the opportunity to tempt student interest in engineering economy by indicating that the concepts they learn in this course can mean the difference between success and failure in the decisions they make in both their engineering and personal lives.

When describing the course title, “Engineering Economics” the instructor may add a context perspective by discussing the “engineering” term and how it relates to the course and career. After this, the word “economics” is discussed again in terms of career, life and course. At this point the instructor leads the discussion on the first part of the course towards the personal implications of “economics” relating it completely to the students themselves and the numerous economic decisions they will be faced with in the near and far future in their lives. This begins the process of “context” or “relevance” which strikes the student’s “deep personal interest” chord. This is where the “horses begin to get thirsty.”

The primary purpose of the first two or three weeks of class can center on students developing a thorough understanding of the concept and application of “time value of money” and “equivalence”. This familiarity comes as the student masters the concepts of discounted cash flow analysis. At the end of the second week the students are ready for some “context” or “application” type of problems. At this point the “Life Long Learning Experiences” series is introduced. Although the student’s retirement was discussed earlier in the semester, they proposed no specific method or plan for saving for their eventual retirement. 401k retirement plans are generally known but not completely understood by the students who are very interested about this reality in their lives. Making the “horses thirsty” at this point continues based on a retirement scenario.

The following illustrates the first “Life Long Learning Experience” series exercise. It provides the details on how it is implemented. The exercise entitled “Investment Strategy” requires the students read two articles related to the subject. The first article, “Allocating Your Assets” provides information on investment strategies in terms of fund distribution for different categories of investment and risk involved when investing in a 401k plan.
The second article, “Automatic Investing” \(^3\) introduces the thought of putting money away on regular (monthly) basis while emphasizing the need for young professionals to start saving early in their career. The students verify the results presented in the article, namely, investing in the first few years of their working lives pays off substantially more than delaying to start saving for retirement until middle age. Student’s rationale for starting to save later in life usually favors the delay because of other perceived pressing needs of a young college graduate. These include but are not limited to: paying off college loans, purchasing an automobile, contemplating marriage, and saving for a down payment on a house. Using the basic factors taught in the first few classes on present, future, and uniform series amounts serves as the basis to perform this simple but eye opening analysis! Immediately students begin to see and sense the relevance of the material taught during the initial classes. One or two page formal reports are required on the assignment with a section for personal reflection on the results. These reports emphasize the student’s need to present their analysis, thoughts and findings in the context of a brief written report.

As pointed out by students providing critiques of the course, they never thought of this (prudence of investing early) before and are appreciative of the insights offered through this exercise. Similar remarks are received for each assignment in the “Life Long Learning Experience” series. Twice each week students are given a problem in the series and a report is due one week after the assignment is made. Table 2 outlines the topics and learning objectives of the current exercises in the series.

It is the intent of the authors to continue to add to the list of “Life Long Learning Experience” assignments to be shared with the entire engineering economy community (perhaps via the division’s internet home page). Many faculty over the years have no doubt developed similar exercises for use in their classes, and we would like to ask all of you to consider contributing these for the general use of the profession. The authors would be happy to serve as the managers of this resource and gratefully accept your ideas in any format. All such contributions will be added to the “Life Long Learning Experiences” data base which will offer all faculty members (especially those who never taught this course before) an excellent resource to make their “horses thirsty” during that critical initial first few weeks of the course.

IV. Conclusions

The “Life Long Learning Exercise” series was initially developed to heighten the student’s awareness of the relevance of the course material to their life. It accomplishes this through a series of practical exercises based upon “real life” scenarios. The positive effects of contextual experience with the type of professional problems to be solved has been demonstrated in the problem-solving abilities of professionals. Any sustained instructional efforts must use a wide range of problem contexts and emphasize those most likely to be encountered in day-to-day professional (and private) practice”. \(^4\)

While addressing areas of “deep personal concern” the student’s learning of the basic concepts of “time value of money” and “equivalence” were greatly reinforced as evidenced by the positive student response to the series. The positive response to these exercises makes sense in light of what is known about active and context-motivated learning. The approach used led to instruction that facilitates current learning while fostering the need and desire for a life long learning mentality.
Realizing knowledge acquisition is an important component of the continuum intended to link professional education and practice, student development of effective mechanisms for self-directed, life long learning is key to the cohesiveness of the continuum. The authors attempt to capitalize on this knowledge added greatly to the cohesiveness of the learning experience for the students as evidenced by their evaluation of the “Life Long Learning Experiences” series.

Table 2: Life Long Learning Exercises

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>LEARNING OBJECTIVES</th>
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<tr>
<td>Investment Strategy</td>
<td>Utilize Present, Future and Uniform Series factors to analyze two different saving plans. The first plan focuses on investing early in one’s career while the second delays funding until middle age.</td>
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<tr>
<td>Leasing Versus Buying</td>
<td>Provide a comparative analysis of two different “owning” options for an automobile while employing the basic concepts of Engineering Economics.</td>
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<tr>
<td>Social Security Retirement Analysis</td>
<td>Analyze various Social Security benefit options based on different retirement ages (62,66,70). Determine which age is the most economical prudent one to retire for a particular set of circumstances.</td>
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<tr>
<td>Asset Allocation</td>
<td>Analyze the future results of allocating “X”, “Y” and “Z” dollars into “High”, “Medium” and “Low” risk factor accounts. Determine the “risk tolerance factor” as a function of the investor’s age. Take into account reallocation as the investor gets older and approaches retirement.</td>
</tr>
<tr>
<td>5th year or Master’s Degree</td>
<td>Analyze the effects of taking five years to complete the undergraduate curriculum versus four (or staying in school for additional years to obtain advanced degree). Students estimate market and salary timing as well as cash and opportunity costs. Promotion/advancement potential included. Must analyze in the context of sensitivity to estimates.</td>
</tr>
<tr>
<td>Home Ownership vs. Renting</td>
<td>Introduce students to all of the concepts in the purchase and maintenance of home ownership. Including concepts of mortgages &amp; PITI, closing costs and interest points, interest deductions on taxes, equity and loans, refinancing, taxes on gains and other concepts. From an economic perspective cost of ownership are compared against the renting option.</td>
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Bibliography

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