

**THE INFLUENCE OF CULTURE AND ATTITUDE
ON STUDENTS' LMS ACCEPTANCE IN
LEARNING MATHEMATICS AT THE
UNIVERSITY OF HA'IL IN SAUDI ARABIA**

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2022

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LEARNING MATHEMATICS AT THE
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by

ALSHAMMARI KHALED FAHAD A

**Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy**

January 2022

ACKNOWLEDGEMENT

I am grateful to all of those with whom I have had the pleasure to work during this and other related projects. Each of the members of my Dissertation Committee has provided me extensive personal and professional guidance and taught me a great deal about both scientific research and life in general.

I would especially like to thank Associate Professor Dr. Azidah Abu Ziden, my main supervisor. As my teacher and mentor, she has taught me more than I could ever give her credit for here. She has shown me, by her example, what a good scientist (and person) should be.

As well as Associate Professor Dr. Dr. Shuki Osman, whom support and guidance played a major role in my career, academically and professionally.

Nobody has been more important to me in the pursuit of this project than the members of my family. I would like to appreciate my dear family, whose love and guidance are with me in whatever I pursue. They are the ultimate role models. Most importantly, I wish to thank my loving and supportive wife, and my wonderful children, who provide unending inspiration

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LIST OF ABBREVIATIONS

APC	Average Path Coefficient
ARS	Average R-squared
AVE	Average Variance Extracted
AVIF	Average Variance Inflation Factor
CFA	Confirmatory Factor Analysis
CR	Composite Reliability
DV	Dependent Variable
ISI	International Scientific Indexing
IV	Independent Variable
LV	Latent Variable
PLS	Partial Least Squares
PLS–SEM	Partial Least Squares–Structural Equation Modeling
SCOPUS	Elsevier’s Abstract and Citation Database
SEM	Structural Equation Modeling
WoS	Web of Science Indexing Database

**PENGARUH BUDAYA DAN SIKAP TERHADAP PENERIMAAN PELAJAR
LMS DALAM PEMBELAJARAN MATEMATIK DI UNIVERSITI HA'IL DI
SAUDI ARABIA**

ABSTRAK

Kepesatan perkembangan teknologi maklumat dan komunikasi (TMK) dalam tempoh beberapa dekad telah mempromosikan penggunaan sumber e-pembelajaran seperti Sistem Pengurusan Pembelajaran (LMS), yang kini menjadi satu bentuk keperluan di Arab Saudi. LMS digunakan bagi meningkatkan pengalaman pembelajaran, menyediakan pelajar dengan mengajar mereka kemahiran yang berkaitan teknologi dan meningkatkan daya saing di samping mengurangkan penggunaan waktu serta ruang dalam proses pendidikan. Teori asas dalam mengkaji variabel yang mempengaruhi penggunaan LMS difokuskan pada *Unified Theory of Acceptance and Use of Technology* (UTAUT). Berdasarkan hipotesis-hipotesis ini, diandaikan bahawa konstruk model akan meningkatkan niat tingkah laku siswazah untuk menggunakan LMS dalam mempelajari matematik. Hanya tiga dimensi budaya yang tidak menunjukkan keinginan yang signifikan untuk menggunakan LMS oleh siswazah yang mungkin berkait dengan masyarakat Arab yang kompleks. Dalam kajian ini, dua kaedah digunakan iaitu soal selidik bagi meneroka persepsi pelajar mengenai pemboleh ubah kajian sementara temu bual separa berstruktur bersama pelajar secara individu digunakan untuk menyokong dapatan daripada kaji selidik. Data dikumpul dan dinilai menggunakan Statistical Package for the Social Sciences (SPSS). Malah, kajian ini turut tertumpu pada prinsip analisis sains sosial, analisis data yang merangkumi tiga langkah utama: menyiapkan dan mengatur data untuk disemak

