Collaborative Technology in the Classroom: A Research Framework

Craig Tyran
University of Colorado

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Craig K. Tyran  
Department of Information Management  
College of Business  
200 Bexell Hall  
Oregon State University  
Corvallis, OR 97331-2603  
tyran@bus.orst.edu

Morgan Shepherd  
Department of Information Systems  
College of Business  
239 Dwire Hall  
University of Colorado, Colorado Springs  
Colorado Springs, CO 80933  
mshepher@mail.uccs.edu

1. Abstract

Over the past several years, a number of research studies have investigated the application of group support system (GSS) technology to the classroom. The purpose of this paper is to present a framework to guide future studies. A framework is introduced that identifies the contextual, group process, and outcome factors that researchers may wish to consider when designing and interpreting future research studies involving the application of collaborative technology to learning.

2. Introduction

Group-oriented learning approaches such as study groups, classroom discussion, project teams, and cooperative learning methods have been used successfully for learners ranging from elementary grades to the university level (e.g., Slaven, 1995). One promising type of technology support for group-oriented learning that has emerged from the information systems field is group support system (GSS) technology. GSS may be used in a classroom setting to provide a “same time, same place” form of group support system (GSS) technology that promotes classroom communication and discussion through the use of networked computers and software tools designed to support and structure group communication activities (e.g., brainstorming, voting). In the past few years, several studies investigating the use of GSS in the classroom have been published, creating an emerging body of research within the information systems discipline (Tyran and Shepherd, 1999). The purpose of this manuscript is to introduce a framework to identify variables that researchers may wish to consider when designing future research projects involving the application of GSS technology in the classroom.

3. A Framework: GSS and learning research

A framework for GSS and learning research is illustrated in Figure 1. Much of this framework is derived from Pinsoneault and Kraemer’s (1990) framework for GSS research, which was based on a systematic review of research in organization behavior and group psychology. By drawing on findings from the research on group-oriented learning methods and GSS-supported learning, the original GSS framework has been modified to incorporate factors relevant to the study of the effects of GSS on learning. As indicated in Figure 1, the theoretical framework includes factors relating to the context of the group learning situation, the group learning process, and the outcomes of the learning process. The theory underlying the framework is that the contextual factors influence the group learning process factors, which in turn influence learning-related outcomes. The framework serves to identify the types of factors that researchers may wish to consider when designing and interpreting future research studies. An overview of the framework is described below.

Contextual factors. The contextual factors describe the elements present in the classroom and learning environment. Five categories of contextual factors associated with group characteristics and GSS support were identified in the Pinsoneault and Kraemer framework: personal factors concerning the students (e.g., attitudes and abilities), situational factors concerning the learning group (e.g., stage in group development), group structure (e.g., group size, cohesiveness), task characteristics (e.g., nature of task, complexity), and technological support (e.g., anonymity, the role of the facilitator, the user interface). Additionally, we add a sixth factor to describe the characteristics of the group learning approach used by the instructor. One of the primary ways in which the approaches differ is with regard to the rules of interaction (Slaven, 1995). For example, group learning involving the large class discussion approach may be relatively unstructured with few rules for interaction among students (Gall, 1987), while group learning involving one of the cooperative learning methods may involve a specific set of rules aimed at structuring the interactions within student groups (Johnson and Johnson, 1994). Additionally, the goal (or reward) structure for learning groups is very important to consider. An extensive review of cooperative learning
studies has found that cooperative learning has its most positive effect when students are rewarded based on individual learning, as well as the group performance (Slaven, 1994).

**Group process factors.** The group process factors describe the interaction and dynamics of the learning group. There are four categories of factors: group learning characteristics (e.g., participation, depth of analysis), communication characteristics (e.g., exchange of information, efficiency), interpersonal characteristics (e.g., cooperation, domination), and structure imposed by GSS approach. The final three categories come directly from the Pinsonneault and Kraemer framework, while the first category is a category that has been modified in name (and slightly in content) to reflect a learning (rather than decisional) context.

**Outcomes.** The outcomes are subdivided into two major categories: individual outcomes and group-related outcomes. The individual outcomes are decomposed into three sub-categories: characteristics of learning (e.g., learning achievement), attitude of group members toward the learning process (e.g., perceived learning, satisfaction), and individual attitudes and behavior (e.g., self-esteem, classroom behavior). The group-related outcomes are decomposed into two sub-categories: attitudes toward the group and group performance. The outcome factors have been substantially revised from the Pinsonneault and Kraemer framework to reflect a learning environment instead of a decisional environment. The outcome variables associated with the characteristics of learning subcategory each refer to measures of learning performance. These variables include learning achievement and retention. Learning achievement relates to a student’s ability to acquire knowledge or skills, while retention relates to a student’s ability to retain knowledge or skills over time. The group performance subcategory also includes a variable related to learning performance: the variability of learning. This factor concerns variations in learning across students in a learning group. For example, one type of issue to consider would be: Do students starting with a lower baseline of knowledge learn more – or less --than students that start with a higher baseline of knowledge (Webb, 1989)? In addition to learning performance, educational researchers have found that there are numerous other types of important outcomes associated with group learning. These outcomes are typically measured by attitudinal or perceptual measures and include: motivation to learn more, liking of school, self-esteem, classroom behavior, cooperation, and acceptance of others. Each of these types of outcomes has been incorporated into the framework.

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**4. Research opportunities**

A review of the empirical research related to GSS and learning indicates that the questions explored by the research have been rather general. For the most part, the only variable that has been manipulated in the studies is technological support, as the studies have compared learning outcomes for GSS-supported vs. unsupported groups of learners. Variations in other contextual or group process factors have typically not been explored. The dependent variables have generally focussed on some form of performance measure (either an objective or a perceptual measure). As we look to the future, it will be important for researchers to conduct follow up studies to take a closer look at the various factors that may explain the effects of GSS technology on learners. There are still many compelling questions that need to be answered regarding the application of collaborative technology for learning.

There are numerous interesting research questions suggested by Figure 1. For example, How do the different aspects of technological support (e.g., anonymity, type of technology) influence the group process for learning groups? And how do variations in the group process (e.g., participation, exchange of information) influence learning outcomes? If technological support is worthwhile for certain learning contexts, which specific contexts (e.g., learning tasks) may be the most – or least – appropriate for support from collaborative technology? Interaction effects are also of interest: Are some forms of technological support useful for certain learning tasks, but not for others? As this brief discussion suggests, the research area of computer support for collaborative learning is one that is very rich in research opportunities. More research activity in this area is encouraged. The framework for collaborative technology and learning research that has been presented may provide a worthwhile framework for future research efforts.

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**5. References**

References available upon request from first author.
Figure 1: Framework for Analyzing the Impact of Collaborative Technology on Group Learning