Developments in Business Simulation and Experiential Learning, Volume 29, 2002

USE OF COMPUTER MODELING IN MANAGEMENT ACCOUNTING

Lamberton, Barbara
University of Hartford
lambertonb@aol.com

ABSTRACT

This primary purpose of this paper is to discuss a cognitive computational model that describes the knowledge and actions involved in the design and use of product costing information. The model building process resulted in the development of teaching materials that reflect realistic industry cost behavior patterns and include tasks with objective performance criteria.

INTRODUCTION

In this study, cognitive computational modeling provides a mechanism for exploring the knowledge and actions involved in selection and use of product costing information in an industry-specific setting. According to Bradley & Murtuza (1988), industry specific insights can help bring "theoretical and sometimes mundane topics to life" in a management accounting class. In its present state, the model is a computational model as described by Ilgen & Hulin (2000). As such, the study involves the use of computer programs to model knowledge, in exact terms, as a *preliminary step* toward development of testable hypotheses about knowledge effects and development of computer games. A number of researchers (Peters, 1990; Biggs, 1991; Peters, 1991; Wright & Willingham, 1997) have highlighted the advantages of computer modeling as an integral part of the research process. In this initial phase, modeling is intended to clarify the different types of knowledge that need to be mastered by the accounting graduate. The model also allows students to see the implications of making poor decisions in terms of product costing information.

BACKGROUND

Prior researchers (Johnson & Kaplan, 1986; Hosseini et al., 1999) have argued that traditional product costing systems fail to provide timely and relevant information for many internal management decisions. In a traditional product costing system, diverse costs such as direct material, direct labor, and manufacturing overhead are assumed to be causally related to one factor, the volume of product being produced in a given time period. Previous modeling research (Gold & Pray, 1989, Gold 1990, Goosen, 1991) indicates that cost behavior is more complex. In addition, empirical research (Cooper & Kaplan, 1988) suggests that in many industries, costs and business processes are affected by multiple factors. Activity based costing (Cooper, 1990; Brimson, 1991) has been proposed as the solution. Unlike traditional accounting systems, Activity based costing (ABC) systems track more information about the factors that cause changes in manufacturing cost. Factors, such as labor hours, machine hours, number of machine setups, are called cost drivers since they are thought to drive or cause changes in cost.

Anecdotal evidence and prior research (Bradley, 1996) suggests that understanding product costing is a critical competency employers expect from accounting graduates. With the adoption of ABC many employers' expectations about product costing knowledge increased. In particular, employers have begun to expect accounting graduates to recognize the causal relationship between a particular manufacturing cost and the factors (cost drivers) that cause the cost to change.

In teaching ABC, a key learning objective involves defining the cost hierarchy and applying it correctly to the design of a product costing system. The cost hierarchy (Zimmerman, 2000) classifies activities into mutually exclusive categories and uses these categories to simplify cost driver selection. When used properly, the ABC cost hierarchy allows the decision-maker to easily select cost drivers through a simplistic heuristic based on reviewing superficial characteristics of the product, business process or activity. Certain activities, such as assembly or fabrication, tend to be strongly correlated with unit volume regardless of the particular industry. These types of activities are called unit-level activities since they are performed each time a unit of product is produced. According to the cost hierarchy, a unit-level cost driver such as production volume, machine hours or direct labor hours should be used for allocating the costs of unit-level activities. Batch-level and product-level are two other categories of activities according to the heuristic. Batch-level activities, such as machine setup, use resources each time a batch of work is performed. For example, the typical text problem suggests that number of machine setups should be used to allocate the costs of setting up the production equipment. Similarly, product-level activities tend to vary with characteristics of the product that cause changes in cost.

When the material is presented in textbooks, authors usually emphasize that the cost hierarchy heuristic implies that there is a strong correlation between cost drivers and the activities they track. Most of the related exercises, however, drill students in applying the heuristic rather than focusing on situations in which it should not be used. As a consequence, students do not always internalize the importance of the correlation between activity and cost. To counteract the tendency for students to ignore the importance of correlation, lessons on ABC need to incorporate concrete examples of situations in which the hierarchy works and situations in which it provides an incorrect solution. Students also need to be given a perspective on the magnitude and consequences of making hasty, incorrect decisions in cost driver selection based on the cost hierarchy.

AN OVERVIEW OF THE MODEL

Given changes in product mix for a package printing business, the model selects an accurate cost function and the least costly, most accurate product costing system. Package printing was chosen due to its inherent complexity and the availability of an industry consultant, an accounting expert and nine individuals with experience in printing. In addition, the author had previous experience as a controller of a package printing plant. The model was built with the input from an industry consultant and an accounting expert and validated through the efforts of the nine experienced individuals.