(penyediaan data), menjelaskan data (statistik deskriptif), dan menilai teori dan model (statistik inferensi). Model pengukuran melibatkan struktur-struktur (pemboleh ubah laten) dan hubungannya dengan penanda mereka (item), yang ditakrifkan dalam PLS - SEM sebagai outer model. Pemilihan alat pengukuran bagi proses pengiraan tersebut bergantung pada jenis struktur dalam model, sama ada ujian ramalan atau formatif. Penyelidikan ini membuat hipotesis bahawa jangkaan kejayaan, jangkaan komitmen, pengaruh sosial, sikap dan budaya pelajar khususnya dari segi kesesuaian, hedonisme, kebajikan, keselesaan, kawalan, pencapaian, dan arahan sendiri mempunyai kesan positif yang signifikan terhadap niat tingkah laku siswazah ke arah penggunaan LMS dalam mempelajari matematik di UOH di Arab Saudi. Di samping itu, niat tingkah laku sangat berkaitan dengan penggunaan sebenar LMS oleh siswazah UOH dalam pengajian matematik. Kajian ini telah memperkenalkan struktur budaya yang berhubung kait dengan niat tingkah laku yang sangat berguna dalam memperkenalkan teknologi baru dalam mempelajari matematik bagi pendidikan tinggi, terutama di UOH. Penemuan semasa menunjukkan bahawa walaupun terdapat beberapa kajian membuktikan wujudnya hubungan positif antara pemikiran pelajar dan niat tingkah laku mereka terhadap penggunaan LMS, namun wujud beberapa kajian yang menunjukkan hasil yang bertentangan kerana perbezaan budaya dan taburan geografi serta latar belakang sosio-ekonomi.

**THE INFLUENCE OF CULTURE AND ATTITUDE ON STUDENTS' LMS
ACCEPTANCE IN LEARNING MATHEMATICS AT THE UNIVERSITY OF
HA'IL IN SAUDI ARABIA**

ABSTRACT

In the past few decades, information and communication technology (ICT) has grown rapidly, promoting the use of e-learning resources such as learning management system (LMS), which is now a requirement in Saudi Arabia. LMS was adopted to increase learning experience, prepare students by teaching them technology-related skills and enabling them to become competitive, and reducing time and space use in educational processes. The theoretical basis for researching variables affecting the usage of the LMS is focused on *Unified Theory of Acceptance and Use of Technology* (UTAUT). On the basis of these hypotheses, it is assumed that the model constructs will improve the behavioural intention of the students to use LMS at an incremental level in studying mathematics. Only three cultural dimensions showed no significant effect on LMS usage by the students, which may be attributed to the complexities of Saudi Arabian society. In this study a questionnaire was used to explore the perceptions of students regarding the variables of the study. The data were collected and evaluated using the Statistical Package for the Social Sciences (SPSS). In fact, focused on analytical principles of the social sciences, data analysis includes three major steps: preparing and arranging data for review (data preparation), explaining data (descriptive statistics), and evaluating theories and models (inferential statistics). Measurement model is a component of the route model that involves structures (latent variables) and their relationships with their markers (items), defined in PLS–SEM as

the outer model. Researchers choose the evaluation tool for the calculation process depending on the type of structures in the model, whether predictive or formative tests. The research hypotheses that success expectation, commitment expectation, social influence, attitude and culture of the students have a significant positive effect on the behavioral intention of the undergraduate students towards the use of the LMS in learning mathematics at UOH in Saudi Arabia. In addition, behavioral intention is strongly linked to the real use of the LMS by UOH undergraduate students in learning mathematics. The current findings illustrated that although several studies showed a positive relationship between the mindset of students and their behavioural intention towards the use of the LMS.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The main objective of this study is to review the impact of using learning management systems (LMS) in public universities in Saudi Arabia, particularly the University of Ha'il (UOH). Several factors were hypothesised in models to adopt the technology and in hypotheses about the acceptance of the LMS. Several platforms have been developed as tools for various LMS to be used as part of the learning process. Nearly every university worldwide is now required to employ such programs as part of academic preparation and learning (Alghamdi & Bayaga, 2016; Schoonenboom, 2014). LMS involves providing online teaching and learning resources and management of subjects (Kamal, 2013; Omar, 2016). In both mixed learning environments and entirely on-line learning environments, LMS has been widely embraced and used as a complementary tool for teaching (Alghamdi & Bayaga, 2016). The knowledge provided by the LMS is accessible to students anywhere and at any time (M. J. S. Asiri, 2012). The LMS provides tagging and marking tools, and enables uploading and exchange of files and documents (M. J. S. Asiri, 2012). LMS also offers multimodal communication methods to promote interaction between teachers and students in the classroom. Such forms of communication include one-to-one social media opportunities (Mutiarra, 2017).

