COMPUTER BASED ASSESSMENT ACCEPTANCE MODEL FOR SECONDARY SCHOOL STUDENTS IN SAUDI ARABIA

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy

School of Computing
Faculty of Engineering
Universiti Teknologi Malaysia

DECEMBER 2020

DEDICATION

This thesis is dedicated to my family, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

ACKNOWLEDGEMENT

I wish to express my deepest appreciation to all those who helped me, in one way or another, to complete this thesis. First and foremost, I thank Allah almighty who provided me with strength, direction and showered me with blessings throughout the years. My sincerest gratitude to my supervisor Assoc. Prof. Dr. Ab Razak Bin Che Hussin for his continuous guidance and support. With his expert guidance and immense knowledge, I was able to overcome all the obstacles that I encountered during my journey of Research I could not have imagine having a better advisor and mentor.

Many thanks to the colleagues of the Faculty of Computing, Universiti Teknologi Malaysia, for their idea's sharing and discussions.

Sincere appreciation to all Faculty of Computing, Universiti Teknologi Malaysia, lecturers and staff for their support and guidance during my research period.

Special thanks to my parents, family, and all my lovely friends for their continuous encouragement and support throughout the time.

ABSTRACT

Computer-based assessment (CBA) has significantly remodelled educational evaluation processes and allowed teachers to better manage growing number of students especially in secondary schools in Saudi Arabia. However, secondary school students are showing resistance to accept CBA systems, and the factors causing this resistance to CBA systems have remained matters of speculation. Using a modified empirically validated model, the present study systematically established major determinants of this resistance by drawing on the well-known Computer-Based Assessment Acceptance Model (CBAAM). The CBAAM model is an efficient model but fails to consider some other factors that will majorly affect the acceptance and use of CBA systems. The researcher carried out a systematic literature review for the period of 2007–2018, followed by a field assessment from 10 secondary schools in Saudi Arabia, where three major factors (computer attitude, computer anxiety and computer literacy) affecting CBA system acceptance were extracted from the researcher's interaction with the students. Drawing from the field assessment, the existing CBAAM model is extended resulting in a comprehensive model with 22 hypotheses. Thereafter, a questionnaire was developed and the content is validated using 15 experts comprising of 9 academics and 6 practitioners. The model was evaluated with 565 responses which comprises of 274 males and 289 females. The Partial Least Squares Structural Equation Modelling (PLS-SEM) technique was used in the evaluation. The result showed that 17 out of the 22 hypotheses were found to be significant and explained 74% of the variance. The most important factors from the significant relationships are 'perceived usefulness', 'perceived playfulness', 'content' and 'computer attitude' which were identified using the Importance-Performance Map Analysis (IPMA). Furthermore, results confirmed that secondary school student's 'behavioural intention' towards CBA acceptance is directly influenced by 'computer anxiety', 'content', 'perceived playfulness' and 'perceived usefulness'. While, 'facilitating conditions', 'goal expectancy', 'computer attitude' and 'perceived ease of use' showed indirect influence. This study's results can effectively guide educationists and decision makers to better manage CBA resistance and improve its acceptance by secondary school students in Saudi Arabia.

