PREDICTORS OF STUDENTS' PERCEIVED LEARNING OUTCOMES IN SAP-ENABLED COURSES: A SYSTEM VIEW OF STUDENTS, INSTRUCTOR, AND THE SOFTWARE

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ABSTRACT

Enterprise Resource Planning (ERP) Systems allow businesses to achieve high performance through distinctive capabilities and is one of the fastest growing areas within Information Systems. Many universities have adopted ERP in their MIS curriculum to increase the marketability of their students. The research will focus on both the IS Success Model and Keller's ARCS Model, along with several constructive learning theories, and integrate several of these components to determine a model that is predictive of students' learning outcomes. More specifically, the purpose of our research is to analyze the predictors of students' perceived learning outcomes in SAP-enabled courses, focusing on a holistic view of the students, instructors, and the ERP software.

INTRODUCTION

During the last two decades, many businesses around the world have adopted Enterprise Resource Planning (ERP) systems. ERP systems are enterprise-wide information systems that replace separate systems for such tasks as sales, purchasing, finance, logistics, manufacturing, and warehousing. "They are designed to address the problem of information fragmentation or 'islands of information' in business organizations (Muscatello & Chen, 2008)." Consequently, the growth in the number of businesses implementing ERP systems has had an enormous impact on the demand for ERP skills. This is one of the main reasons that many universities have adopted ERP in their MIS curriculum (Ravesteyn and Kohler, 2009). While the application of ERP in education

is well documented in many articles on information systems education, there is still only limited proof of its added value.

The influence of ERP courses in the MIS curriculum on the students' learning experience has not been widely supported by research. Although there are some studies that indicate that using an ERP system helps students to better understand business processes and integration (Johansson, Zimmerman, et. al., 2014; Halonen, Thomander, et. al., 2010), the educational benefits of instructional use of ERP systems are still mostly based on anecdotal statements from faculty and students rather than on empirical and objectively measured data secured by educational research methods (Noguera & Watson, 1999; Noguera & Watson, 2004; Nelson & Millet, 2001; Wagner, Najdawi, & Otto, 2000). Understanding the factors that lead to student learning outcomes and satisfaction in ERP courses can be of great help to MIS instructors in colleges and universities. Instructors can use this information as they formulate and refine curriculum that focuses on or includes ERP concepts and modules.

Because ERP related skills are in great demand, the use of ERP in higher education can also improve students' marketability, thus helping them to obtain higher paying jobs. Employers expect new college graduates to understand how companies function in today's economy, which requires knowledge of basic business processes and the technology used to support them. As faculty, we are responsible for preparing our students to work in an ERP environment. The content of an ERP course should include explanation of and hands-on experience with key business processes in the ERP course (Nelson & Millet, 2001). Regardless of the software used, the course content should be a blend of information about ERP and hands-on experiences (Lane, 2009). It is important to understand the factors that lead to student learning outcomes and satisfaction in ERP courses so that instructors can facilitate student learning of ERP concepts and systems. Sager et al., (2006) tracked graduates from their College of Business and found that students graduating with an extensive ERP background consistently obtained higher salaries than students without this background. The authors' Information Systems advisory council (Alshare and Lane,2011) shared that graduates with a basic understanding of ERP concepts and systems will have a competitive advantage over those who do not have such an understanding when entering the workforce.

The purpose of this research is to analyze the predictors of students' perceived learning outcomes in SAP-enabled courses, focusing on a holistic view of the students, instructors, and the ERP software. This paper will analyze the components of both the IS Success Model and Keller's ARCS Model, along with several constructive learning theories, and integrate several of these components in our own model to determine a model that is predictive of students' learning outcomes. The paper will begin with a discussion of the theoretical background of the study and a conceptual framework will be developed and tested to determine the predictors of students' perceived learning outcomes in SAP-enabled courses. The following sections will present the research model, research design, the research survey, and will end with implications of the research.

THEORETICAL BACKGROUND

Much research has been conducted over the last 35 years concerning the topic of information system (IS) success based on different evaluation perspectives. IS researchers have created and

tested various models to determine which constructs most likely lead to IS success. We will briefly discuss some of the most popular models and their constructs for determining IS success leading to positive student learning outcomes.

One of the most popular models that has been used to evaluate IS success is DeLone and McLean's IS Success Model, discussed below.

