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How Do We Accept Technology? The Effect of Individual Differences

Khaled Dahawy and Sherif Kamel

Dept of Management, School of Business, Economics & Comm., The American University in Cairo, 113 Kasr El Eini St.,
Cairo 11511, Egypt, {dahawy, skamel@aucegypt.edu}

ABSTRACT

Individual factors and their effect on the rate of acceptance of technology is one of the most important research questions related to technology acceptance. Several theories have addressed the adoption of technology. The Technology Acceptance Model (TAM) has gained significant support and proved its success and reliability in both forecasting and interpreting behavior across a broad range of domains. Beliefs and attitudes represent the main constructs in TAM. However, a parallel line of research suggests that individual differences factors are important in the acceptance of technology. The aim of this paper is to examine a model presented by Agarwal and Prasad (1999) that combines both streams of research. The model demonstrates that the relationship between individual differences and information technology acceptance is mediated by the constructs of TAM. This paper examines the Agarwal and Prasad (1999) model through a case study from Egypt by assessing the effect of individual differences on the acceptance of using technology in teaching a course in the Certified Public Accounting (CPA) certification.

INTRODUCTION

The effect of individual factors on the rate of acceptance of technology is one of the most important questions that currently face research in accounting education. It is important to study whether these factors relate to the individual's inherent personality and background or is the acceptance of information technology driven by other external factors that can be influenced by educators and managers. This concern is a direct result of the continuous technological advancements taking place around the globe. Over the past few decades, technological developments have been progressing at an exponential rate. The impact of such technological advances can be felt at both individual and organizational levels through the use of personal computers, cell phones, and digital cameras amongst other emerging information and communication technologies. The adoption, diffusion and adaptation of computing, the Internet, the World Wide Web and other fully integrated software applications have facilitated recording business transactions and calculations and leading in organizational and societal transformation while ensuring quality, speed and accuracy.

Moreover, the learning process has also been dramatically affected by these technological advances in information and communication technology and the methodologies used in their introduction and implementation in the organization through a change management gradual mechanism. For example, in the field of accounting Al Hashim et al (2003) envision that the future accounting classroom will have the technology to accommodate a combination of both in-class and distance learning audiences, with seating arrangements for students and workstation equipment. In other words, the future will be represented in the form of the hybrid classroom that combines the old and the new, the traditional and the unconventional to be able to cater for the different school of thoughts and management and also to accommodate bringing in new ideas while preserving experiences and the knowledge acquired. These technology advances will allow the instructor to incorporate information from various sources both online and offline as well as from

nearby and remote locations irrespective of time and distance barriers. It is predicted that physical campuses will decay and crumble in the near future with the continuous growth of borderless societies and the extended enterprise bringing in more of the virtual classroom and the networked learning environment that extends beyond the limitations of the classroom.

Researchers and educators in accounting education amongst other areas have reported that the use of information and communication technology in the classroom provides (a) the ability to cut cost, while reaching a wider audience through tools such as the World Wide Web and video conferencing, (b) allow for standardization of quality of instruction, (c) enable each student to learn at his/her own pace, and (d) allow for continuous collaboration between the students and their peers as well as between the students and their instructors through a learning environment that extends during the duration of the course and beyond. The use of information technology in classrooms allows schools to expand their markets, respond to the business and environmental requirements, supports cross cultural and cross functional teams of students to engage and work together, and allows faster and more practical cooperation between instructors from various nations through the development of a network of learners and education material providers thus adding to the added-value enabled to the recipient groups including but not limited to students. The use of information technology in the classroom can allow more time and space flexibility for instructors and students to use the educational materials, can allow for continuous testing of users of the educational materials, allow the students more freedom in taking initiatives, learn on their own, be more creative, and individually study at their own pace.