ABSTRAK

Pentaksiran berasaskan komputer (CBA) telah mengstruktur kembali proses penilaian pendidikan dengan jelas dan membolehkan guru menguruskan peningkatan jumlah pelajar dengan lebih baik. Walau bagaimanapun, para pelajar menunjukkan penolakan dalam penerimaan sistem CBA, dan faktor-faktor yang menyebabkan penolakan terhadap sistem CBA ini telah mewujudkan spekulasi permasalahan. Dengan menggunakan model yang disahkan secara empirikal, kajian ini secara sistematik mewujudkan penentu utama terhadap penolakan ini dengan menggunakan Model Penerimaan Penilaian Berasaskan Komputer (CBAAM) yang dikenali secara meluas. Penyelidik melakukan tinjauan literatur sistematik dari tempoh 2007 hingga 2018, hal ini diikuti dengan penilaian lapangan dari 10 sekolah menengah di Arab Saudi; di mana tiga faktor utama (sikap terhadap komputer, kegelisahan komputer dan literasi komputer) yang mempengaruhi penerimaan sistem CBA telah diambil dari interaksi antara penyelidik dengan pelajar. Berdasarkan penilaian bidang yang berkaitan, model CBAAM yang sedia ada telah diperluaskan skop sehingga menghasilkan model yang komprehensif dengan melibatkan 22 hipotesis. Sehubungan dengan itu, borang soal selidik disediakan dan isi kandungannya disahkan dengan melibatkan 15 pakar rujuk yang terdiri daripada 9 ahli akademik dan 6 pengamal aktif di dalam isu berkaitan. Model tersebut dinilai dengan 565 responden yang terdiri daripada 274 lelaki dan 289 wanita. Teknik Partial Least Squares Structural Equation Modeling (PLS-SEM) digunakan dalam proses penilaian. Hasil kajian menunjukkan bahawa 17 daripada 22 hipotesis didapati signifikan dan merangkumi 74% varians. Faktor-faktor yang paling penting dari hubungan yang signifikan adalah 'kegunaan yang dirasakan', 'keseronokan yang dirasakan', 'isi kandungan' dan 'sikap terhadap komputer' yang dikenal pasti menggunakan Analisis Peta Kepentingan-Prestasi (IPMA). Tambahan pula, keputusan kajian mengesahkan bahawa 'niat tingkah laku' pelajar sekolah menengah terhadap penerimaan CBA secara langsung dipengaruhi oleh 'kegelisahan menggunakan komputer', 'isi kandungan', 'keseronokan yang dirasakan' dan 'kegunaan yang dirasakan'. Sementara itu, 'syarat pemudahcaraan', 'jangkaan tujuan' dan 'kemudahan penggunaan yang dirasakan' menunjukkan pengaruh secara tidak langsung. Hasil kajian ini berhasil membimbing para pendidik dan pihak pembuat keputusan untuk menguruskan penolakan CBA dengan lebih baik dan meningkatkan penerimaannya dikalangan pelajar sekolah menengah di Arab Saudi secara lebih berkesan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AVE	-	Average Variance Extracted
BI	-	Behavioural Intention
C	-	Content
CA	-	Computer Anxiety
CAC	-	Cronbach's Alpha Coefficient
CATT	-	Computer Attitude
CBA	-	Computer Based Assessment
CBAAM	-	Computer Based Assessment Acceptance Model
CBT	-	Computer Based Test
CL	-	Computer Literacy
CR	-	Composite Reliability
CSE	-	Computer Self-Efficacy
CVI	-	Content Validity Index
EP	-	Explanation and Prediction
FC	-	Facilitating Conditions
GE	-	Goal Expectancy
HEI	-	Higher Education Institution
ICT	-	Information and Communications Technology
IPMA	-	Importance-Performance Map Analysis
IRT	-	Item Response Theory
IS	-	Information System
IT	-	Information Technology
KSA	-	Kingdom of Saudi Arabia
LV	-	Latent Variables
NAEP	-	National Assessment of Educational Progress
PBA	-	Paper-Based Assessment
PEOU	-	Perceived Ease of Use
PLS	-	Partial Least Squares
PP	-	Perceived Playfulness
PU	-	Perceived Usefulness

PEOU		Perceived Ese of Use
QA	-	Quality Assessment
RQ	-	Research Question
SCT	-	Social Cognitive Theory
SEM	-	Structural Equation Modelling
SE		Self-Efficacy
SI	-	Social Influence
SLR	-	Systematic Literature Review
TAM	-	Technology Acceptance Model
TPB	-	Theory of Planned Behavior
TRA	-	Theory of Reasoned Action
UTAUT	-	Unified Theory of Acceptance and Use of Technology
UTM		University Technology Malaysia
VIF	-	Variance Inflation Factor

