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INNOVATIVE SOFTWARE USE AFTER MANDATORY ADOPTION

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Abstract

This research seeks to identify factors that influence high school students' software usage. Students in our study have been observed to vary with respect to their use of a specific software application, Geometer's Sketchpad®. The use of Geometer's Sketchpad® is mandatory in Geometry class. However, some students have voluntarily expanded their use of the tool to other classes (for example, Biology class) and to non-school related activities (for example, landscape design).

The original Technology Acceptance Model (TAM) model proposed by Davis (1986, 1989) and the numerous extensions of TAM (Hartwick and Barki, 1994; Karahanna and Straub, 1999; Venkatesh and Davis, 2000) have been used to model computer and software adoption and acceptance. Most of the research in this area examines computer acceptance in voluntary settings, although a few studies have looked at acceptance in mandatory settings (Rawstorne, et al., 1998, 2000). Our research will investigate if the TAM2 model can be adapted to explain (and later to predict) innovative use of a software application by high school students when the initial use of the application is mandatory. We define innovative use as "voluntarily expanding the use of a software application to new tasks and new settings after mandatory adoption for a specific task in a specific setting".

Keywords: High school students, innovative use, technology acceptance, TAM and voluntary usage

Introduction

IS researchers have long sought to understand factors that influence information technology adoption and use. Our research proposes a model that can be used to explain and later predict innovative use of a software application after mandatory adoption. Our subjects are students enrolled in a girls' Catholic high school in the southern United States. For the last four years, the high school has followed a technology-immersed curriculum, which requires use of computers by teachers and students in all classes. As part of this curriculum, all incoming freshmen are provided with laptop computers connected via wireless technology and teachers are evaluated based on the degree of technology immersion in their lesson plans. Students are required to use Geometer's Sketchpad® as part of their 9th or 10th grade Geometry class. Some students have been observed to voluntarily extend the use of the tool for other class assignments (for example, Biology) and for non-school related tasks (for example, landscape design). The model we have developed to explain the innovative usage behavior is grounded in several well-established theories including TAM and TAM2 (Davis, 1989; Venkatesh and Davis, 2000). We define innovative use as "voluntarily expanding the use of a software application to new tasks and new settings after mandatory adoption for a specific task in a specific setting". Please see Figure 1 for our adaptation of the TAM2 model.

Theoretical Background and Research Propositions

In order to predict and explain technology acceptance Davis (1986, 1989) developed the Technology Acceptance Model (TAM), which identified Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as key determinants of technology acceptance. Based on the Theory of Reasoned Action (TRA), attitude and intention were included in the TAM model. TRA proposes that the immediate antecedent of any behavior is the intention to perform that behavior, and that intention is jointly determined by attitudes toward the behavior and by Subjective Norms (Ajzen and Madden, 1986). In addition to incorporating the TRA

relationships, TAM assumes that PU has a direct effect on intention. Venkatesh and Davis (2000) introduced TAM2 to explain how social influences (Subjective Norm, Voluntariness, and Image) and cognitive instrumental processes (Job Relevance, Output Quality, Results Demonstrability, and PEOU) affect PU and usage intentions. Other technology acceptance studies have ignored attitude and/or behavioral intention and looked at the effects of PU and PEOU directly on usage (Lederer et al., 2000). We chose to ignore intention in this study because subjects' initial use of the software is mandatory, and certain subjects have already established innovative usage patterns. Subsequent studies may look at innovative usage over time (for example Pre-Geometry class, during Geometry class and Post-Geometry class), in which case intention would be added back into the model.

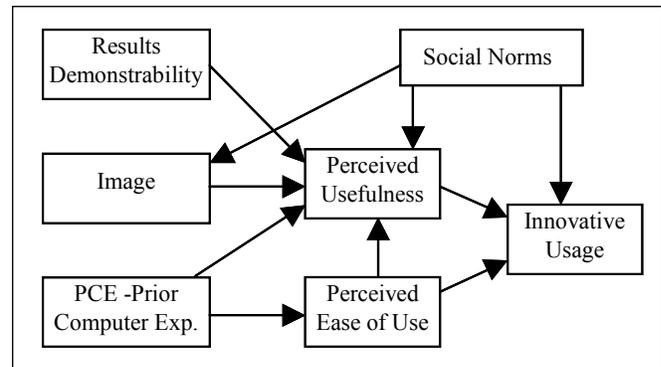


Figure 1. Research Model

Based on the pertinent literature we have incorporated the following factors in our version of the TAM2 model.

Perceived Usefulness and Perceived Ease of Use: PU and PEOU have been studied as key determinants of technology acceptance and usage (Davis, 1989; Adams et al., 1992; Venkatesh and Davis, 2000). PU is defined as “the degree to which a person believes that using a particular system would enhance his/her job performance”, and PEOU is defined as “the degree to which a person believes that using a particular system would be of physical and mental effort” (Davis, 1989, p. 320). Previous research has shown that PU is an important direct determinant of technology acceptance. However research on the direct effects of PEOU on technology acceptance has produced mixed results. It was suggested that PEOU would influence technology acceptance through PU (Davis, 1989; Venkatesh and Morris, 2000). Therefore we propose:

- P1: There will be a positive relationship between PU and innovative usage behavior.
- P2: There will be a positive relationship between PEOU and innovative usage behavior.
- P3: There will be a positive relationship between PEOU and PU.