The model describes product mix change in the context of acquisition of another, virtually identical plant. To evaluate product mix diversity, the model compares key characteristics of the typical order for the newly acquired plant to the same features for the old plant. The change in product mix diversity is defined in terms of two factors, the number of colors printed and the number of setups per order. In terms of cost driver selection, the model uses product mix and tracking cost as cost-benefit criterion. As a consequence, there is only one correct set of cost drivers and one accurate cost computation for each case being evaluated. Users can input product mix characteristics, such as number of colors printed and number of setups and see how it affects the cost function and product costing system accuracy. In package printing, the machine setup activity is not always strongly correlated with the number of machine setups. Depending on the characteristics of the order, the model demonstrates when use of setups is acceptable and when it results in highly distorted costs.

LIMITATIONS

One potential limitation of this work relates to the scope of the study. The model was limited to one major industry with product mix defined in terms of only two factors. As a consequence, the results may be less applicable to other tasks and other institutional settings. The materials, however, appear to reasonably reflect the cost patterns of the institutional setting chosen for this study. Perhaps most importantly, the controller and experienced participants agreed with the recommendations made by the model. In the debriefing session, all nine participants indicated that the materials appeared realistic given their personal experiences.

One additional limitation relates to the small number of experienced participants involved in validation and the homogeneity of their backgrounds. Each of the experienced participants had adequate levels of several types of knowledge making it impossible to isolate one type of knowledge (Industry, ABC, accounting) as the sole determinant of skilled performance. However, the primary purpose of testing the model with experienced individuals was to validate the solutions generated by the model. The intent was to use the validated model as the first step toward development of teaching materials with objective performance criteria and realistic cost behavior patterns for future research, classroom exercises and development of a computer game.

CONCLUSIONS

By use of computer programs, this paper provides preliminary evidence of the intricacy of the relationship between knowledge and performance in an industry-specific setting. In particular, the model suggests a relationship between product mix, knowledge and skilled performance. By describing the elements of knowledge required for skilled performance, the model can be used to develop teaching exercises and specific hypotheses about the effects of knowledge and other factors on cost driver selection and use.

REFERENCES

Biggs, S. (1991) "Cognitive modeling of Expert Judgment in Accounting: Strengths and Limitations." *Decision Making, Cognitive Science & Accounting Conference Proceedings*.

Bradley, Michael & A. Murtuza. (1988) "Providing an experiential dimension to cost/managerial accounting courses." *Developments in Business Simulation & Experiential Exercises*, Volume 15, 1988. p. 28-31.

Bradley, Michael. (1996) " The Relational Database as a link between operations and cost accounting:" Developments in Business Simulation & Experiential Exercises, Volume 23, 88-89.

Brimson, J. (1991) *Activity Accounting*. New York, John Wiley & Sons.

Cooper, Robin and R. Kaplan. (1988) "Measure costs Right: Make the Right Decisions." *Harvard Business Review*, (September-October, 1988) 97-98.

Cooper, Robin. (1990) "Cost Classifications in Unit-based and Activity-Based Manufacturing Cost Systems." *Journal of Cost Management*. (Fall 1990), 4-14.

Gold, Steven. & Thomas Pray, (1989) "The Production Frontier in Computerized Business Simulations." Developments in Business Simulation & Experiential Exercises, Volume 16, 24-30.

Gold, Steven. (1990) "Modeling Cost Functions in Computerized Business Simulations: An Application of Duality Theory and Sheppard's Lemma." Developments in Business Simulation & Experiential Exercises, Volume 17, 70-72.

Goosen, Kenneth. (1991) "Increasing Simulation Realism through Modeling of Step Costs Cost Behavior in Business Simulations. " Developments in Business Simulation & Experiential Exercises, Volume 18, 38-43.

Ilgen, Daniel and C. Hulin. (2000) *Computational Modeling of Behavior in Organizations: The Third Scientific Discipline*. Washington, DC: American Psychological Association.

Hosseini, A, Brad Foldger, B. Lamberton. 1999. " A survey of Financial Managers Perceptions of Activity-Based Costing. International Review of Accounting. October 1999.

Johnson, T & R. Kaplan. 1986. *Relevance Lost: The Rise and Fall of Management Accounting*. Harvard Business School Press.

Peters, J. M. (1990) "A cognitive computational model of risk hypothesis generation." *Journal of Accounting Research*. (Supplement): 83-103.

Peters, J. M. (1991) "Cognitive sciences and accounting: An overview of the intersection." *Decision Making, Cognitive Science and Accounting Conference Proceedings.*

Wright, W. and John J. Willingham. (1997) "A computational model of load loss Judgments." *Auditing A Journal of Practice & Theory*. Volume 16: 99-113.

Zimmerman, J.(2000) *Accounting for Decision Making & Control*. Third Edition. McGraw-Hill.