LIST OF SYMBOLS

R^2	-	Coefficient of Determination
η	-	Dependent Variable
f^2	-	Effect Size
α	-	Error Probability
ξ	-	Independent Variable
p	-	Path Coefficient Values
β	-	Path coefficients
£	-	Pound Sterling
Q^2	-	Predictive Relevance
q^2	-	Q^2 effect size
t	-	Standard Error Values

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

Student assessments are vital to the evaluation of teaching quality and learners' subject knowledge (Nikou 2013; Faniran & Ajayi 2017). This essential component of any learning model measures overall student performance and involves systematic collection and analysis of student data, data interpretation, and actions taken regarding adverse performance outcomes (De & Do 2011). Tutors assess learners and learning output to provide informed and motivational directives based on the results (Maqableh *et al.* 2015). Assessment should not simply be done to gauge students' success; it must be used to improve their learning capabilities (Shute 2017). Information and Communications Technology (ICT) is widely used in higher educational settings with many applications to electronic learning and maintaining student records *(Deutsch et al.* 2012; Masa'deh, Shannak & Maqableh 2013; Maqableh *et al.* 2015). The introduction of these technologies marked a new era of precise, personalized, instantaneous and fascinating Computer Based Assessment (CBA) capabilities (Christakoudis *et al.* 2011).

CBA systems comprise electronic/digital forms of assessment (Nguyen *et al.* 2017). Current assessment techniques necessitate the use of ICT tools and applications (Terzis & Economides, 2011) which offer numerous benefits over conventional methods, including test security, cost reductions and less time as a result of the use of digital formats when assessing student progress (Nguyen et al. 2017). CBA's endless possibilities also involve processes that better enable students to identify and resolve complex tasks (Ras *et al.* 2013). With CBA's, attractive features include speed, cost-reduction, automated feedback, record maintenance, and a variety of very reliable collaborative assessment techniques (Drasgow, 2015). CBA has, therefore, become an

essential tool in student evaluation because it allows educators to save time and money while maintaining standard in student's evaluation (Deutsch *et al.* 2012).

Furthermore, contemporary global educational assessments techniques have abandoned Paper-Based Assessment methods (PBA) and embrace the CBA systems (Scherer *et al.* 2017). CBA is now preferred to traditional methods, especially in secondary and higher institutions (Maqableh *et al.* 2015). CBA systems also enable qualified learners to understand and resolve complex tasks (Greiff *et al.* 2016; Tempelaar *et al.* 2015). By using clever adaptation algorithms, assessment systems can also be tailored to fit a desired knowledge base by accessing enormous databases to allow a more precise selection of complementary items. Thus, it is possible to deliver different versions of the same assessment technique that is specifically tailored for different group of learners. Assessments can also be enhanced by directly addressing a learner's knowledge level. This increases accuracy by targeting learner abilities and help optimize preparation efficiency when selecting a specific level of difficulty for examinations.

The growing importance of CBA and its effect on education have substantially transformed the academic environment in Saudi Arabia (KSA) (Al-asmari & Khan, 2014). Saudi Arabia joined this race with other nations early on (Noor-Ul-Amin, 2013). However, even though the government made massive investments to develop public education (Albugami & Ahmed, 2015), these efforts did not translate to wider CBA acceptance. Moreover, few empirical studies on the use of CBA exists, and those that do, generally focus on CBA implementation rather than acceptance, especially by students (Dammas, 2016). Therefore, it is a necessity to examine factors that affect the acceptance of CBA systems in KSA.

