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Conceptualizing task-technology fit and the effect on adoption – A case study of a digital textbook service

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ABSTRACT

Although information technology has revolutionized virtually every aspect of how we interact with products and services, it has changed learning to a surprisingly small degree. In a study of a digital textbook service, we provide a new conceptual definition and measurement of technology fit. We conceptualize task-technology fit as how well a technology is integrated with a set of interrelated tasks included in achieving the goal of the behavior where the technology is used. Whereas research on technology adoption typically explains around 40 percent of the variance in motivation to adopt, our model explains as much as 76 percent.

1. Introduction

Information technology has revolutionized how we interact with products and services, but has had less of an effect on learning. Despite schools and universities investing heavily in computer technology during recent decades [1], the effects on learning have been minimal. The OECD's Director for Education and Skills, Andreas Schleicher, concluded: "The reality in our schools lags considerably behind the promise of technology as the basic skills in reading, mathematics or science remain unchanged in the countries that have invested most heavily in computer technology" ([2], p. 3). Critics have argued that computers add expenses, but fail to revolutionize the classroom learning experience [3]. A comprehensive meta-analysis by Sung et al. [4] of 110 experimental and quasi-experimental journal articles published between 1993 and 2013 on research related to the effect of integrating mobile devices with teaching and learning on students' learning performance found that such methods had only a moderate effect. They reported that the effect of technology on learning outcome depends on instructional strategies; that is, in order for technology to have an effect, the technology must be integrated with the overall learning process addressing specific pedagogical challenges. Also, successful classroom implementation of technology requires active support of technology from teachers, adequate computer proficiency among students, and development of classroom technology that is easy to use and directly related to course outcomes [5]. Therefore, understanding the conditions under which students and teachers adopt new digital learning technologies to improve learning outcomes is an important research issue, from both theoretical and managerial perspectives.

Theories of technology adoption propose that the better an information technology fits the task environment (TTF), the more motivated potential users will be to adopt it [6–8]. However, the challenge is how to conceptualize the task environment to reflect the user's goals and the causal mechanisms for adoption [9]. For example, a digital learning technology can enhance and improve the task of reading text material. Alternately, the digital service can enhance and improve the task of learning, which is another goal. In a review of the literature related to adoption of digital learning technologies, we find that researchers have conceptualized technology fit as a degree of efficiency and not effectiveness. While efficiency refers to how well something is done, effectiveness refers to how useful something is. Effectiveness is about doing the right task, completing activities and achieving goals. Efficiency is about doing things in an optimal way; for example, doing it the fastest or least expensive way. Conceptualized technology fit as a degree of efficiency is a problem because efficiency is not likely to have the same level of effect on adoption as effectiveness. If students find that a digital learning technology can really help them to improve their learning and subsequently their grades, they are likely to be very motivated because good grades are important for being accepted at the best schools and universities, and also later when they enter the job market. Our literature review also shows that researchers have more or less ignored the social context in conceptualizing the task environment.

The task-technology fit model (TTF) and the technology-acceptance model (TAM) have received significant academic attention and gained support for their explanatory and predictive properties. However, as

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scholars leaning on sociocultural perspectives (e.g. [10,11]) have argued, one might reasonably ask whether these models are able to capture the subtleties and characteristics of various use contexts when new technology is adopted. Even though the TTF model emphasizes the importance of fit between task and technology, it does not provide a coherent understanding of what constitutes a task environment and how such an environment affects adoption in a multifaceted context in which the interrelatedness between tasks might be high. The present research contributes by conceptualizing the task environment through an alternative lens that emphasizes how the interrelatedness of various tasks predetermines the intention to adopt new technology. Importantly, our research shows that the fit of a new technology with a set of interrelated tasks (practices) has a strong, positive effect on intention to adopt. Hence, our study supports the notion that acceptance of a technology is closely connected to the acceptance of existing and emerging practices [12]. We also show that intention to adopt is mediated by perceived usefulness and ease of use, as predicted by the TAM.

The purpose of our research is to provide a better conceptual understanding of what task-technology fit should mean, as well as a theoretical rationale for why task-technology fit should have an effect on motivation to adopt and use a digital learning technology. Although we use a digital textbook service to empirically test the proposed model, our conceptualization should be general across different types of information technologies where users have free will to adopt the technology or not. We believe that this paper will provide technology providers and managers with a better understanding of how to develop and implement new information technologies.