Through classroom observation and video studies, Leung, (2001) identified some common features of classroom practices and beliefs in East Asian countries in contrast to the Western context, and stated that "culture (Confucian culture) might be the more plausible explanation for the features than simply accepting the features as established

practices” (p. 46). After decades of investigation, it has been widely accepted that the shared culture of East Asian countries (i.e. Confucian Heritage Culture) might contribute to their extraordinary mathematics performance (Leung, Graf, & Lopez-Real, 2006; Stankov, 2010; Watkins & Biggs, 2001; Wong, 2004).

However, insufficient empirical studies have been conducted on the relationship between culture and mathematics achievement so far. Although researchers are paying increasing attention to the effect of culture on mathematics education, most previous studies have investigated cultural influences on mathematics achievement using the emic approach. The emic approach addresses cross-culture phenomena from an indigenous and interpretive perspective (Berry et. al, 2002).

Thus, the major aim of the study is to investigate the impact of the culture and attitude of students on LMS acceptance at the UOH in Saudi Arabia. Each chapter is designed in such a way that these goals are accomplished. Specifically, the chapter starts with the research context, which provides an overview of the LMS, with the contributors to its worldwide use and acceptance, especially at UOH in Saudi Arabia. The chapter presents the background, problem statement, and research questions and objectives.

1.2 Research Background

Mathematics (from Greek: μάθημα, *máthēma*, 'knowledge, study, learning') includes the study of such topics as quantity (number theory) (Dictionary, 1989), structure (algebra) (Kneebone, 1963), space (geometry) (Dictionary, 1989), and change (analysis) (LaTorre, Kenelly, Reed, Carpenter, & Harris, 2011; Ramana, 2007; Ziegler & Loos, 2017). It has no generally accepted definition (Mura, 1993; Tobies, 2012). Mathematicians seek and use patterns (Devlin, 1996; Steen, 1988) to formulate

new conjectures; they resolve the truth or falsity of such by mathematical proof. When mathematical structures are good models of real phenomena, mathematical reasoning can be used to provide insight or predictions about nature. Through the use of abstraction and logic, mathematics developed from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity from as far back as written records exist. The research required to solve mathematical problems can take years or even centuries of sustained inquiry.

One of the developments in modern research science is the use of new technology in the learning process (Alghamdi & Bayaga, 2016). Societies are making technological solutions easier and more desirable (Venter et al., 2015) . In addition, technology is a useful aid to learning in general and learning mathematics in particular (Hadi & Mastur, 2021; Kiyanovska & Rashevskaya, 2015; Venter et al., 2015). Specifically, this study considers the use of the LMS as a technological tool that has been used widely to improve the learning process. LMS systems have been developed for the technical incorporation of the functions required in the blended learning process or what is known as electronic (e-) or online learning (Fathema & Sutton, 2013; Nagy, 2016; Suriyah, Zainudin, & Yektiana, 2021).