1.2 Problem Background

Assessment procedures provide a useful feedback that measures learning progress (Zhang *et al.* 2017). Understanding advantages or hindrances to students' progress in learning environment is crucial to improving the performance of instruments, teachers, designers and learners (Soffer *et al.* 2017), especially for 21st century skills in problem solving, collaboration and information literacy. CBA systems can effectively measure all such areas in real time settings that simulate specific environments (Engelhardt *et al.* 2017). Secondary and post-secondary education researchers have examined CBA systems to determine whether or not students prefer traditional paper-based testing (Oduntan *et al.* 2015). Evidence consistently demonstrate that, post-secondary students are quick to accept CBA testing methods (Bloom *et al.* 2017). However, secondary school students, especially in KSA are not, and there is limited empirical literature on this issues. The Saudi government has shown keen interest in advancing an efficient strategy for ICT implementation in all educational domains especially assessment, and requires empirical studies on ICT acceptance, implementation and practice (Al-asmari & Khan, 2014).

Student assessment is fundamental to every learning paradigm *(Maqableh et al.* 2015). Hence, it is crucial to determine elements that affect learners' attitudes towards CBA usage for successful implementation. Nearly 25% of KSA's budget in 2015 was committed to education ($36 billion), with substantial increases targeting technologies like CBA integration within national curricula as well as improved ICT facilities (Ministry of Finance, 2015). This colossal venture cannot yield the desired outcomes if students are unwilling to accept these systems. The literature reflects little to no assessment of student attitudes and responses to CBA usage (Dammas, 2016). Studies have also shown a distinct lack of student interest in accepting CBA as an effective means of evaluation (Faniran & Ajayi, 2018). This distinct lack of interest was accompanied by an endemic fear factor among KSA students, making it nearly impossible to achieve projected ICT objectives. The present research therefore provides empirical evidence of factors that influence CBA acceptance by students, thereby supporting the kingdom's aspirations for improved acceptance of CBA.

Furthermore, regular assessments and feedback delivery for large number of students requires a lot of time, which makes it unpleasant and impractical, yet a necessary task (Cazan & Cocorad, 2016). Technology have lightened this burden by light years. Smartphones, tablets, high-speed computers, Internet, wearable devices and virtual/augmented reality machines have stimulated countless innovations in assessment design, applications and practice (Shute & Rahimi, 2017). PBAs are therefore becoming archaic tools, as CBA assessment systems progressively advance with online adaptations (computer adaptive testing) for vibrant collaborative tasks and models (Pawasauskas *et al.* 2014). CBA's benefits include timely and important feedback with a personalized learning experience (Shute & Rahimi, 2017). Several researchers have investigated the influence of CBA with a focus on affordability and complexity compared to traditional assessment techniques (Nguyen *et al.* 2017). Although a priority for decision makers, any investment in CBA systems amounts to nothing, if students are unwilling to accept this technology. The present study provides a defined solution to CBA resistance by the Kingdom's secondary school students.

Faniran and Ajayi (2016) reported that even university students well acquainted with computers still face challenges when using CBA systems, one of which is, computer anxiety. Noting that secondary school students have little or no experience in CBA, some studies reveal a negative relation between anxiety and performance outcomes (Anisa & Miranda, 2011; Mamasseh, 2013; Lu *et al.* 2016). However, few studies have assessed any association between CBAs and test anxiety (Oduntan *et al.* 2015). Some writers posit that, inadequate computer skills raise the level of student anxiety, which invariably influences CBA performance outcomes (Olufemi & Oluwatayo, 2014). Hence, with a focus on Behavioral Intention (BI) in secondary school students, the present study investigate the factors that can mitigate anxiety and student resistance to CBA systems in Saudi Arabia.

The assessment of secondary school students in Saudi Arabia is fast becoming a difficult task as a result of the growing number of students. It is evidently clear all over the world, that a teacher who is supposed to teach a few number of students now has to take twice the required size of the class. As it is well known, assessing large

number of students consume much of the valuable time of these teachers that would have been channeled towards more productive activities. Thus, the need for the integration of CBA in the method of assessing secondary school students in Saudi Arabia.

