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Task-Technology Fit and Performance in Learning

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***Abstract*—With the advancement in computing and communication technologies, more tasks are accomplished effectively and efficiently using information technology as tools. Learning is one of such tasks. The research on how information technology assists an individual in performing tasks evolves to the theories of task-technology fit and technology-to-performance chain, as well as technology acceptance model. Through literature review, areas such as online learning and learning management systems; intention toward technology integration; computer self-efficacy; virtual learning environments; technology attributes on learning relating to task-technology fit and performance in learning are presented and discussed.**

Keywords-task-technology fit; performance in learning; onine education

I. INTRODUCTION

A key concern in the research of information systems (IS) is to understand the relationship between information technology (IT) and individual performance [1]. With the rapid advancement in computer hardware, software, and communication technologies, IT has gradually been extensively adopted as efficient tools to accomplish tasks by individuals. Learning is one example of such tasks. According to the U.S. Department of Education [2], technologies can support the learning experience of (a) expository instruction, (b) active learning, and (c) interactive learning (p. 3). The research on the relationship between IT and individual performance lead to the development on how technology fits to task and whether it enhances individual performance, hence the theory on task-technology fit (TTF).

II. RESEARCH MODELS FOR TASK-TECHNOLOGY FIT

Fitness of technology is subject to recognizing how usefulness technology is perceived and how technology is accepted, thus leading to the theory on technology acceptance model (TAM) [3]. If technology is not perceived as useful (or easy to use) and is not accepted, it is impractical to explore the fitness of technology to task. In fact, many tasks could be accomplished successfully without using technology.

Goodhue and Thompson [1] defined TTF as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (p. 216). They discussed three models of the link from technology to performance: (a) utilization focus model, (b) fit focus model, and (c) model combining utilization and fit. They named the last model technology-to-performance chain (TPC).

In order for IT to have a positive impact on individual performance, the technology must be utilized and must be a good fit with the tasks it supports [1]. The variables of TPC model used in their study were (a) task characteristics, (b) technology characteristics, and (c) utilization. They tested the TPC model by investigating whether task and technology characteristics predict TTF and whether utilization and TTF predict performance impacts. Later they found out that to predict performance, both TTF and utilization must be included and technologies did add value to individual performance.

Chen, Wu, and Yang [4] used empirical data to validate the hypothesized relationships between online synchronous learning systems (the independent variables) and learning outcomes (the dependent variable). The variables were similar to those used by Goodhue and Thompson [1] except the independent variable used in this research had a narrower focus on online synchronous audio and video systems.

Gebauer and Ginsburg [5] did a research on TTF which centered on mobile information systems. User reviews from the postings on www.cnet.com of four technology products (a smart cell phone, two competing personal digital assistant [PDA] devices, and an ultra-light laptop) were selected. This research adopted a more user-perceived view using the variables of (a) task-related fit, (b) use context-related fit, and (c) technology performance. Gebauer and Ginsburg [5] commented that technology performance and technology maturity had been found to have an impact on the overall user evaluation of the technology. They concluded that "task-technology fit for mobile information systems could practically be assessed only within a narrow (perhaps even product-based) domain of technology" (p. 135).

III. TTF AND IT IMPACT ON LEARNING

IT has been changing education as more and more learning is taken place through the use of newer technologies. Information and communications technology has increasingly influenced higher education [6]. Techniques such as blogging, podcasting, and video blogging (also known as vlogging or vidblogging) as well as social software practices (for example, Twitter, Facebook, or Second Life) are changing how we learn [7].

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Thus, new frontier on the relationship between TTF and performance in learning continues to be explored.

The following literature review examines different areas of TTF and IT impact on performance in learning.

A. Online Learning and Learning Management Systems

Online learning or e-learning is asynchronous distance education through the Internet. It is one of the fastest growing trends in educational use of technology [8]. Online learning has become popular because content and instruction are accessible without time and geographical limitation. Technology development during the past decade has greatly enhanced the effectiveness and efficiency of information 'reach and richness' from the World Wide Web.

U.S. Department of Education [2] conducted a meta-analysis on 51 independent effects screened from more than a thousand empirical studies of online learning. After comparing the effectiveness of online learning with that of face-to-face instruction, the results from the meta-analysis indicated "…that classes with online learning (whether taught completely online or blended) on average produce stronger student learning outcomes than do classes with solely face-to-face instruction" (p. 18). Results also shown that blended learning (supplementing face-to-face instruction with online instruction) "…on average, had stronger learning outcomes than did face-to-face instruction alone" (p. 19).

A Learning Management Systems (LMSs) is an information system that facilitates e-learning (which can also be described as IT-supported learning). McGill and Klobas [9] conducted a study using the TPC as a framework to look into how TTF influences the performance impacts of LMSs. The results from their study provided strong support for the importance of TTF, which had a strong influence on perceived impact of the LMS on learning but had a weak impact on outcomes in terms of student grades. They also found out that facilitating conditions and common social norms did not affect the performance impacts of LMSs while instructor norms had a significant effect on perceived impact on learning through the use of LMSs.

It is not the combination of technology, instructor, learner, and task each functioning separately that drives online education. It is the synergy among the various roles of learner, task, and technology that strongly contributes to the success of online learning [10].