Technology is a broad term that provides versatility, connectivity and convenience to education courses. In today's society, the educational environment characterised by advancements in communications technology has led to new forms of education such as mixing, listening and computer-assisted teaching. These new forms are designed to meet the needs of learners through methods and techniques that focus on complex, transparent and open discussion. A feature of learning is the

abolition of formal barriers and elimination of spaces by introducing temporal flexibility and creation of a new type of student–teacher relationship (Anderson & Anderson, 2020; Crutcher, 2019; French, 2016; Suriyah et al., 2021).

Several applications have been created as tools and implemented in various LMSs to be used as part of the teaching and learning process. Almost all universities around the world are now pushing their students to use these systems as part of academic teaching and learning practices (Alghamdi & Bayaga, 2016; Schoonenboom, 2014). The LMS includes the provision of subjects and educational management tools for the delivery of online teaching and learning activities (Coates, James, & Baldwin, 2005; Kamal, 2013; Omar, 2016).

The LMS was widely adopted and used as a complimentary medium for teaching content in both blended learning environments and fully online learning environments (e-learning) (Alghamdi & Bayaga, 2016). Through the LMS, students can access course information anywhere, at any time (Al-Busaidi & Al-Shihi, 2010; M. J. S. Asiri, 2012). The LMS offers tools for task tagging, note taking, and uploading and sharing of files and documents (M. J. S. Asiri, 2012). Multi-modal communication approaches are also provided in the LMS to promote interaction between students and teachers in the classroom. Such modes of communication offer opportunities for one or more platforms in the form of social media (Alghamdi & Bayaga, 2016).

Blackboard, Moodle, JUSUR and Desire2Learn are some of the most popular LMS sites that provide a unique teaching experience outside traditional teaching (M. F. Moseti, 2019; A. B. N. R. Putra, Mukhadis, Poerwanto, Irdianto, & Sembiring, 2018). The LMS is used for academic institutions to help faculty members and universities save time and money by offering online assessment methods through

proctored assessments and examinations, as well as by arranging services. LMSs are useful learning instruments that improve pedagogical processes in a contemporary manner to fulfil the current educational demands of information and communication technology (ICT) in modern societies (Al-Harbi, 2011; Hernández-Ramos, Martínez-Abad, Peñalvo, García, & Rodríguez-Conde, 2014; Teo & Noyes, 2011).

Despite the availability of technology and its widespread use, learners do not make effective use of it in their learning process (Venter et al., 2015), particularly in Saudi Arabia, where the acceptance and use of LMS has faced many obstacles embedded in cultural and moral debate (Aljaloud, 2012). Many individuals have not fully adopted LMS in their learning or teaching activities (Aljaloud, 2012). Understanding Saudi Arabia's citizens as 'drones' who are extremely cautious and conservative towards new technologies contributes to an understanding of their actual usage and attitude towards LMS (Alghamdi & Bayaga, 2016).

Integrating technology into the curriculum entails incorporating technology as a tool to enhance learning in a content area or multidisciplinary setting... Effective technology integration occurs when students are able to select technology tools that assist them in obtaining information quickly, analysing and synthesising it, and presenting it professionally to an authentic audience. Technology should become ingrained in the way the classroom operates as accessible as all other classroom tools. Each lesson or unit is focused on the curriculum outcome, not on the technology (Greene, 2019).

Integrating technology into a standard curriculum not only empowers students, but also enables more advanced learning across broad subject areas. However, these technologies require infrastructure, ongoing maintenance, and repair – one factor

among many that determines whether or not these technologies can be used in curricula and are successful (Bhetuwal, 2019). Beyond the initial cost of the hardware and software, examples of infrastructure required to operate and support technology integration in schools include electricity, Internet service providers, routers, modems, and personnel to maintain the network (Gellersen, Schmidt, Beaudouin-Lafon, & Mackay, 2006).