The IS Success Model

Many researchers have tried to identify the factors contributing to IS success. Largely, however, different researchers addressed different aspects of IS success, making comparisons difficult. In order to organize the large body of existing literature as well as to integrate the different concepts and findings and to present a comprehensive taxonomy, DeLone and McLean (1992) introduced their original IS Success Model (D&M IS Success Model). DeLone and McLean defined six distinct dimensions of IS success: *system quality*, *information quality*, *use*, *user satisfaction*, *individual impact*, and *organizational impact*. Ten years after they published their first model, and based on the evaluation of the many contributions to it, DeLone and McLean (2002, 2003) proposed an updated IS success model. The primary differences between the original and the updated model are: (1) the addition of *service quality* to reflect the importance of service and support in successful e-commerce systems; (2) the addition of *intention to use* to measure user attitude as an alternative measure of use; and (3) the collapsing of *individual impact* and *organizational impact* into a more parsimonious *net benefits* construct. The updated model consists of six interrelated dimensions of IS success: *information*, *system*, and *service quality*; *(intention to) use*; *user satisfaction*; and *net benefits*. The arrows demonstrate proposed associations between the success dimensions. Looking at its constructs and their interrelations, the model can be interpreted as follows: a system can be evaluated in terms of information, system, and service quality; these characteristics affect subsequent use or intention to use and user satisfaction. Certain benefits will be achieved by using the system. The net benefits will (positively or negatively) influence user satisfaction and the further use of the IS. Wang et. al. (2007) used the DeLone and McLean IS Success 2003 Model in evaluating success of a web-based course from an organizational approach. The authors modified the model to be used from the learners' (students) perspective. Lin (2007) also used the DeLone and McLean Model in her online course. Lin studied how system quality, information quality, and service quality influence use via user satisfaction and intention to use.

The D&M IS Success Model is the main theoretical basis of the reviewed studies. Several success models for evaluating specific types of IS – like knowledge management systems (Kulkarni et al. 2007) or enterprise systems (Gable et al. 2003) – have been developed from this theory. Given its high citation counts and the intense investigation of the model's propositions in a broad spectrum of contexts, many researchers believe that the D&M IS Success Model should be part of a comprehensive compendium of IS theories. According to the literature, the Delong and McLean IS Success Model is the most frequently cited model when applied to researching IS success (Urbach and Mueller, 2011).

Another major model that affects IS success is Keller's ARCS Model for Motivational Design, which is discussed in the next section.

Keller's ARCS Model for Motivational Design

Research has indicated that motivational issues are influential on instructional outcomes since they are the fundamental factors that drive students' academic performance (Weiner, B., 1985; Ames, C., 1992; Anderman, E. & Maehr, M., 1994; Bandura, A., 1997; Durik, A., & Harackiewicz, J.; 2003). The ARCS Model for Motivational Design (Keller, J., 1987) was adopted due to its applicability and practicability in designing, developing, and evaluating instructional materials. Keller suggested that learning motivation is affected by four perceptual components: **A**ttention, **R**elevance, **C**onfidence, and **S**atisfaction. Each component plays a critical role in motivating students throughout the learning process. The ARCS Model is widely applied to the production of instructional material due to its connectivity between learning motivation theories and instructional design and development processes (Huang, W. & Johnson, J., 2002).

The development of the ARCS Model of Motivational Design originated from various learning and instructional theories (Driscoll, M., 2000). Keller's primary assumption as to how the ARCS Model works is based on the interaction between instructional materials and learners. Attention refers to the learner's response to perceived instructional stimuli provided by the instructional materials. It is important to design instruction such that effective stimuli are present at the beginning of and maintained throughout the learning process at a level to arouse learner's attention and curiosity (Keller, J., 1983). Relevance helps learners associate their prior learning experience with the given instructional materials; it also enables learners understanding of the applicability of learned knowledge or skills in their future tasks. Confidence stresses the value of building learners' positive expectation towards the learning task. Meaningful experiences support learners' confidence development during the learning process. Satisfaction comes when learners are allowed to practice using newly acquired knowledge or skills and receive feedback in a manner that leads to positive attitudes towards the learning task. This also enables learners to receive reinforcement to maintain desirable learning behaviors (Keller, J., 1987).

Further analysis of learning theories and their effects on student learning outcomes will be presented in the next section.

Analysis of Constructive Learning Theories

In the field of education, motivation has been identified as a critical factor affecting learning (Lim, 2004). Past studies have shown that learner motivation associates with a variety of important learning consequences such as persistence (Vallerand & Bissonnette, 1992), retention (Lepper & Cordova, 1992), achievement (Eccles et al., 1993), and course satisfaction (Fujita-Starck & Thompson, 1994). Research evidence suggests that motivation should be taken seriously in educational learning environment.