B. Intention Toward Technology Integration

In a study on user acceptance of computer technology, Davis, Bagozzi, and Warshaw [11] found out that ease of use is important; however, the usefulness of the system is even more important. Similarly a study on TAM and TTF model to consumer e-commerce suggested that the perceptions of usefulness of a web site were more related to use than perceptions of ease of use [12]. How would perceived usefulness and perceived ease of use of IT affect teaching and learning?

Wu, Chang, and Guo [13] applied the TAM, social cognitive theory, and TTF to assess teachers' use of IT in a study of science teachers' intention toward technology integration. The science teacher participants (348 science teachers from 40 middle schools in the central region of Taiwan) in this study were likely to use IT because they believed educational technologies could improve teaching performance and students' learning capabilities. The variables used in this study were (a) perceived fit, (b) perceived usefulness, (c) perceived ease of use, and (d) computer self-efficacy. The term self-efficacy was defined by Bandura [14] as the belief that one is capable of performing.

Wu, Chang, and Guo [13] subsequently learned that the mere presence of IT did not lead to educational transformation and concluded that computer self-efficacy of teachers had a positive correlation to pedagogical technology integration.

C. Computer Self-Efficacy

Chen, Wu, and Yang [4] conducted a study to investigate the impact of online synchronous audio and video systems on the performance of cooperative learning in decision making and intellective tasks. The results of the research indicated that "systems (the artifact of information richness) or task types did not have an impact on learning performance" (p. 125).

However, they found out that "…the learners' attitude toward the synchronous learning system significantly affects the satisfaction of synchronous online learning" (p. 125). The groups with more positive attitude toward synchronous audio and video systems had higher learning satisfaction. The results also indicated that the main effects of platforms and task types were independent. The findings from this research are useful for those who are interested to explore the relationship between TTF (of online synchronous audio and video systems) and performance in learning.

D. Virtual Learning Environments

Virtual learning environments (VLEs) can be described as the learning environment mediated by computers and digital technologies [15]. According to McGill and Hobbs [6], VLEs are widespread in higher education and are typically used to facilitate communication within a course and to deliver instructional materials. They performed a study to investigate the TTF of VLEs for instructors and students. WebCT was the VLE considered in this study. Two sample groups (students who were using WebCT in their studies and instructors who were using WebCT in their teaching) from an Australian university were selected. There were a total of 334 participants consisting of 267 students and 67 instructors.

McGill & Hobbs, [6] found that TTF, user satisfaction, attitude towards use, and anticipated consequences of use

of VLE were higher for students than for instructors. They suggested this might be due to the fact that interaction with the system required by instructors to complete their tasks was more complex that than required of students (p. 197). The methodology and variables used were similar to those covered by Goodhue and Thompson [1] except the dependent variables of this study were narrowed to TTF for students and TTF for instructors under VLE.

Researches on TTF generally investigate the task-technology fit between different information technology and individual performance. The results from this research are significant to those who are interested in TTF in learning from the perceptions of instructors and students as they relate to VLE. McGill and Hobbs, [6] recommended further research to investigate the role of TTF in addressing the gap of perceived user satisfaction between instructors and students using VLEs.

E. Technology Attributes on Learning

Nicholson, Nicholson, and Valacich [16] suggested that instructional material delivered through technology might not always be presented in a manner that maximizes the learning experience (p. 185). That was why they did a study to investigate the influence of vividness, interactivity, task complexity, and learning style on performance in learning (in the context of using an office productivity tool via a computer-mediated learning environment).

Their findings indicated a positive correlation between (a) presenting information in a more vivid or more interactive environment and (b) both satisfaction with the learning environment and interest in the presentation topic. They reviewed dual coding theory and cognitive load theory as well as mental models and learner control. The independent variables used were task complexity, vividness, interactivity, and learning style. The dependent variables were performance, satisfaction, interest, and perceived mental effort. The research was very thorough. They recommended further research in the areas of long-term influence of the treatment conditions on learning (such as retention of knowledge) and examine the relationships between the various learning outcomes (p. 198). Researchers who are looking for the most efficient way for learning to occur will find this article useful.

IV. Discussion

The application of IT in education is constantly being developed and adopted. Thus, the investigation on TTF in learning is significant to education institutions. TTF also has a strong influence on perceived impact of the LMSs on learning [9]. Educators should become aware of the impact of IT to the learners and to the academia in general.

There are still many gaps between the fitness, interest, and satisfaction of adopting IT and the effectiveness of education. Further researches are needed "to investigate how, why, and under what conditions technology, task, and individual characteristics can be combined to design computer-mediated learning environment that enhance learning outcomes" p. 199 [16].

Advancement in IT is making it feasible for organizations to create global virtual teams (GVTs) that work effectively across space and time. Massey, Montoya-Weiss, Hung, and Ramesh [17] observed that the perceptions of fit between technology and task are affected by cultural variability. Since IT is opening up the possibility of learning across the globe, perhaps future research on TTF and performance in learning should also consider cultural differences.

In spite of technology advancement, learning can still be accomplished successfully without the use of IT. The effectiveness of learning the old fashion way has not changed. For example, learning can be carried out productively through storytelling, observation, communities of practice, or shadowing. Thus, it is essential to recognize that IT is only a tool that can be used to enhance performance in learning; and TTF is the concept of matching the right technology with the individual, subject to the individual's perceived usefulness of the tool.

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