Several obstacles to the use of LMS have been established in the literature. One of the obstacles suggested by Aljaloud (2012) and Alghamdi and Bayaga (2016) was a lack of technical knowledge that could influence students' attitudes towards the use of LMS. In this respect, the attitude of students towards LMS is significantly influenced by their technical skills, and the absence of such skills that lead to not using the current LMS. They add that proper training should overcome this limitation and enhance students' attitude towards using LMS (Garone, Pynoo, & Tondeur, 2019; Gharat, Vij, & Gopal, 2017; A. Gunasinghe, J. A. Hamid, & A. Khatibi, 2019b). Other researchers argued that, to make a meaningful impact by improving educational experience in any institution for the benefit of students and lecturers, the LMS is dependent on more effective use as a result of a positive attitude towards it. The reason is that the information system generally depends on user attitudes, participation and satisfaction (Alghamdi & Bayaga, 2016; Motaghian, Hassanzadeh, & Moghadam, 2013).

In fact, students learning mathematics achieve greater success by using the LMS in their learning process (Putra et al., 2018) . 'Mathematics is an educational field in which incentives for learning directly affect achievement... Mathematical skills are not developed in isolation, but are developed through the undertaking of

challenging problems and the understanding, at times, of complex ideas. This is not accidental; it typically has to be prepared and guided and is a direct function of teaching' (Ismail & Salih, 2018). LMS has enabled teachers to distinguish teaching, allow curriculum modifications for students of all skill levels, and provide students with appropriate preparation and meaningful guidance that contributes to significant gains in mathematics (Mosiiuk & Minhalova, 2017). In general, technology-based tools can enhance student performance when they are integrated into the curriculum and used in accordance with learning knowledge. Nevertheless, the mere existence of these instruments in the classroom does not provide any assurance that student performance can be improved; they must be part of a cohesive approach to education (Gharat et al., 2017).

State and education officials in Saudi Arabia have initiated a systematic plan to improve general education (AlBalawi, 2013) . The program was designed to accomplish a variety of goals, with particular emphasis on developing the Saudi curriculum to take advantage of the use of technology to improve education. The aim of this project was to make LMS part of public education in an effort to improve student learning and make education accessible to all citizens (AlBalawi, 2013). UOH is one of the universities in Saudi Arabia that takes this trend of using LMS systems to make use of technical resources in the learning process carried out at the university. Blackboard was the LMS application that was deployed in UOH.

In this study, Blackboard for UOH, which was introduced at the university in 2014, is selected to be the experimental platform used in this study. The main functions of the Blackboard system include a homepage of Blackboard, teaching/learning materials, discussion board, quizzes, homework assignments, and links (Lin, Persada,

& Nadlifatin, 2014) . According to Lin et al. (2014); Tella (2012)the Blackboard webpage provides information on the overall course. This webpage contains the syllabus, material on the curriculum, grading and other course-related information. In mathematical contexts, Blackboard provided the creation/editing tools for mathematical equations, such as the menu interface in the word processor. A pop-up calculation tool was implemented into several environments, one of which was the Virtual Classroom where both the chat area and virtual whiteboard were available for use. In the Blackboard Virtual Classroom, the chat area and the Virtual Whiteboard provide an equation tool as a pop-up menu that helps you to enter equations. Nevertheless, those statistical methods are not yet widely available (Alshabeb, Alharbi, & Almaqrn, 2020; Damola, Adebimbo, & ... 2016; M. Moseti, 2019). The goal of this thesis is to adopt these devices along with other Blackboard tools, as LMS technology by UOH students.

According to Bervell and Umar (2017), the features of the learner are one of the factors of successful LMS. Learner traits indicate the need to understand the target population. The characteristics of learners, such as self-efficacy, self-directed behaviour and autonomy, need to be identified (Damola et al., 2016; Gharat et al., 2017). Some researchers have attempted to identify specific student characteristics or other factors that can be used to predict whether or not a student will drop out of apprenticeship or otherwise fail to achieve satisfactory results ; (Abrami et al., 2011; Bouhnik & Marcus, 2006). Characteristics and other circumstances identified in previous studies, including clarity of design, interaction with instructors and active discussion in the context of the course (Barbera, Clara, & Linder-Vanberschot, 2013) Swan, 2001), would increase student satisfaction with LMS. Knowing the behaviours of learners towards LMS is a critical issue in improving LMS usage and outcomes.