However, such advantages are hindered by the presence of several hurdles that arise from the use of various information and communication technologies including the need for expensive infrastructure and large startup costs, finding qualified instructors, and the lack of face-to-face instruction, which may diminish the students interpersonal, social, and communication skills. Many studies have been developed during the period 2000-2002 to react to these issues (Watson et al, 2003). Such issues are further intensified in developing countries where it has been documented that the level of accounting education in developing countries is rather low; therefore, it is crucial to find ways to speed up the educational process of its citizens and one of the venues could be distance learning and computer based technologies which could lead to a cheaper process and at the same time capitalize on the large number of students and trainees that could be accommodated. Most of the implementations took place in developed nations and there is an urgency to test the environment in a developing setting to check the extent of the effects of the environment of operations and the local conditions (Rose and Straub, 1998, Dahawy et al, 2002, and El Hashim et al. 2003). This paper focuses on the Becker-Visser Program conducted in Egypt through the Institute of Management Development of The American University in Cairo.

Egypt is a developing nation in the midst of developing its accounting education processes, where the hunger for technological advancement in accounting education is hindered by the lack of financial resources and

basic infrastructures. Recently, investment in infrastructure development in information and communication technology has witnessed major steps with the establishment in 1999 of the Ministry of Communications and Information Technology and the inclusion of technology diffusion on the government agenda as well as the continuous partnership with the private sector that had remarkable implications on the diffusion of computing and the Internet over the last 5 years.

Egypt, a developing nation, is home to more than 70 million people and growing at an estimated rate of 1.9% (www.mcit.gov.eg). Egypt is one of the largest economies in the Middle East. Its current economic growth rate to stand at 3.2% annually with an inflation rate of 5.5% (www.economic.idsc.gov.eg). It is undergoing a liberalization program of a large number of its major economic sectors. Although, population is settling on 4% only of its land which extends to around 1 million square kilometers, infrastructure development and extension is reaching its 26 different provinces realizing a two-tier development process both vertically and horizontally. Egypt has a large service sector mainly built around tourism and transportation. Its major exports are human resource capacities, petroleum products, cotton and leather products; its major imports are food, machinery and vehicles. Agriculture accounts for nearly 16% of the gross domestic product, industry 35% and services 49% (Kamel, 2003).

The information and communication sector is one of the key sectors that attracted the attention of both the government and the private sector to contribute to development plans since the mid 1980s and various projects were initiated and implemented in Egypt's different provinces witnessing a shift in the perception and use of information technology. The market was liberalized, leading to a vast increase in the number of multinationals, vendors and local software houses. Information technology was perceived as a tool to reposition the organization in a growing competitive market where the decisions taken and the resources allocated directly affected its status and position. At that point, there was the involvement of a new and large customer in the market with new ideas, strategies and plans; the government helping to redefine the role of information and communication technology within the context of socioeconomic development. Following is the demonstration of the context of the technology acceptance model and its application in accounting instructional methods followed by testing of hypothesis, and the documentation of the case study covered and the analysis of the findings.

OVERVIEW OF THE TECHNOLOGY ACCEPTANCE MODEL

Several theories have addressed the adoption of technology. The Technology Acceptance Model has gained significant support and proved its success and reliability in both forecasting and interpreting behavior across broad range of domains (Davis, 1989). TAM has been proven to have better explanatory power than more sophisticated models, such as theory of reasoned action (TRA) and the theory of planned behavior (TPB) (Lu et al. 2003, Davies 1997, Mathieson 1991, and Taylor and Todd 1995).

Beliefs and attitudes represent the main constructs in TAM. However, a parallel line of research suggests that individual differences factors are important in the acceptance of technology. Prior research has identified individual differences as the most important external variables that affect TAM. Zmud (1979) and Nelson (1990) indicated that individual differences were highly relevant to the acceptance of information technology. Some empirical studies have also found significant relationships between individual differences and IT acceptance in different contexts (Adam et al, 1992; Igbaria et al, 1995; Jackson et al, 1997; Venkatesh, 2000; Hong et al, 2002; Lu et al, 2003). However, Chen et al (2000) warns that despite the presence of this body of theoretical and empirical support caution should be taken when applying the findings of earlier generations and different environments. Therefore, it is imperative to examine the effects of individual differences in the context of the environment and in this case in the profession of teaching accounting in Egypt as part of the education and learning processes.