In a literature review article, (Miltiadou and Savenye, 2003) examined six motivation constructs and discussed their implications for online learning. The authors concluded that, in order to reduce attrition rates and ensure student success, more empirical studies are needed to test motivation theories and constructs in the learning environment using online technologies. In line with Miltiadou and Savenye's (2003) statement, Gabrielle (2003) applied Keller's (1983) ARCS (attention, relevance, confidence, and satisfaction) model to design technology-based instructional

strategies for online students. Results showed that the ARCS-based learning support was effective in promoting students' motivation, achievement, and self-directed learning. Lee (2002) investigated constructs of self-efficacy on online technologies (Bandura, 1982) and task value (Eccles, 1983) and found that the two constructs were significant predictors of students' satisfaction and performance.

Self-determination theory (SDT) is a general theory of motivation that purports to systematically explicate the dynamics of human needs, motivation, and well-being within the immediate social context (Deci & Ryan, 1985, 2002). The term self-determination, as defined by Deci and Ryan (1985), is "a quality of human functioning that involves the experience of choice. [It is] the capacity to choose and have those choices . . . be the determinants of one's actions" (p. 38). One central tenet of SDT is that as opposed to other motivational theories (e.g., Bandura's social cognitive theory) that treat human motivation as a monolithic construct, SDT theorizes human motivation into three main categories: intrinsic motivation (doing something because it is enjoyable, optimally challenging, or aesthetically pleasing), extrinsic motivation (doing something because it leads to a separable outcome) and amotivation (the state of lacking intention to act). Extrinsic motivation is further categorized into four stages/types: (1) external regulation, (2) introjected regulation, (3) identified regulation, and (4) integrated regulation. Amotivation represents the least self-determined type of motivation while intrinsic motivation signifies the most self-determined type of motivation. According to SDT, self-determined types of motivation (intrinsic motivation，integrated and identified regulation) may lead to positive outcomes while nonself-determined types of motivation (amotivation, external and introjected regulations) may result in negative outcomes (Deci & Ryan, 1991). Contextual support serves as a key concept in self-determination theory. Individuals absorb "nutrients" from social interactions that provide support for autonomy, competence, and relatedness, the three basic needs. With basic needs satisfied, individuals become more assured and self-determined, and in turn achieve enhanced psychological well-being.

A number of factors suggest that SDT is an appropriate framework for addressing motivation in the online learning environment. First, SDT may serve as a theoretical framework that integrates issues in online learning. Self-determination theory addresses autonomy, relatedness, and competency as determinants of motivation. The three constructs correspond to features of online learning such as flexible learning (Moore, 1993), computer mediated communication and social interaction (Gunawardena, 1995), and challenges for learning technical skills (Howland & Moore, 2002). The notion of contextual support is especially valuable, as online learners need a variety of support from instructors, peers, administrators, and technical support personnel (Mills, 2003; Tait, 2000, 2003). Past experimental research indicates that self-determination theory predicts a variety of learning outcomes, including performance, persistence, and course satisfaction (Deci & Ryan, 1985, for a review). Self-determination theory has the potential to address learning problems such as student attrition in the online learning environment (Chen and Jang, 2010).

Saba (2013), who researched the integration of the TAM (Technology Acceptance Model) and IS Success Models on implications of e-learning systems and self-efficacy on students' outcomes, concluded that system quality, information quality, and computer self-efficacy all affected system use, user satisfaction, and self-managed learning behaviors of the students. Kim, Trimi, Park, and Rhee (2012) investigated the impact of quality on the outcomes of e-learning based on Keller's IS

success model and concluded that system quality, information quality, and instructional quality positively influenced user satisfaction. Li et al. (2012) identified that e-learning service quality, course quality, perceived usefulness, perceived ease of use, and self-efficacy directly affect system functionality, while system interactivity insignificantly affects users' intentions towards use. Chang (2013) showed that web quality significantly and positively influences user value and user satisfaction; furthermore, he concluded that perceived value and satisfaction play the antecedent role in the user's intention towards use of e-learning. Wang and Chiu (2011) who incorporated communication quality, information quality, and service quality in his model showed that all had significant positive effects on user satisfaction and loyalty intention to use the e-learning system for interacting experience, collaborating with others, and getting feedback. Because of the scarcity of research that examines students' learning satisfaction with system quality of a system, Tajuddin, Baharudin, and Hoon (2013) conducted a study to examine the relationship between learning satisfaction and system quality which revealed a positive relationship.