This study therefore explores the attitudes of learners towards LMS to understand how to improve LMS satisfaction, behavioural intent and improve learning efficiency. In this analysis, Blackboard is an LMS system used experimentally in this study because it is used for UOH.

Technology adoption is a term that refers to the acceptance, integration, and use of new technology into an environment, while technology acceptance defines how users come to accept and use a technology. Technology acceptance is the first step of technology adoption (Renaud & Van Biljon, 2008; Taherdoost, 2018). So, in order to study the adoption of LMS in learning and inspecting the various factors affecting the adoption of the technology, literature about the acceptance and use of the technology were investigated finding out that UTAUT is one of the most popular theories that explain and predict the intention and actual usage of a technology.

The Unified Theory of Acceptance, and Use of Technology (UTAUT) is a concept that is used to measure the level of recognition of the use of technology in the learning process (Cheng et al., 2011). The model is based on the planned behaviour model (Bervell & Umar, 2017), which is designed to measure the strength of behaviour on the basis of a retained disposition towards that behaviour. According to UTAUT, several factors influence behavioural attitudes towards the use of behaviour, such as performance expectations, commitment expectations and social influence. Sex, age and experience are moderate influences in the design of UTAUT. In fact, the facilitation parameters are used as controls in this model (Mutiara, 2017).

Quality goals are described as the degree to which a person expects that the use of the program can allow him or her to obtain job performance gains. Essentially, as users feel less comfortable about information technology, they often feel less

optimistic about technology (Lin et al., 2014). Expecting effort is defined as the degree of ease associated with the use of the system. Ajarma suggested in 2007 that failure in using LMS may occur due to confusion of its intention and lack of planning (AlBalawi, 2013). Social influence is characterised as the degree to which a person perceives that important others believe that the new system should be used. To ensure the success of the LMS, people need to change their views on the LMS and see it as an option that allows many students in developing countries to have access to better education (AlBalawi, 2013). These factors must be tested in the Saudi Arabian environment.

In an area such as Saudi Arabia with a specific culture and norms, considering the effect of culture on students' expectations of using the LMS is important. Culture and its effect on the adoption of the LMS technologies need to be clarified and understood. Cultural study originated from anthropology and sociology, which was used by many disciplines as an explanation of why people behave in a particular way (Alshabeb et al., 2020). The literature suggested the importance of studying the relationship between culture and technology, especially LMS technology and culture (Abu Nadi, 2012; Ain, Kaur, & Waheed, 2016; Alsaif, 2014; M. J. S. Asiri, 2012; Rajapakse, 2011; Silic & Back, 2013; Tarhini, Teo, & Tarhini, 2016). Successful use of the LMS cannot take place without a similar analysis of cultural influences on the adoption of the LMS (Tarhini, et al., 2016).

The influence of culture has become apparent in many fields, including information systems and telecommunications (Al-Gahtani, Hubona, & Wang, 2007; Baker, Al-Gahtani, & Hubona, 2010); Davison & Martinsons, 2003). In addition, researchers have established a significant correlation between cultural factors and ICT implementation (Elgort, 2005; Erumban & De Jong, 2006; Zhang & Maruping, 2008),

information system (IS) (Twati, 2008) and information technology (IT) (Srite & Karahanna, 2006). Straub, Loch and Hill (2003) clarified that in reality, the effectiveness of technologies developed in one society and then translated to another requires more than technological guidance (Erumban & De Jong, 2006). As a culture is a collection of values and beliefs that are distinct from those of other cultures, culture affects the design and reception of technological systems. Consequently, a lack of acceptance occurs as people have cultural biases, beliefs and values that influence their views of technology (Hill et al., 1994). Understanding and communicating with the receiving cultures would thus enable a better and more successful transfer of technology systems (Straub et al., 2003). As a result, the basic human values theory proposed by Schwartz (1992, 1994) is used in this study to find a correlation between cultural factors and the use of LMS technology.