Agarwal and Prasad (1999) introduced a model that combines the technology acceptance model with individual differences. The model shows that the relationship between individual differences and information technology acceptance is mediated by the constructs of the technology acceptance model. The main aim of this paper is to test this model in the accounting education research. Agarwal and Prasad (1999) model extends both TAM and individual differences streams of research. The model specifies the role of individual differences in TAM, where beliefs and perceptions as introduced in TAM intervene between individual difference variables and acceptance of information technology. Students and professors need to develop new skills and knowledge of the current and existing technology. However, implementing the necessary changes may present great challenges. Many factors including costs of technology adoption and individual differences are too high and may represent a major barrier. Age, educational background, beliefs, and personality are all factors that affect the acceptance of any newly introduced and emerging technology. This led to the development of a number of models and theories that address the issue of technology adoption and acceptance such as the theory of reasoned action (Ajzen and Fishbein, 1980), theory of planned behavior (Ajzen and Madden, 1986), theory of diffusion of innovation (Rogers, 1983), and the technology acceptance model (Davis, 1989). Based on these models, TAM received significant support and proved its success and reliability in both forecasting and interpreting behavior across broad range of domains (Davis, 1989). The reason may be due to the simplicity of its assumptions and the wealth of recent empirical support for it (Agarwal et al, 1999). Figure 1 demonstrates the relationships that TAM represents.

The objective of the technology acceptance model is to interpret the factors affecting technology acceptance within the context of the environment in place while accommodating to all dependent, independent and moderating variables. It is a simple and powerful model to use (Davis, 1989). TAM consists of two beliefs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which reflect the attitudes and behavioral intention to accept technology. PEOU can be defined as the degree to which a person believes that using a particular system would be free of effort (Davis, 1989). So the more the person thinks of a technology as being easy to use, the greater probability he/she will be willing to adopt and use the proposed technology-based system. PU is defined as the degree to which a person believes that using a particular system would enhance his/her performance (Davis, 1989). Consequently, the more an individual perceives a technology as being useful, the more he will be willing to adopt and utilize such technology-based system. In the case of applying PU and PEOU to the education sector, it is evident that the easier the media tool to use, the more it will be adopted and the more the media tool being used is able to communicate information, the more the students and their professors will regard it as useful with a varying degree of effectiveness and efficiency. The Agarwal and Prasad (1999) model combines TAM and the social psychology literature with an emphasis on individual difference as a key variable.

Figure 1. Technology Acceptance Model

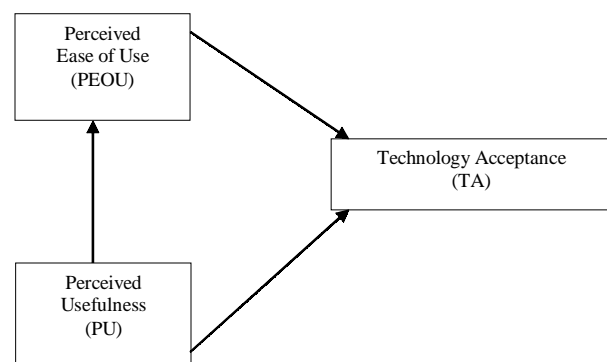
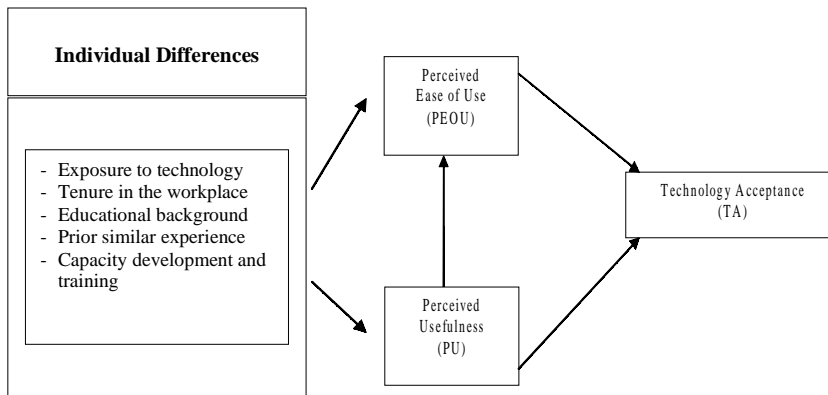


