AN EMPIRICAL STUDY OF ALTERNATIVE MICROCOMPUTER-BASED DESIGN APPROACH TO MANAGEMENT SCIENCE INSTRUCTIONAL SOFTWARE: IMPLICATIONS FOR MANAGING THE TYPE IV IMPLEMENTATION PROBLEM

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Two microcomputer-based approaches to management science (MS) software design — the basic input/output design and the integrated software design — are discussed and compared. The details of an empirical study of the two approaches are described, and data are presented on student preferences for the two design approaches. The data indicate that students prefer the integrated software design for learning purposes on a number of relevant criteria, including as being easier and more fun to use, and as an aid to understanding textbook material, especially the details/steps of the model solution process. These results suggest that the integrated software design may be instrumental in managing the Type IV implementation problem (the error of developing a model that solves the right problem but is not used) by using microcomputers to improve organizational communication between managers and management scientists.

The Type IV Error Problem

Schultz & Slevin (1975) defined a Type IV error as the error of developing a model that solves the right problem but is not used. Such a model is said to be technically valid but organizationally invalid. The rationale for identifying the Type IV error has a distinguished history in the literature on implementing MS models. Churchman & Schainblatt (1965) viewed the context for committing the Type IV error as an organizational dialectic wherein the management scientist sought to have his/her models embraced by managers who weren’t buying the somewhat threatening product. “Mutual understanding” was seen as the key to correcting the error to the benefit of both parties. Rubinstein, Radnor, Baker, Heiman & McColly (1967) identified “client receptivity” as a factor relevant to accepting and absorbing MS models into organizational decision making. A key element of client receptivity, they observed, was management’s understanding of the
MS discipline. Harvey (1970) argued for an emphasis on developing management’s “sophistication” in using mathematical approaches to problem solving, in particular, an insistence on the use of quantitative criteria in assessing alternative courses of action. Shycon (1972) turned the tables a bit by observing that management would like to understand MS models but that management scientists tended to talk at managers and not do a very effective job of explaining what the MS models were intended to do or how they worked.

The Type IV error is fundamentally a problem of organizational communication. The management scientist blames management for an unwillingness to take the time and trouble to understand the aesthetic and practical qualities of MS models. The manager blames the management scientist for being removed and somewhat incomprehensible. Both individuals have a point. The management scientist has demonstrably superior tools that can be of value to the manager if only the manager would adopt them. On the other hand, the manager is exercising conservative wisdom in not placing trust in something he/she does not fully understand. From an educational point of view, requiring business students to take college courses in MS prior to entering the world of business only alleviates the problem somewhat, since traditionally MS courses are among the most difficult to do well in from the student’s vantage point and among the most creative to conduct and grade from the instructor’s viewpoint.

**Enter the Microcomputer**

Although the large-scale digital computer made it possible to realize what management scientists had only theorized could be done on a practical level, it is partly to blame for the Type IV error occurring in business organizations. Many managers still distrust the computer as an incomprehensible “black box”, especially large mainframe computers that require data processing staff support, and are unwilling to entrust their careers to the workings of a machine they do not understand (Lucas, 1981).

Whereas the large computer is incomprehensible to many managers, the microcomputer has found more acceptance (Brenner & Molloy, 1983; Oliva & Khosrowpour, 1989). It is not only smaller and easier to use than a large computer but it also allows the manager a degree of autonomy which is lacking when he/she is dependent on data processing support staff.

There are a number of programs written for microcomputers which simply mimic MS programs written for larger computers. Although these microcomputer programs have a place in education, they are essentially static, i.e., they allow the input of data which is processed through a model to produce output without revealing how the data is processed. In this sense they make no advance over their large computer counterparts and actually contribute to the perpetuation of the Type IV error, since they do not aid in increasing user understanding of the workings of the model (Szewczak, 1986).

**Using Microcomputers to Teach MS**

The use of microcomputers in classrooms as well as in industry (Hasty, Herbst & Mahmood, 1989) has become significant enough to suggest a statement of guidelines and procedures for selecting MS software. Turban & Erikson (1985) argue that one fundamental criterion for selecting MS software is “ease of use,” and that one major aspect of ease of use is a basic input/output design. If the primary objective of a user is to solve problems, then any input/output design which effectively shelters the user from the details of a software package’s manipulation of input data to produce output information should be evaluated as desirable.

However if a user is a newcomer to MS analyses and/or mistrustful of the outputs of MS analyses because he/she is not familiar with the details of MS model solution processes, then a different form of software design is needed to help such a user to accept MS for use in problem solving.
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