Students play an important role in the usage of CBA to ensure successful deployment. The current CBA system employed by secondary schools in Saudi Arabia is very simple. The questions appearance were randomized for each student. Each question has four possible answers and a "next" button, which allow the students to move to the next question after he/she has answered the present question. The CBA system has been used by these students for some time with reservations. To have a first-hand understanding of the students' reservations towards the use of CBA for assessment, the researcher was allowed access to these students during his visits and was able to interact with them on their preference for paper or computer based assessment. To the surprise of this researcher, about 90% of the students choose paper-based assessment as their preferred means of assessment. This aroused the interest of the researcher to find out the factors affecting the acceptance of CBA among these students.

In the process of identifying the major reason why these students prefer paper-based assessment, the researcher was able to realize the fear/anxiety of the students in changing their traditional mode of assessment. They mostly stay away from the computer system whenever possible. Their fear/anxiety of change has transformed into computer anxiety, as the computer is considered a major obstacle to their educational goal attainment. Additionally, from the assessment of the researcher, the students exhibit a negative attitude towards the use of any technology in their assessment. This has made them to form a rigid mindset towards any innovation with the believe that it will negatively affect their future goals. Furthermore, the literacy level of the students in terms of computer usage is quite low. This could be attributed to the general populace, because computer literacy level in the kingdom of Saudi Arabia is low (Alasmary *et al.,* 2014; Dammas, 2016). Thus, computer literacy level of the students

does not come as a surprise to the researcher. This could be a major reason why these students possess negative attitude and anxiety towards the use of CBA. In order to encourage the usage and acceptance of CBA in Saudi Arabia, these factors have to be studied and further explained to guide and enhance the usage of CBA among secondary school students. Thus, this research has taken this opportunity to investigate these factors as well as other factors from the literature to extend the knowledge of CBA acceptance in Saudi Arabia.

1.3 Problem Statement and Research Questions

Assessment is a core component of the learning process as it guides all stakeholders on the outcome of their educational investment. These assessments help the students to assess their learning priorities as well as their commitment to the achievement of their learning goals. Assessing few students is an interesting aspect as the teacher is at a liberty to give feedbacks and encouragement/guidance to the students. However, with the growing number of students, assessment has become a tedious and difficult task for teachers in Saudi Arabia. Thus, the integration of ICT facilities into the learning environment is a pressing need. Additionally, the massive investment in ICT and its integration will amount to nothing if these students are not willing to accept such technology.

Although Saudi Arabia has experienced enormous ICT growth due to massive investments, the extent of CBA implementation, adaptation and acceptance have yet to be fully investigated. Existing studies are either inadequate or non-practical and none address learner acceptance in secondary school settings (Albugami & Ahmed, 2015). Aside from institutional and administrative barriers, significant implementation demands CBA acceptance by learners many of whom are simply not prepared to accept these systems (Boevé *et al.* 2015). Researchers have therefore tried to classify factors that impact student behavioral intention regarding CBA systems, mostly because KSA's investments will amount to nothing if students remain resistant. Along with the increasing proliferation of ICT facilities, post-secondary students have eagerly

accepted CBA systems, which might be attributed to their level of experience as against that of secondary school students.

Furthermore, researchers have mostly looked at CBA's impacts with respect to affordability and complexity, and little attention has been given its acceptability. Noting that even the most experienced students face challenges when using CBA systems, including computer anxiety, a few studies did examine the relationship between CBA systems and computer anxiety (Oduntan *et al.* 2015). Secondary school students seem to be particularly vulnerable to computer anxiety, computer literacy and computer attitude as confirmed from the field assessment carried out by the researcher. Therefore, there is a need to empirically validate these factors and find ways for mitigation. With this in mind, the researcher developed a suitable research model to assess the factors affecting CBA acceptance by secondary school students in KSA.