Figure 2. Agarwal and Prasad Model (1999)



The choice of variables was guided by the typologies of individual difference variables and the law of proactive inhibition. The individual differences variables were selected to represent the prior knowledge base individuals would possess at the time of interacting with the newly introduced information technology. These variables represent traits that can potentially interfere with the acceptance of new technology. Figure 2 demonstrates the relationships that the model depicts.

The examination of the Agarwal and Prasad (1999) model in the education arena is beneficial as it tests whether the findings can be generalized to the educational process. This would help educators understand the effect of introducing technology in the classroom. It would also help educators understand how they can better utilize the use of technology in the classroom, focusing on the individual traits that need to be present in the students before introducing the technology in the classroom. Elements related to both stakeholders (students and instructors) would need to be studied due to their implications on the success of accepting technology within the environment of education and learning.

USING INSTRUCTIONAL METHODS IN ACCOUNTING

The accounting instructional methods have recently witnessed rapid change in a relatively short period of time. Before the mid 20th century, the technology used for accounting instruction consisted of nothing more than chalks and lectures. The 1950s and 1960s, witnessed minor changes with the rare use of flip charts on an easel in addition to audio visual equipment like a movie, filmstrip or projectors. Video tapes and overhead transparencies began to appear in classrooms during the 1970s, and by the end of the 1980s, there was the establishment of computer labs, as well as the adoption and incorporation of computer applications in the accounting curriculum (Al Hashim et al, 2003). However, such step is still in its infancy stage in many universities in Egypt. It is important to note that computing was introduced in Egypt in the early 1960s and has seen two major developments in during 1985 and again in 1999 when it was officially placed on the national agenda of the cabinet of ministers.

The progression of the 1990s brought rapid developments in computer technology and its applications. Computers are now becoming more and more user friendly and a large number of students entering colleges are computer literate (Al Hashim et al, 2003). Computer applications like presentation tools help enhance education delivery and facilitate the communication process between students and their instructors as well as among the community of students. Additionally, the establishment of the Internet and World Wide Web gave infinite access to information (Al Hashim et al, 2003). Besides, we have the appearance of CD-ROMs authored courses and tutorials that have many advantages and are beginning to be diffused across the community in the education sector worldwide. All the progression in technology raises the issue of the importance of possessing and developing the necessary technological

skills among accounting professionals, professors, and students all around the world so as to maintain a competitive edge. Much of these developments are clearer in developed nations than in developing nations because the integration of information technology in teaching accounting is hindered by the lack of resources and infrastructure that is ready to compete and to provide the latest in education to a community that is customer-based and that needs to accommodate to the continuous changing needs of customers; in this context students. Very little is known and available in the literature about the use and acceptance of information technology in teaching accounting in developing nations, as a result of the focus of accounting research on developed nations (Dahawy et al, 2002). More needs to be developed and cases need to be documented on the technologies used in teaching different disciplines such as accounting in developing nations.

In summary, the research this paper aims to investigate the relationship between individual differences and the acceptance of new instructional methodology in a developing nation. This is done through the examination of potential intervening factors. In this model the constructs and relationships underlying TAM are expected to mediate the influence of the individual variables.

HYPOTHESES

The hypotheses tested in this manuscript were generated based on the model presented by Agarwal and Prasad (1999). Table 1 reflects the hypotheses tested.

