

Using Cases to Teach Accounting Concepts for Engineering Managers

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Abstract

Basic financial accounting literacy is becoming essential in the professional life of engineers and engineering managers. Finding a way to include it in a meaningful way is a challenge in most curricula. Most texts in engineering economics offer little coverage. What is offered tends to focus on the mechanics of accounting transactions and financial ratio computations. Conceptual foundations are mostly omitted. As a richer alternative, accounting courses themselves usually consume a whole semester and spend a great deal of the course time and effort on fine points potentially of interest to budding accountants. A middle ground that emphasizes essential concepts and their logical underpinnings is needed. These concepts include accrual accounting, cash flow, value, capitalizing and expensing costs among others. A thorough list is developed in a prior ASEE paper, Graduate Engineering Economics for Engineering Managers¹

That paper provides a list of topics that should be included and makes suggestions for embedding them in a graduate course. The purpose of this paper is to develop specific learning objectives and describe a set of teaching materials and cases which have been successfully used to accomplish them. The presentation will emphasize the use of these cases and provide guidance in maximizing their learning effectiveness for an engineering management audience.

Introduction

Teaching financial accounting to engineering managers is a contentious proposition. Those who argue for this content view the material as important and essential in providing a business perspective for engineering students. Those who argue against including accounting courses in the curriculum usually are reluctant to sacrifice the space in the curriculum because of the rapid expansion of technical material in the engineering disciplines. Both arguments have merits and some compromise is needed. Certainly it is difficult to justify the usual two-course sequence of financial and managerial accounting usually required in the business school curricula. Even the single combined course offered in some business schools seems too a large price to pay according to many engineering faculty. Since the students usually find the accounting material uninteresting and in their view, unimportant, they tend to side with the latter faculty group creating even more impetus for the technology driven argument to avoid the topic altogether.

Of course, this is a narrow argument, which, if followed, graduates engineering students bereft of any financial literacy and unable to understand the accounting scorecard in their eventual work organizations. One possible solution is to identify the most critical learning objectives and deliver them as a portion of a business-flavored course in engineering. One such opportunity lies in the engineering economics course. The purpose of this paper is to suggest an approach to an instructional module in accounting that meets critical knowledge needs, generates engineering

student interest and motivation, and fits within a reasonable time frame. This paper focuses upon financial accounting as the approach for a three-session course in managerial accounting is described in the SE ASEE proceedings

Identifying Critical Knowledge

Obviously, there may also be legitimate differences of opinion regarding the set of topics that should constitute the essentials that engineers and their managers should possess. Resolving those differences would be no small task and more importantly there is not necessarily a single solution appropriate for all circumstances. However, it is certainly viable to build a reasonable set of topics based upon a reasonable process and subsequently develop the learning objectives and explore teaching materials for that solution. That approach will be used in this paper.

A model developed and used by the author and colleagues in course development is based upon the work of Mager² regarding learning objectives. The extension to Mager's work involves a Levels of Learning model that sorts learning objectives into three categories: Awareness, Understanding, Capability. These categories are meaningful if they are referenced to a specific performance objective. In this case the performance objective is ability to use accounting information in making decisions that affect the financial condition of the firm. This includes reading and interpreting financial reports, understanding the accounting framework for accrual accounting, and knowing the standards and conventions underlying the development of accounting reports.

The Capability level is the most exacting of the three levels. However, we are not concerned with the capability to generate accounting information per se. The learning objectives addressed here are targeted to the ability to read and interpret accounting information for basic and straightforward circumstances. Because business school accounting classes are targeted to the Capability Level for the generation of financial statements, the class time for attainment of their learning objectives is much longer than necessary for engineers. Engineers, however, can achieve the performance level by focusing on the second level, Understanding. This does not obviate their need to work through semi-realistic situations and generate basic financial reports as a way of developing and confirming their understanding of the accounting concepts that they must learn. It does however eliminate the need for extensive drills that really are teaching bookkeeping rather than accounting concepts. That difference in focus provides the avenue for developing a set of specific learning objectives that can be met in a fraction of a semester.

Attaining the Accounting Understanding

One benchmark for the attainment of financial literacy is the popular monograph produced by Merrill Lynch, How to Read A Financial Report³. It is available free of charge from Merrill Lynch. Its intent, of course, is to educate potential customers of the investment service and it assumes no prior background in accounting. Its glossary of terms provides a useful guide for the breadth of education required for financial literacy. The depth of the required understanding must go beyond glossary definitions. If engineers are to communicate with managers in their company, it is essential that they understand the logic and structure of the accrual accounting process that

generates the reported numbers. Accounting is not covered in the brochure.