Addressing key issues, our main research question is: *"How can CBA systems be accepted by secondary school students in Saudi Arabia?"* Three sub-questions were also formulated:

1. What are the factors influencing CBA acceptance by secondary school students in Saudi Arabia?
2. How to develop and evaluate an enhanced CBA acceptance model from the identified factors?
3. How to investigate the most important factors in the proposed model?

These questions posed will help the researcher to achieve the objectives of the research, as it will lead to the identification of factors affecting the acceptance of CBA in Saudi Arabia, formulate an acceptance model as well as determining the most important factors. This will be achieved with a thorough literature review and an on-field assessment of secondary schools and CBA practitioners in Saudi Arabia.

1.4 Research Objectives

To uncover issues that impact student resistance to CBA systems, the following objectives were targeted:

1. To identify the factors that influence CBA acceptance by secondary school students in Saudi Arabia.
2. To develop and evaluate an enhanced CBA acceptance models from the identified factors.
3. To investigate the most important factors from the proposed model.

1.5 Scope of the Research

This study focuses on secondary school students' intentions to accept CBA system. This study's respondents are secondary school students from the Kingdom of Saudi Arabia. For the purpose of this study, the researcher investigated current CBA system practices in Saudi Arabia using 10 secondary schools from different genders (six females, four male) in order to establish the levels of CBA acceptance among the students. Secondary schools in Saudi Arabia are separated based on the two genders. The same curriculum is used for both the schools. More details on secondary school systems in Saudi Arabia is presented in Section 2.4. These schools have exposed their students to the use of CBA systems in assessing their performance for the past ten years. Additionally, only the courses taught in the secondary schools were assessed using CBA. The model development is based on the factors extracted from the interaction between the researcher and the students as well as from the practitioners' input.

1.6 Significance of the Research

This study's significance and contributions are theoretical and practical. Theoretically, prior studies had employed generic acceptance theories, including 1) the Technology Acceptance Model (TAM); 2) the Theory of Reasoned Action (TRA); and 3) the Theory of Planned Behaviour' (TPB). The study investigates vital elements that affect CBA system acceptance by enhancing the Computer Based Assessment Acceptance Model (CBAAM) with input from the students.

As for practical contributions, outcomes provide insight on conditions for optimal CBA system deployment for administrators, management teams, educators, learners, professional organizations, and researchers. The study also provides a comprehensive overview of student perceptions of CBA for appraisal by examination bodies in Saudi Arabia. As such, it will help administrators identify and consequently tackle specific problems affecting students when utilizing CBA and other forms of e-assessment. The study's results might ultimately become a benchmark reference for stakeholders in KSA educational processes, as well as product development and procurement. Finally, it provides empirical evidence for additional research on learner perceptions on CBA systems in Saudi Arabia.

1.7 Thesis Structure

This thesis is organized and presented in six chapters. This section provides an overview on how the chapters are structured.

CHAPTER 1 (Introduction): This chapter presented the main context of this research highlighting the research problem, objectives, scope, and the significance of this study.

CHAPTER 2 (Literature Review): this chapter will review prior literatures related to CBA acceptance and highlights the importance of developing Computer Based Assessment Acceptance Model for Secondary School Students in Saudi Arabia.

CHAPTER 3 (Research Methodology): Describes the study's methodology and approach; defines factors that affect student's acceptance of CBA; then outlines the research framework based on these factors.

CHAPTER 4 (Model Development and Instrument Validation): Examines theories regarding the acceptance of CBA; classifies factors that impede CBA acceptance; develops a research model in terms of face validation, content validity plus a pilot study; discusses metrics and structural model assessment in PLS.

CHAPTER 5 (Data and Model Validation): Describes survey results; assesses outcomes from the measurement model based on collected data; demonstrates acceptance of a CBA system.

CHAPTER 6 (Conclusion and Implications): Reviews research outcomes and concludes with a discussion of contributions and potential.

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