Result Demonstrability: Result Demonstrability is defined as “the tangibility of the results of using the innovation including their observability and communicability” (Moore and Benbasat, 1991, p. 203). Agarwal and Prasad (1997) demonstrated the effects of Result Demonstrability on usage intentions. Venkatesh and Davis (2000) state that even though a system produces effective results, if those results are indistinct, users will have difficulty understanding the usefulness of the system. Their study showed that Result Demonstrability is a significant determinant of PU. Thus we propose:

- P4: There will be a positive relationship between Results Demonstrability and PU.

Image: Image is defined as “the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” (Moore and Benbasat, 1991, p. 195). Venkatesh and Davis (2000) demonstrated the effect of Image on PU to be significant over time. They argued that higher image leads to higher support from the group, which makes it easier to achieve goals only attainable through group membership, resulting in increased productivity and higher performance. We believe that image will be especially important for high school students. Therefore we propose:

- P5: There will be a positive relationship between Image and PU.

Prior Computer Experience (PCE): An individual’s general computer experience leads to positive attitudes toward computers (Rawstorne et al., 2000; Robinson-Staveley and Cooper, 1990), increased perceived self-efficacy (Delcourt and Kinzie, 1993; Henry and Stone, 1995; Marakas et al., 1998) and usage behavior. Igbaria and Iivari (1995) demonstrated that computer experience has positive direct effects on self-efficacy, computer anxiety, PEOU and positive indirect effects on PU. Furthermore, they stated that computer experience would not have a significant direct effect on usage but the overall effect would be positive and significant. Therefore we propose that:

- P6: There will be a positive relationship between PCE and PU.
- P7: There will be a positive relationship between PCE and PEOU.

Subjective Norm: Subjective Norm is defined as “a person’s perception that most people who are important to him think he should or shouldn’t perform the behavior in question” (Fishbein and Ajzen, 1975, p. 302). Some researchers have not found a

significant relationship between Social Norms and usage behavior (Sheppard et al., 1988) while others have shown that Subjective Norm plays a role in determining behavior (Hartwick and Barki, 1994; Venkatesh and Morris, 2000). Peer influence and superior influence are important determinants of Subjective Norm (Mathieson, 1991; Taylor and Todd, 1995). For high school student subjects, we believe that teacher, parental and peer influences will be important determinants of Subjective Norm.

Venkatesh and Davis (2000) demonstrated the effect of Subjective Norm on Image to be significant over time. They argued that Subjective Norm affects Image because if an individual's social group expects him/her to perform a behavior, then performing that behavior will increase his/her status in the group. Furthermore, they stated that if an important or influential individual believes that a person should use a system, then an individual would incorporate this belief into his/her belief structure. This would result in the belief that using the system might be useful and would increase the likelihood that he/she intends to use the system. Therefore we propose:

P8: There will be a positive relationship between Social Norms and Image.

P9: There will be a positive relationship between Social Norms and PU.

P10: There will be a positive relationship between Social Norms and innovative usage behavior.

Innovative Usage: This is the dependent variable, which is measured by actual usage. Subjects indicate how often they use the tool for non-Geometry school related activities (for example, Biology Class assignments) and for non-school related activities (for example, landscape design for Mother's Day gift). Innovative use is defined as using the tool at least once a week for non-Geometry school activities (the tool is used daily in Geometry) and more than once during the year for non-school related activities. Students who have never used the tool outside of school but routinely use it for non-Geometry school assignments or tasks are also considered innovative users.

Research Study

We operationalized the above factors by modifying questions from previously validated instruments. Our survey instrument was pre-tested for content analysis and to ensure proper wording by domain experts. We pilot tested the instrument using 12th grade students in April 2002 and finalized it based on pilot study results. In May, we will test the research model by administering the instrument over the web to the remaining approximately 450 students who have taken or are currently taking Geometry. The survey will be administered using WebSurveyor and Blackboard to reduce possible interactions between test administrations and discussions between subjects. The results will be used presented at AMCIS.

Conclusion

We believe our study will have theoretical and practical contributions. The completed research should add to the literature regarding innovative usage after mandatory adoption, especially since it focuses on adolescents where social norms and image are likely to be important. Once we have identified innovative users, educators can explore ways to encourage such individuals to experiment with technology and investigate mechanisms that will increase the entire populations' voluntary innovative use. We plan to extend this study with qualitative research (focus groups, interviews and cognitive mapping) and longitudinal studies with 9th grade students (Fall, 2002). Other theoretical foundations, such as Diffusion of Innovation (Rogers, 1983, 1995) will be researched over the summer, and included in future research extensions. For AMCIS, we are only reporting the first exploratory piece of a long-term research program. Based on finding from this initial study, we hope to identify factors that encourage students to experiment with technology and identify ways that educators can encourage all students to increase their experimentation and innovative use of information technology. We plan to ground such factors and any interventions we devise with our educational partners in a more extensive set of cross-disciplinary literature.

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