With respect to the first hypothesis (mediation) it reflects the fact that beliefs mediate the influence of all other factors in the environment that may exhibit effects on individual acceptance of emerging information technology (Agarwal and Prasad 1999). Most prior research has focused on examining the relationship between beliefs and acceptance of information technology. The literature in the past attempted to investigate the mediating role of beliefs (Davis, 1993; Venkatesh and Davis, 1996). Other research aimed at testing the individual differences such as user involvement Jackson et al, 1997), training (Compeau and Higgins 1995; Venkatesh and Davis, 1996), and prior experience (Thompson et al, 1994). The findings of these studies were mostly contradicting and only Venkatesh and Davis 1996 and Agarwal and Prasad (1999) supported full mediation. It is worth noting that all previous research has built its inconclusive results based on social cognitive theory (Bandura, 1977) and/or the work of Triandis (1980) on attitudes. Agarwal and Prasad (1999) Model addresses full mediation by utilizing the learning theory and a variety of individual variables as indicated earlier.

Agarwal and Prasad (1999) base their model on the comparability between the belief formation process and the learning process. As a result, they postulate that the learning theory can be used to provide basis for understanding how individual variables might influence the development of beliefs. The law of proactive inhibition or interference suggests that the prior knowledge and experiences interfere with the ability to learn to exhibit specific behavior (McGeoh and Irion, 1952). The argument is that the degree of similarity or dissimilarity of the prior experience and knowledge of an individual would greatly affect the individual's behavior. It is expected that the higher the degree of similarity between the prior experience and the new one the higher the expected degree of acceptance.

The research literature provides typologies of individual differences (Agarwal and Prasad, 1999). The individual differences variables included in the model are in line with prior literature and the law of proactive inhibition. These variables were chosen to illustrate the prior knowledge base that the students would possess when they interact with the newly introduced technology. In other terms, these variables

Table 1. Hypotheses Tested

Hypothesis
H1: Ease of use and usefulness beliefs fully mediate the influence of selected individual differences variables on acceptance of new educational technology
H2: The length of tenure in the workplace is negatively associated with ease of use and usefulness beliefs about an information technology innovation
H3: Level of education is positively associated with ease of use and usefulness beliefs about an information technology innovation
H4: The extent of prior experience with similar technologies is positively associated with ease of use and usefulness beliefs about an information technology innovation
H5: Participation in training on an information technology innovation is positively associated with ease of use and usefulness beliefs about information technology innovation

represent traits that can interfere with the acceptance of the new technology. This research includes the following individual difference variables: workplace tenure, the level of education, extent of prior knowledge with similar technologies and participation in training related to information technology. It is worth noting that Agarwal and Prasad (1999) model included 5 variables but the 5th variable was the individual's relation with technology and this is operationalized by asking the respondent to indicate if he/she is a user or a provider of information technology. This variable would be inappropriate for this paper since the respondents are all accountants studying for the CPA exams and therefore none of them would be providers of information technology but they would all be end-users.

Prior research implicates that individuals with longer tenure and older age are more likely to resist new technology (Gattiker 1992; Kerr and Hiltz, 1988; Marjchrzack and Cotton, 1988). It is expected that the older the individual the harder it will be for him/her to accept new and emerging information technology. Therefore, the following hypothesis is tested "the length of tenure in the workplace is negatively associated with ease of use and usefulness beliefs about an information technology innovation".

The literature shows the presence of a relationship between level of education and technology. Igbaria and Parsurman (1989) found a negative relationship between education and computer anxiety. Davis and Davis (1990) found a significant relationship between the level of education and the performance in training courses. Bower and Hilgrad (1981) found that sophisticated cognitive structures, acquired by higher education level, lead to a better ability to learn in novel situations. The results of prior research indicates that the level of education is positively related to a better ability to learn, indicating that individuals with a higher level of education would be more receptive to newer technology than individuals with lower educational level. Therefore, the following hypothesis is tested "level of education is positively associated with ease of use and usefulness beliefs about an information technology innovation". Moreover, prior research has established the presence of a positive relationship between prior experience with similar technology and the acceptance of new technology (Levin and Gordon 1989; Harrison and Rainer 1992; Igbaria, 1995; Jiang, 2000). Therefore, based on prior research and the law of proactive inhibition the following hypothesis is tested "the extent of prior experience with similar technologies is positively associated with ease of use and usefulness beliefs about an information technology innovation". Finally, Training reduces uncertainty about innovations by providing information about the various features of the innovations. Therefore, prior knowledge of the innovation would lead to better understanding of it. Thus the following hypothesis is tested "participation in training on an information technology innovation is positively associated with ease of use and usefulness beliefs about information technology innovation". Table 2 presents the operationalization of the variables as presented in this manuscript.