According to Tseng, Lin, and Chen (2011), the most significant determinants of e-learning effectiveness were the quality of the e-learning system and learner attractiveness. In their study, they found that the increased use of multimedia features positively improved the learner's attention and they found that when instructors were responsive to students' questions, e-learning greatly improved. Islam (2012), who included perceived system quality in his expectation–confirmation based IS model, revealed that perceived usefulness, confirmation of initial expectation, and system quality significantly influenced students' satisfaction. Udo, Bagchi, and Kirs (2011) indicated an instrument for assessing e-learning quality comprises five components including assurance, empathy, responsiveness, reliability, and website content that four of which (except reliability) are valid and reliable constructs to measure e-learning quality and influence learners' satisfactions and intentions to attend in online courses.

There are other related learning theories that should be mentioned. Social Cognitive Theory (SCT) is a framework for understanding, predicting, and changing behavior which introduces human behavior as a result of the interaction between personal factors, behavior, and the environment. Jordan (2013) identified that students' effectiveness mostly relies on the teachers' way of designing and orienting the online learning experience. In other words, the succession of a learning environment emanated from a strong pedagogical method that put emphasis on a constructivist approach in practice, without which technology could not guarantee that online learning would occur on its own. Chang (2013) reported that perceived value determines users' intentions towards use of system. He also added that perceived support had a significant effect on perceived usefulness of the e-learning system. Islam (2013) identified three main constructs which significantly affect students' perceptions. They are a perceived learning assistant, a perceived community building assistant, and perceived academic performance, which are influenced by perceived usefulness and perceived ease of use and the learning environment.

Research on the learning outcomes of incorporating ERP in the business curriculum is minimal. This study investigated the influence of using SAP systems on course learning, which is different from the previous studies which examined the impact of e-learning systems on students' learning outcomes. We propose that student motivation, perceived instructor support, and system quality affect students' perceived learning outcomes. The moderating variables are continued-use intention and student satisfaction. Our research model is discussed in the following section.

RESEARCH MODEL

Based on the updated IS success model, the ARCS model for motivational design, and constructive learning theories and studies, the research model to study the predictors of students' perceived learning outcomes in SAP-enabled courses was developed and is shown in figure 2. The research model is explained below in terms of its three distinct but related antecedents: 1) student motivation, 2) perceived instructor support, and 3) system quality.

Figure 1: Research model
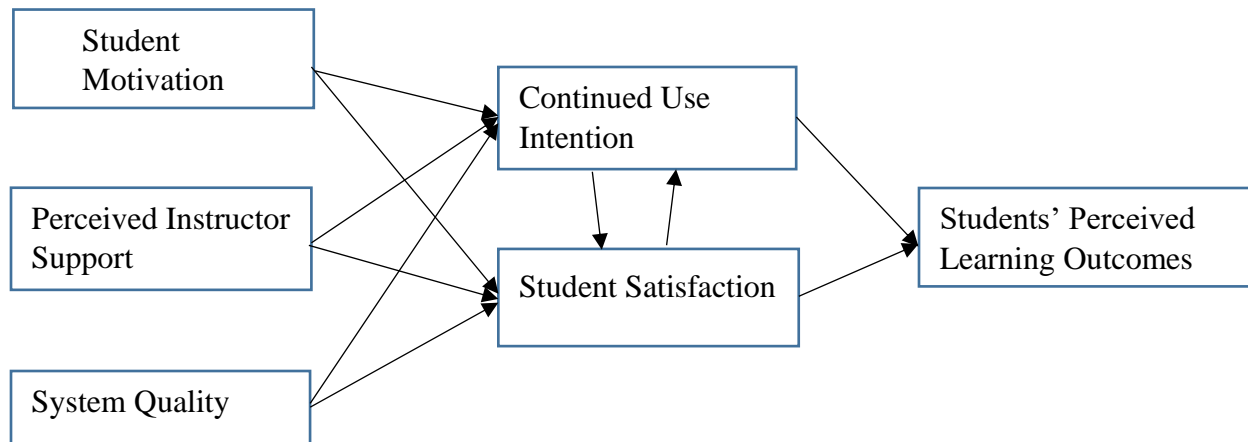
Student motivation is defined as the degree to which it drives the academic performance of a student, thereby influencing the perceived learning outcomes (Keller, 2009). The relationship between student motivation and students' perceived learning outcomes is mediated by continued use intention and student satisfaction. Prior research has suggested that motivated students will pursue and continue to use knowledge and skills gained in a learning environment. Also, motivated students will gain more satisfaction as a learning consequence. In our context, the students' perceived learning outcomes in SAP-enabled courses depend on the degree to which a student is motivated to learn an ERP system. Hence, it is logical to theorize that the students with higher motivation will continue to use the ERP system with more satisfaction and will have better learning outcomes.

