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Abstract

Understanding the way students use information technology in an educational setting is described as a critical factor in evaluating the effectiveness of IT use. A theoretical model, derivative of prior research, proposes three educational contexts that must be considered in evaluating performance-based effectiveness. A method of collecting information on student work patterns through unobtrusive means is presented, and a research project using the model and methods is described.

Introduction

Understanding the way information systems (IS) are used has been identified as a "critical issue" for both practitioners and for researchers (Yi and Venkatesh, 1996). In the educational context understanding how our students utilize technology is also a critical issue. Obtaining a working knowledge of the ways in which students interact with technology and acquire (or fail to acquire) end-user skills has long been the grail of IS education. What follows is a report of an on-going research on how students work, the antecedents of particular work patterns, and the outcomes associated with those patterns.

Relevant Literature

Leidner and Jarvenpaa (1995) make a strong case for IS educators to closely examine the pedagogical assumptions surrounding the use of information technology (IT) in the educational process. They argue that this examination is a necessary first-step in the use of IT to improve the learning process. They call for future research that identifies the appropriate model for a given educational context and evaluates the effectiveness of information technology within a specific pedagogical model. The focus of this paper is on the latter. By appropriately contextualizing the educational process this work proposes a model of IT effectiveness based on performance outcomes.

To evaluate the educational effectiveness of IT it is important to contextualize the learning process. Within any educational process there are at least three contexts that must be considered. The first context concerns the interaction between the participants, including student-instructor, student-student and participant-environment interactions. I will refer to this context as classroom influences, though an actual physical classroom is not necessary. The second context that must be considered is the set of individual traits that the student brings to the learning process. With regard to IT effectiveness, prior research has revealed a set of relevant attitudes that must be considered. Included in these attitudes are perceived usefulness, perceived ease of use (Davis 1989; Davis et al. 1992), and computer anxiety .

It has also been noted that demographic characteristics such as gender (Dambrot et al., 1988; Shashaani, 1994), age (Harrison and Ranier, 1992) as well as previous computer experience (Marcoulides, 1988; Levin and Gordon, 1989; Howard and Mendelow, 1991; Harrison and Ranier, 1992) should also be included among the individual traits relevant to the educational process.

The third context that must be considered in the educational process is related to student behavior. The behavior that this paper focuses on is work patterns. The work patterns examined in this study include eagerness to begin work, effort exerted, and persistence.

The reader may notice a similarity between these contexts and the "environment-person-behavior" triad found in Bandura's social cognitive theory. While the components are similar, Bandura assumes a reciprocality between components that is not adopted in the proposed model. With a focus on attained performance, many of the "return paths" can be assumed to be of little consequence (*i.e.* the effect of personal traits on classroom influences is not as important *vis vis* performance as is its effect on student work patterns). The model adopted in this analysis assumes that individual traits serve to moderate classroom influences and that both work primarily through the behavioral link of work patterns to affect performance outcomes. This model is shown graphically in figure 1. There is strong evidence of interaction effects within the individual traits context, (especially with regard to gender, previous experience, and computer attitudes. See Shashaani, 1994; Taylor and Mounfield, 1994; and Busch, 1995). These interaction effects, while not shown in figure 1, are included in the model estimations.

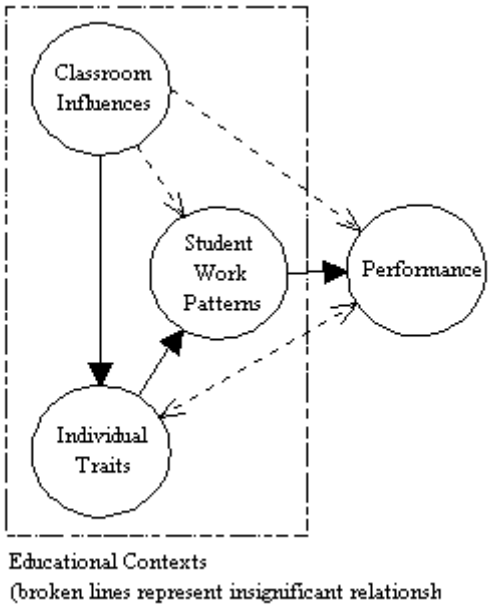

Figure 1

Methodological Considerations

To state that one must understand how students work in order to evaluate the effectiveness of IT in the learning process verges on truism. Unfortunately, much of the research in this area fails to take this contextualization seriously. This deficiency becomes clear when considering the design and scope of these evaluative studies.

