Technology Acceptance for CBT in Secondary Schools of Saudi Arabia

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Abstract— Assessment is integral to any learning environment in the present era of ‘Information and Computer Technology’ (ICT), where numerous and different e-Learning environments are on offer. For assessment of these environments, Computer Based Testing (CBT) is the norm that now eases the path for both learning and assessment in student-centered e-Learning environments. Current implementation of CBT in Saudi Arabia’s secondary schools suffers limitations that include insufficient planning and evaluation. To help overcome these limitations, this paper looks at critical success factors for CBT implementation as facilitated by the Adaptive Structuration Theory (AST) for assessing the acceptance of technology by students. A conceptual model is proposed along with a theoretical discussion; leaving the development and evaluation of a practical framework for the future.

Keywords: computer based testing; e-learning; e-assessment; secondary schools; Saudi Arabia; acceptance theory

I. INTRODUCTION

In this modern era of web technology, many e-Learning environments abound such as the Personal Learning Environment [2], Computer Based Learning (CBL) system. As assessment is integral to any learning environment, Computer Based Testing (CBT) is the most popular tool available to assess e-Learning environments. As discussed in a previous work [4] CBT focuses on three major dimensions: Technical, Educational, and Economical. In the case of education in the secondary schools of Saudi Arabia, the Technical domain is absent and two evaluation sub-domains covering the roles of teachers and students have also been neglected. In addition, e-assessment in Saudi Arabia’s secondary educational venue suffers a lack of suitable planning as well as any comprehensive policy framework. Sadly, the present norm presents little to no evaluation-of or feedback-on the system’s performance and/or acceptance by users. But remedies do exist and there are different theories developed that intelligently assess user acceptance of a given technology.

This paper extends the purview of a previous submission by proposing a model for the development of a CBT system for secondary schools in Saudi Arabia. Previously, we presented and clearly identified critical factors affecting implementation [4]. In this paper, a discussion of the advantages and disadvantages regarding theoretical approaches to assessing the ‘acceptance’ of CBT systems is undertaken by means of a select literature review; after which, a conceptual model is presented.

II. LITERATURE REVIEW

Whenever a new technology is proposed and delivered, the need arises to learn about its acceptance by users as a crucial component of research leading to the development of technological improvements. There are several theories that help us determine the acceptance of any specified IT technology. These include: ‘Theory of Reasoned Action’ (TRA) [7]; ‘Technology Acceptance Model’ (TAM) [5]; ‘Theory of Planned Behavior’ (TPB) [1]; ‘Combined TAM and TPB’ (C-TAM-TPB) [11]; ‘Technology Acceptance Model 2’ (TAM 2) [13]; ‘Social Cognitive Theory’ (SCT) [3]; ‘Model of PC Utilization’ (MPCU) [12]; ‘Innovation Diffusion Theory’ (IDT) [10]; and ‘Unified Theory of Acceptance and Use of Technology’ (UTAUT) [10]. Of these, the ‘Technology Acceptance Model’ (TAM) is the most popular and is widely used by international researchers as the gold standard for assessing technology acceptance. ‘Unified Theory of Acceptance’ and ‘Use of Technology’ (UTAUT) are hybrids of ‘all the above’ mentioned theories. They were developed by employing different constructs from each theory cited and have become quite popular. However, all these approaches focus on different factors that measure the acceptance of technology. The most crucial factors that require highlighting are, however, the ‘social influences on users’ by technology, and the ‘social behaviors of users’ towards technology. Most especially in an e-Learning environment, each learner should be satisfied by the technology and comprehend the system. In order to achieve this degree of approval, designers and educators are best advised to appreciate both aspects of these socially oriented effects. Such knowledge helps to improve the technology according to user-needs and, in turn, facilitates enhanced reliability and effectiveness of the e-Assessment system. For this reason, Adaptive Structuration Theory (AST) [10] is proposed. Descriptions of TAM, TAM2, UTAUT and AST are given in the following section.

A. Technology Acceptance Model (TAM)

Causal relationships between perceived usefulness, perceived ease of use, system design features, attitude toward using, and actual usage behavior can be specified by the Technology Acceptance Model (TAM) [5].
choices influence user acceptance, they are very helpful in evaluating information technology acceptance by users; TAM just happens to provide all of this with an informative presentation mechanism. Davis, Bagozzi & Warshaw published the original TAM schemata under the title, “User Acceptance of Computer Technology: Comparison of Two Theoretical Models” in a pioneering article [5]. Their novel work is frequently cited by many students, researchers, authors, PhD students and sundry scholars, but very seldom by business practitioners. Fig. 1 illustrates the TAM model.

B. Technology Acceptance Model 2 (TAM 2)

To address TAM’s limitations, Venkatesh and Davis [13] proposed TAM 2 which incorporates additional theoretical constructs covering social influence processes (subjective norm, voluntariness, and image), and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease-of-use). The general determinants of perceived usefulness in TAM 2 are: subjective norm, image, job relevance, output quality, result demonstrability, and perceived ease-of-use. TAM 2 also identifies the moderator’s experience and voluntariness. This model was tested in more than four systems; two of which were ‘mandatory usage’ and two ‘voluntary’. TAM 2 and UTAUT were able to differentiate between mandatory and voluntary use. Fig. 2 illustrates the model.

C. Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT theory [14] examines one’s ‘intention’ to use an information system. This theory describes fours variables: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. These are considered direct dominant indicators of the ‘intention-to-use’ and of ‘usage behavior’ towards information systems. Venkatesh, et al. suggested that gender, age, experience and voluntariness of use each moderate the previously listed four constructs of use intention and usage behavior [14]. Fig. 3 shows a model that incorporates the core construct of intention-to-use and usable technology from numerous behavioral models on available information systems (IS) usage.
D. Adaptive Structuration Theory (AST)

AST is based on Structuration Theory as presented by [8]. The Structuration Theory was adapted by [6] who studied the interaction of organizations and groups with information technology, which is why it is called Adaptive Structuration Theory. This theory is a lens through which one can view day-to-day interactions in a group or organization. “If the structure of a group stays the same, it is because members are acting in such a way that the same structure is created and maintained with every act” [6]. AST is a way of making observable the invisible communication processes that shape behavior in groups (see Fig. 4). When change is needed, AST helps identify shared responsibilities and areas where new or different rules and resources can be introduced. Every organization records some variation in their structure as they implement advanced technologies. AST assists in studying these variations and changes. Neiderman suggested an expansion of AST by adding the consideration of contextual and organizational elements [9].

![Figure 4. Adaptive Structuration Theory (AST) [6]](image)

TABLE II. General summary of strengths and weakness of each theory

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<th>Theory</th>
<th>Strength</th>
<th>Limitation</th>
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| Technology Acceptance Model (TAM) | • Perceived usefulness  
• Perceived ease-of-use  
• More factors involved to determine user perceptions of usefulness  
• Lower explanation of intention variance (~30%)  
• Does not address voluntariness of use and facilitating factors  
• Fails to address individual differences, e.g. experience, age | • Field studies did not involve experimental manipulation of theoretical constructs |
| Technology Acceptance Model 2 (TAM 2) | • Differentiates between mandatory and voluntary use  
• Explains 60% of intention variations  
• Direct effect on user intentions; perceived usefulness; and  
• Sample size is less than 50 which reduces power of significance test  
• Constructs were measured by only two items; data analysis did not use structured equation modeling which might by | • Needs additional research on validation of measure and robustness  
• Does not include individual factors; e.g. self-motivation that may help explain information system acceptance |
| Unified Theory of Acceptance and Use of Technology (UTAUT) | • Superior factor strength  
• Explains 70% of intention variance  
• Differentiates mediating from determining factors  
• More focused on social structures and rules provided by technology  
• Considers social structures related to technology as well as social actions  
• Analyzes differences between groups | • Vague information about the influence of actions on the structure  
• Differentiating influence delivery is not clear; as if action is delivered with or without effects  
• Difficulty in assigning a particular effect to the particular content in a dynamic environment |

III. PROPOSED CONCEPTUAL MODEL

As discussed above, successful CBT implementation initially requires the identification of a curriculum’s goals as well as learning outcomes and requisite skills. An adequate ICT infrastructure and the necessary resources are also basic requirements of a reliable CBT system. Moreover, a precise evaluation method is extremely crucial when monitoring CBT’s effective implementation. However, any lack of proper evaluation leaves the entire system open to undesirable changes without means of detecting when or how or to what extent any drift had occurred. This is, unfortunately, presently the situation with Saudi Arabia’s CBT system, as after several years of implementation, no proper evaluation system is in place.

Hence, after identifying critical factors for CBT implementation in Saudi Arabia’s secondary school system, i.e. the roles of Technology, Teachers and Students, we selected AST for the future development of its CBT framework. Our proposed conceptual model is based on critical factors and theory that further advance a practical CBT structure. Fig. 5 illustrates the proposed conceptual model in detail.
As described above, we propose the utilization of Adaptive Structuration Theory (AST) because AST focuses on behavioral changes that occur when implementing new technologies. Its method and framework also facilitate the analysis of between-group differences. Furthermore, AST accounts for the structural potential of technology while at the same time it focuses squarely on technology use as a key determinant of technology’s several impacts. These are critical factors that will help Saudi Arabia develop a CBT framework that will rise above the limitations and shortfalls of its previous implementations.

IV. CONCLUSION AND FUTURE RESEARCH

Assessment, being an essential part of the learning environment, needs careful attention. In the context of e-Learning environments, Computer Based Testing (CBT) provides a rational approach to e-Assessment. CBT is already implemented in Saudi Arabia’s secondary schools but lack of proper planning and evaluation has diminished its value. Major areas that are critical factors for success are the roles of technology, teachers and students in the e-education milieu. Another vital area is that of effectively evaluating the CBT system. For these reasons, Adaptive Structuration Theory (AST) was selected as the optimal means to assess the CBT framework. Future works therefore include the development of a CBT framework based on the critical success factors discussed above and AST. After the development of a framework, initial evaluations are then required before implementation in the secondary school system of Saudi Arabia.

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