RESEARCH METHODOLOGY

The research method used included the use of survey questionnaires among sample of students studying for the accounting professional certification offered by the BeckerConviser Institute for higher education operating at the Institute of Management Development (IMD) at The American University in Cairo. The objective of the questionnaire was to illustrate and examine the relationship between the research variables by measuring students' beliefs and intentions. The study covered the Certified Public Accountant (CPA) course. The questionnaire was coupled with a set of open-ended interviews with selected students and instructors delivering modules in the course. The questionnaire was distributed to a sample of 150 students with a return ratio of 66% having 100 students only responding to the questionnaire. The study will focus mainly on the students attending and the instructors contributing to the course offered by the Institute of Management Development.

CASE DESCRIPTION

BeckerConviser is a division of Devry Inc, which is a large publicly held higher education company whose main objective is to provide students with the required training that enables them to pass exams to get professional certification in a variety of disciplines. BeckerConviser was launched in Egypt in 1996 at The American University in Cairo offering three main courses; Certified Public Accountant (CPA), Certified Management Accountant (CMA), and Certified Financial Analyst (CFA). Becker Conviser – Egypt mainly depends on pre-recorded CDs that offer comprehensive explanation, examples, and problems that cover the concepts, constructs and information needed by the students. CDs usually run in the classroom and are used as the primary source of instruction. However, during the class time there is always an instructor who acts as a moderator to explain some of the issues that might not be self-explanatory in the CD. CDs are developed to ensure that all students from around the world receive the same quality of education. However, it is important to note that students with English as their second language frequently find it difficult to follow up with the tutorial, without the moderator, since the tutorials have been set for native English language speakers. Respectively, the presence of the tutor becomes vital in the classroom. In addition to the fact that from a cultural perspective, in some markets, in-class interaction and class discussions are still favored. The case of BeckerConviser represents an opportunity to assess the acceptance of technology in the context of a developing country: Egypt.

Research Focus

The objective of the research is to focus on a number of issues that will be addressed through the conduct of the actual study and the analysis of the data collected through the survey questionnaire and the interviews and that includes:

- Validate the technology acceptance model in the context covered.
- Demonstrate that beliefs mediate the effect of individual differences on acceptance of technology.

Table 2. Operationalization of Variables

Variables				
Variable	Description	Type	Data Type	Scale
TA	Technology Acceptance	Dependant	Ordinal	Discrete (0-5) 0: Accept, 5: Reject
PEOU	Perceived Ease of Use	Independent/ Dependant	Ordinal	Discrete (0-5) 0: Easy, 5: Not Easy
PU	Perceived Usefulness	Independent	Ordinal	Discrete (0-5) 0: Usefull, 5: Not Usefull
TiW	Tenure in Workplace	Independent	Ordinal	Discrete (0-1) 0: junior, 1: senior
LoE	Level of Education	Independent	Ordinal	Discrete (0-1) 0: Graduate, 1: Undergraduate
PsE	Prior Similar Experiences	Independent	Ordinal	Discrete (0-1) 0: Yes, 1: No
PiT	Participation in Training	Independent	Ordinal	Discrete (0-1) 0: yes, 1: No

- C. The ease of use and usefulness beliefs about information technology innovation is:
 - a. Negatively associated with the length of tenure in the workplace
 - b. Significantly and positively associated with the level of education.
 - c. Significantly and positively associated with the extent of prior experience with similar technologies.
 - d. Significantly and positively associated with the participation in training.

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