Perceived instructor support is defined as the degree to which a student perceives the instructor of a course to be knowledgeable about the course content, to be facilitating the teaching, and providing feedback (Eom and Ashill, 2016). The relationship between perceived instructor support and learning outcomes is also mediated by continued use intention and student satisfaction. Research has shown that perceived instructor support has a positive influence on students' learning outcomes. We expect that students in SAP-enabled courses with knowledgeable instructors actively involved in facilitating teaching activities and providing timely feedback are inclined to have better learning outcomes.

System quality is defined as the degree to which the desired characteristics of the information system itself produces the information (DeLone and McLean, 1992). The relationship between

system quality and students' perceived learning outcomes is mediated by continued use intention and student satisfaction. The earlier studies have concluded that the effect of system quality on students' learning outcomes is positive. In context of our research, we posited that the students will have better learning outcomes if an ERP system used in the course is easy to use, user-friendly, stable, secure, fast, and responsive.

The research design we used is explained in the next section.

RESEARCH DESIGN

The measures used to operationalize the constructs were taken from relevant prior studies. A thorough review of literature on IS success, the motivational design, and constructive learning theories was conducted to identify studies in which constructs similar to the ones used in our study were operationalized. Adapting existing measures isomorphically to the context of the study, metrics for the study variables were generated. Table 1 summarizes the relevant prior research that served as the basis for construct operationalization in this study.

Table 1: Relevant references for research model constructs

Student Motivation	Keller, 2009
Perceived Instructor Support	Eom, Wen, and Ashill, 2006; Eom and Ashill, 2016;
System Quality	DeLone and McLean, 1992; DeLone and McLean, 2003
Continued Use Intention	Chau and Hu (2001), Davis (1989), Venkatesh et al. (2003)
Student Satisfaction	DeLone and McLean, 2003; Keller, 2009; Alshare and Lane, 2011
Students' Perceived Learning Outcomes	Eom, Wen, and Ashill, 2006; Alshare and Lane, 2011

SURVEY

Purposive sampling method will be used for this study. A purposive sampling method searches for a specific profile based on target respondent definition for the concerned survey. The target respondents for this study will be undergraduate and graduate students attending U.S. universities and enrolled in at least one SAP-enabled course. Undergraduate and graduate business students at three mid-sized regional state universities in the United States will be surveyed. The universities are members of the SAP University Alliance. A pilot test will be conducted initially by randomly selecting 100 respondents. The pilot study will reveal if there are any problems or confusion about the survey instrument, confirming the suitability of the instrument. The model will be tested using structural equation modeling.

IMPLICATIONS

The purpose of the study is to explain the factors that influence the perceived learning outcomes of students in SAP-enabled courses. This research has much potential. First, Enterprise Resource Planning (ERP) Systems allow businesses to achieve high performance through distinctive capabilities and is one of the fastest growing areas within Information Systems. SAP – the ERP System used in this study--is one of the world's leading producer of business software. Today, more than 350,100 customers in more than 180 countries use SAP applications. SAP customers include 87% of the Forbes Global 2000 companies, 98% of the 100 most valued brands, and 100% of the Dow Jones top scoring sustainability companies. SAP customers produce 78% of the world's food and 82% of the world's medical devices. Also, 76% of the world's transaction revenue touches an SAP system. Therefore, understanding what may facilitate the learning of ERP systems is of interest.

Second, the findings of this study will be important to MIS faculty teaching in colleges and universities. Faculty will benefit from gaining a better understanding of student acceptance of SAP-enabled courses. This will enable faculty to develop and refine curriculum geared toward ERP concepts. Third, the implications of this study will potentially benefit students taking SAP-enabled courses. Better designed courses offered in a positive learning environment will promote SAP usage ultimately. Lastly, from an academic standpoint, the importance of the study lies in its ability to test the research model based on the updated IS success model, the ARCS model for motivational design, and constructive learning theories and studies, in the context of predicting student perceived learning outcomes in an ERP-enabled environment.

REFERENCES

References are available upon request from Yu (Audrey) Zhao, Kakoli Bandyopadhyay, and Cynthia Barnes.