While the experimental design has no peer with regard to the level of researcher control and protection from confounded results, these gifts come at a great cost. This cost is an inability to generalize to the pedagogical environment that most interests educators. For meaningful generalization it is necessary to study actual educational processes and events. A theme developing in the business education literature is that we must turn our analytical tools inward and use those tools to reengineer, not simply renovate, an educational process that is more a product of the nineteenth- than the twentieth-century (Alavi et al., 1995).

Another important design issue has to do with the reliance on self-reported data. While that is an appropriate approach for measuring attitudes, it has a notorious history of failure in measuring actual behavior (Judd et al., 1991). Furthermore, the problems of self-reported data are exacerbated in the educational setting where respondents may be sensitive to researcher expectations about performance.

Finally with regard to scope, it is important to note that studies using real educational processes often suffer from small sample sizes. This is problematic for two reasons: First, the results from small sample studies are easily influenced by random variation. The results from large samples are less likely to improperly reject a null hypotheses (Baroudi and Orlikowski, 1989). Second, because the research has traded the control of experimental design for the generalizability of observational data it is mandatory that as many confounding factors as possible be controlled in the estimation of empirical models. This necessarily involves the estimation of many variables and requires increased degrees of freedom, available only with increased sample size.

Developing Unobtrusive Measures

The importance of unobtrusive measures has long been known to social scientists (Webb et al., 1966). With the advent of object oriented technology and the integration of this technology into important tools like spreadsheets and databases, we are now able to easily design and incorporate unobtrusive measures of student work patterns into existing educational exercises. Even-driven code makes it easy to measure the "when" and "how long" facets of student work, and with a meager amount of additional work one can also access the "correctness" of the student work. This allows for the unobtrusive measure of student work characteristics like procrastination, persistence, efficiency and effectiveness.

Research Design

For the methodological reasons listed above, the most appropriate research design would be a large sample analysis of observational data, where self reported data could either be verified or replaced.

This study is based on the responses and work patterns of 627 students in an introductory business computing course at a large Midwestern university. Students were asked to complete an extensive user profile survey at the beginning and end of the course, which incorporated validated measures of user attitudes as well as relevant background characteristics. The unobtrusive measurement techniques described above were used to record student work patterns for four assignments. The students had complete control over the length and persistence of these work sessions. Nearly 27,000 sessions were recorded. A record of start and finish times and score was recorded for each session. Measures of procrastination, effort, persistence, and effectiveness were estimated from this data. Performance was measured using the standardized test scores on a two hour practical examination. Component scores were calculated to allow for specific matching of a work session with the relevant testing component. With work session scores including, the sample produced nearly 83,000 component scores.

The theoretical model described above is currently being tested using a variety of multivariate techniques that offer as much statistical control as possible.

Discussion

The theoretical model developed in this paper is clearly derivative of preceding work. It represents a modest suggestion for advancing our understanding of the relevant variables affecting student performance in IS courses. The data collection, especially the unobtrusive measures of student work patterns, and the analysis that this facilitates, represent a significant improvement in evaluating the effectiveness of IT within a given pedagogical model.

This research represents one attempt to focus the analytical tools of IS research on the educational process. By analyzing student work patterns recorded in an unobtrusive manner, this research promises rich insight into the ways students work, interact with IT, and acquire (or not) important end-user skills. The hope is that this insight will be used to inform changes in IT instruction, teacher training, and student evaluation.

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