2. Theory and hypotheses

Derived from the more general theory of reasoned action [13], Davis [14] proposed that adoption of a new technology is driven by perceptions of its ease of use and usefulness, mediated by attitudes about using the innovation and the behavioral intention to adopt. The proposed theory, referred to as the Technology Acceptance Model (TAM), became the dominant approach in analyzing information technology adoption [9,14–16]. The model's emphasis on utility complements the attributes of relative advantage (usefulness) and complexity (ease of use) proposed in Roger's diffusion theory [17].

A particularly helpful aspect of TAM, from a managerial perspective, is its assertion that any factor that influences adoption behavior only does so indirectly by influencing perceived usefulness, perceived ease of use, and intention to adopt [9]. Numerous studies across a wide variety of technologies [18], user groups [19], and cultures [20] have supported the generalizability of the TAM model.

Although TAM tells us that an information technology needs to be perceived as useful (that is, effective), the theory does not address antecedents other than perceived ease of use [9]. However, Goodhue and Thompson [6] proposed that the most important antecedent of a technology's effectiveness is how well the technology fits the task for which it is used. Other innovation researchers have proposed similar antecedents, such as job relevance, output quality, and result demonstrability [21], task compatibility [22], relative advantage [23], and outcome expectations [24]. A main challenge in this line of research is that the exact causal mechanism between task-technology fit and perceived usefulness (that is, effectiveness) is not clear. We believe that the main reason for this lack of clarity is that previous research has not properly addressed the conceptual definition and understanding of what constitutes a task environment, and the meaning of fit to a task environment.

2.1. Conceptualizing task-technology fit

Goodhue and Thompson's [6] definition of task-technology fit does not take the interdependence of tasks into account. Although they defined task-technology fit as "the degree to which a technology assists an individual in performing his or her portfolio of tasks" (p. 216), they did not address the interrelatedness among the portfolio of tasks. In learning, for example, students engage in a set of interrelated tasks, such as attending lectures, writing term papers, and reading textbooks. Interdependence means that attending lectures will affect, and is affected by, reading the textbook and with writing a term paper. As tasks are interdependent, task-technology fit needs to be addressed as how well the technology facilitates and improves the set of interrelated learning tasks.

We find that practice theory [25,26] provides guidance for how to conceptualize the interrelatedness of tasks. Practices have been defined as "routinized types of behavior which consist of several elements, interconnected to one another. Adoption of a new technology is seen as a resource-integration process that enhances individuals' practices, leading to an improved practice or the possible emergence of a new practice" [27].

2.2. Social norms and the symbolic meaning of a new technology

Practice theorists propose that the adoption of new technologies is not only a matter of individual decisions, but grows out of how a new social reality is formed through changes in the nexus of practices (e.g., [25,26,28,29]). As such, *practice* refers to activity patterns across individuals that are infused with broader meaning and provide tools for ordering social life and activity [30].

Interestingly, Goodhue and Thompson's definition of technology environment does not include the social network among potential users of the technology. This is surprising given that adoption theories emphasize that innovation and adoption occur in a social environment [13,31–35]. In learning, students interact with other students and teachers affecting their learning activities.

Following this line of reasoning, we propose that task-technology fit should be conceptualized and defined as *how well the technology is integrated with the set of interrelated tasks (practices) in a social context.*

2.3. Adoption of digital learning technologies

We identified 10 empirical studies of the adoption of digital learning technologies grounded in the TAM framework (see Table 1). The different types of digital learning technologies include e-textbooks, company e-learning systems (platforms), and internet-based learning systems. With the exception of Islam [36], explained variance in adoption ranges from 26.0 percent to 49.2 percent. This is in line with other TAM research, where explained variance in adoption (usage) is 40 percent or lower ([21], p. 186; [16], p. 202). The explained variance of Islam [36] is 60.0 percent; that study included usage satisfaction (Beta = 0.22) as an independent variable in addition to perceived usefulness and perceived ease of use, and is therefore not directly comparable with the other TAM models as an additional variable is included.

Table 2 shows how these 10 studies measured perceived usefulness and also shows the effect of perceived usefulness on adoption. We observe that the 10 studies vary in terms of what is considered as the overall goal of the technology, including course performance, job performance, reading performance, and learning. Therefore, we observe that the measures are a combination of efficiency and effectiveness. Although some technologies are used to enhance efficiency, we believe that a much stronger motivation for adopting a digital learning technology is to enhance their goal of learning (that is, effectiveness). This is in line with the original proposition in [14], p. 320), which states that "people tend to use or not use an application to the extent they believe it will help them perform their job better." Therefore, we propose that perceived usefulness should reflect how well the new digital learning technology improves effectiveness in learning.

Following the general predictions in TAM [9,14], students are expected to be more motivated to adopt a digital learning technology they