An alternative learning aid is the note, Primary Financial Statements⁴, available from Harvard Business School Publishing. It explains the basic income and Financial Statements and includes a six-page appendix that carefully explains accounting transactions, closing the books, and statement construction. The first 20 pages explain the accounting concepts and the rationale for the various categories of accounts. Although well written, it requires patience for engineers as it is predictably dry and matter of fact in its exposition. The most natural follow up piece, Assessing a Company's Future Financial Health⁵ is more interesting for the students. It is presented in programmed learning context, making it a good exercise for out-of-class preparation. It also includes a short case, The Case of the Unidentified Industries, which requires students to match companies (automotive, electric utility, grocery chain, aerospace, and importer) to five sets of financial statistics. This helps drive home the notion that there are no absolutes, each company's ratios must fit the characteristics of their business and must be compared with like companies.

An alternative to these materials is a financial accounting tutorial developed for engineering students at Stevens Institute in New Jersey. It includes seven sessions which cover the gamut of accounting basics and logic through financial statement analysis and comparative ratios. It should generate learning interest as it is interactive but it focuses upon "how to do it", with little emphasis on "why we do it".

A more satisfying way to communicate accounting concepts and why they are important can be developed through the Chemlite case⁶. There, students observe the first and second board meetings of an entrepreneurial start-up, Chemlite. They observe the first period's results and must resolve a dispute among board members regarding the first period's profit (or lack thereof). They are led to understand the need for accrual accounting, and the difference between capitalizing and expensing an outlay of cash.

Armed with this newly found knowledge of accounting based upon common sense and a set of standard conventions and accounting principles, they take on the task of reconciling the financial scorecard for the second accounting period. In so doing they are shown quite vividly, the difference between cash accounting and accrual accounting and are led to the need for statements of cash flow as the third major accounting report.

Reinforcement of the seemingly mysterious cash flow statement is necessary. Some potentially useful materials include:

- Understanding the statement of Cash Flows⁷
- Statement of Cash Flows: Three Examples⁸
- Solving the Puzzle of Cash Flow Statements⁹

Using the Materials

After experimenting with these materials and others, the following is the recommended sequence of materials

Session	Class Activities	Learning Objectives	Prior Student Preparation
1	Read Chemlite First six months Discuss Alternative Solutions Walk through Climax example in Primary Financial Statements	Understand why accrual accounting is necessary. Learn concepts of capitalization, motivation for accounting principles, balance sheet identity,	None
2	Discuss alternative solutions to second half of Chemlite	Reinforcement of accounting concepts. Practice accounting transactions	Read Primary Financial Statements Read and prepare second six months of Chemlite
3	Review solutions for financial health. Discuss Unidentified Industries	See the mechanics of the ratios. Understand the logic for each and the rationale for the numerator and denominator. Understand how companies differ	Prepare <u>Assessing a Company's Future Financial Health</u> Prepare <u>The Case of the Unidentified Industries</u>
4	Discuss the Three Examples Rank the companies by their viability Learn the identity of each company	Learn how isolation of cash flows from operations, financing, & investments reveal strengths and limitations not shown on the balance sheet	<u>Read Solving the Puzzle of Cash Flow Statements</u> Prepare <u>Statement of Cash Flows: Three Examples</u>
5	Summarize accounting concepts. Solicit questions on glossary items Provide additional illustrations for example: Constructing a personal balance sheet, understanding workflow and inventory accounting, working capital Discuss behavioral implications of financial accounting measures	Finally understand the difference between cash and equity, Motivate students with personal examples e.g. ROE for a mortgaged house sold at a profit. Illustrate financial leverage.	Review module. Self test understanding of glossary terms from <u>How to Read A Financial Report</u>

As may be obvious from the sequence of events these are highly interactive sessions where

students must prepare ahead of class and learn much of the major lessons by discovery. If this seems heartless, consider the alternative of lecturing this deadly, dull material. For example, the Chemalite case should be taught before any coverage of bookkeeping, debits, credit, T-accounts, etc. This will allow the class to focus on the important concepts before attempting to cope with an unfamiliar structure. Then, it helps to review the mechanics using the appendix in Primary Financial Statements. By focusing on the objective of de-mystifying accounting, student confidence can be

There are other cases that can be used to solidify comprehension of these concepts that may be used if time is available. For example, Marion Boats [9-196-041] provides more practice in accounting transactions, their valuation, and their impact on financial statements. Students can be challenged to evaluate an annual report. With proper motivation graduate students in engineering management can master this material with a degree of confidence that will enhance their ability to contribute to the solution of problems and the development of opportunities in their companies.

Bibliography

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- 6 Chemalite, Inc. Harvard Business School Publishing, 9-177-078
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- 8 Statement of Cash Flows: Three Examples, Harvard Business School Publishing, 9-193-103
- 9 Solving the Puzzle of Cash Flow Statements, Harvard Business School Publishing,BH 013

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