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Experimental Research in Systems Development Methodologies: Opportunities and Challenges

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PANEL 17

EXPERIMENTAL RESEARCH IN SYSTEMS DEVELOPMENT METHODOLOGIES: OPPORTUNITIES AND CHALLENGES

Panel Chair: Jeffrey Parsons, Memorial University of Newfoundland

Panelists: Ritu Agarwal, University of Dayton
Dinesh Batra, Florida International University
Iris Vessey, Pennsylvania State University and University of California, Los Angeles
Yair Wand, University of British Columbia

Many systems analysis and design (SA/D) methods have been proposed over the years, each hailed by proponents as a panacea for improving productivity and quality in the SA/D process and product. There has been significant interest in evaluating such techniques based on their modeling power (e.g., Fowler 1992; Olle, Sol and Tully 1983). However, surprisingly little rigorous experimental research has been conducted to evaluate the available tools and techniques. One possible explanation of the lack of attention by IS researchers to this area is the inherent difficulty in conducting experiments on SA/D methods. The panel will (1) argue for the *importance* of experimental research to evaluate SA/D methods/techniques; (2) examine the *challenges* in conducting experiments in this area; and (3) present *strategies* adopted by each of the panelists in addressing these challenges.

Importance of Experimental Research in Systems Development

New SA/D methods are often surrounded by hype and anecdotal evidence about their value. However, published controlled studies assessing these claims are rare. Such research can aid practitioners in choosing techniques and method/technique/tool builders in constructing them. In addition, recent research has suggested that intrinsic modeling power cannot be the sole basis for evaluating SA/D techniques (Vessey and Galletta 1991). Other considerations, including the nature of the task, as well as the characteristics of the individuals applying them, may influence the choice of a technique. There is, consequently, a need for both practical and methodological guidance as organizations attempt to incorporate new techniques, such as object-oriented methods, into their portfolios.

In this context, experimentation is but one of several empirical research strategies for studying SA/D methods. While experiments relinquish the "realism" of field settings, they allow better control over the many confounding variables which are likely to arise in the field when studying something as complex as a systems development methodology.

Challenges in Doing Experimental Research in Systems Development

The challenges facing researchers interested in studying SA/D techniques in an experimental setting can be classified according to whether they involve the *context* of an experiment or its *execution*.

With respect to context, there are a number of issues. First, how can one choose, among many options, representative methods for comparison? Second, since a methodology generally addresses several aspects of systems development, and since different methods address different components of the development process, what constitutes a valid comparison? Third, since experimenters are often constrained to use students as subjects, the generalizability of the results to practitioners is in question. Fourth, experimental and logistical problems often preclude using very complex tasks which mirror real world systems analysis and design problems. If the experimental design requires the comparison of performance across a

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set of tasks, it is necessary to evaluate the complexity of each task so that the comparison is reasonable. Unfortunately we do not have very good or precise metrics for assessing task complexity.

With respect to the execution of an experiment, other challenges arise. First, how can one prevent the experimental task from biasing the outcome? Second, what are the appropriate dependent variables? Third, which data analysis methods should be used? In conducting experiments, one would generally like to use statistical comparison procedures for assessing the worth of a methodology. However, such procedures may not provide the level of insight offered by process-oriented techniques, such as protocol analysis.

Given the importance of methodologies to systems development and the diversity of approaches, there are many exciting research issues in using experimental techniques to study and evaluate development techniques and tools. The panel will debate the importance of these challenges and offer constructive approaches to solving them.

Position Statements

The panelists have adopted a variety of approaches for addressing the challenges discussed above. Each panelist will discuss how s/he has attempted to design and execute studies with a view to overcoming specific challenges. Jeff Parsons will set the stage for the panelists' positions by outlining the importance of experimental research on systems development and the types of challenges which must be overcome to conduct effective research in this area.

Ritu Agarwal will discuss issues related to the operationalization of experiments; specifically, in the choice of dependent variables and tasks. She will describe how these issues were resolved in the context of on-going research examining traditional process-oriented and object-oriented methods (Agarwal, Sinha and Tanniru 1993).

Dinesh Batra will argue that, since systems development encompasses different phases such as analysis, design, and coding, it would be very difficult to test all phases of systems methodology in a laboratory situation; one needs to consider components that address similar activities. Comparing methodologies as a whole may not provide us with a list of principles to guide systems development since there are too many methodologies and each methodology has a number of distinct phases.

Iris Vessey will propose several principles to guide experimental research: (1) analyze the area under investigation prior to conducting the study to fully determine the crucial issues to examine (Dubin 1979); (2) choose experimental tasks carefully, since one solution is unlikely to be optimal for all types of problems (Vessey 1991); and (3) consider examining problem-solving processes, since process analysis can yield more insights than studies that assess only problem-solving outcomes, particularly in exploratory work.

Yair Wand will argue that, although it is practically impossible in empirical research to achieve the ideal of evaluating a systems development methodology by the quality of the developed information system, it is possible to concentrate on certain aspects of methodologies. Of particular importance is the *modelling power*, or ability of the techniques associated with a methodology to model the application domain. However, to judge the modelling power, one needs a benchmark model. Ontology, the branch of philosophy dealing with models of the world, can provide such a model.

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