Some believe that learning through technology will be an essential requirement in life, and this is why preparing students to be effective in using technology will become a divisive issue. Classrooms will stay for training, but the methodology will change many specifics (AlBalawi, 2013). Classroom training will include digital demonstrations, and discovering electronic documents and learning languages will be part of the curriculum. (AlBalawi, 2013) argued that students must be fully committed to using technology to improve student learning and performance.

1.3 Problem Statement

Students' attitude in using LMS for Mathematics has not been discussed extensively in the literature. During the last decade, the movement towards using LMS as a technical resource in the education system in general and in teaching/learning mathematics in Saudi Arabia in particular has been increased (AlBalawi, 2013; E.

Alshehri, 2014). However, to a large extent, this technology is not yet fully utilised due to the lack of positive LMS attitudes among students and the lack of student skills to use this technology (Alebaikan & Troudi, 2010; Alkhater, Wills, & Walters, 2014). Proper training is necessary to overcome this barrier by Saudi universities, but the use of these technologies is still weak and needs to be investigated (Al-Hariri & Al-Hattami, 2017; Nagy, 2016). Several studies have been conducted to predict whether technology will be accepted or adapted, and sequentially many models have been produced to predict technology acceptance (Alasmari, 2017; Cheng et al., 2011). UTAUT is a well-defined acceptance model that examines all potential factors that affect technology acceptance (Alasmari, 2017; Alshehri, 2012; Cheng et al., 2011)). UTAUT was formulated based on the significant elements of all previous models (Alasmari, 2017; Cheng et al., 2011; Hsiao & Tang, 2014; Oye, Iahad, & Rahim, 2014). The pattern, which is not commonly used and examined in Saudi Arabia, also needs to be examined in a complex society such as this country. This model is therefore used in this study.

Teaching can only be changed by using methods known to change culture. Primary among these methods is the analysis of practice, which brings cultural routines to awareness so that Mathematics' teachers can consciously evaluate and improve these methods. A recent study by Hill and Ball (2019) of a large scale professional development program found that analysis of classroom practice was one of three factors predicting growth of teachers' content knowledge. Analysis of classroom practice plays several important roles. It gives math teachers the opportunity to analyse how teaching affects learning and to examine closely those cases in which learning does not occur. It also gives Math teachers the skills they need to integrate new ideas into their own practice. For example, by analysing videotaped examples of other

teachers implementing making connections problems, teachers can identify the techniques used to implement such problems, as well as the way in which teachers embed these techniques within the flow of a lesson.

Several colleges have implemented innovative LMSs, such as Blackboard, to offer mixed learning and e-learning to their students. However, these packages were clearly not designed with respect to mathematics and science in mind. Although some efforts have been made to provide equation editing tools that were not included in earlier versions of the LMS products, they are not easy to use in key areas of collaboration that allow students to work together to solve problems or ask questions from tutors (Leventhall, 2004). In this respect, Leventhall (2004) claimed that ‘if such programs are to be made suitable for studying mathematics, it is important that a well-researched set of specifications be made available to developers.’ To assist in the process of designing the mathematics tools needed in the LMS that are tailored to the Saudi learning environment, this study aims to examine the effect of the factors affecting on the adoption of the Blackboard LMS, because it is the eLearning platform used in UOH. This study uses the perspective of mathematics students at UOH during this examination.

Universities in Saudi Arabia, including UOH, are educational resources that follow the pattern of using LMS technologies (e.g. Blackboard LMS that is used in UOH) in its 2014 education system. However, a number of studies predict that technology will be accepted in educational settings (Alasmari, 2017).

Therefore, the acceptance of LMS technology in Saudi Arabia and the impact of this technology on student achievement are still questionable to a large extent (Al-Hariri & Al-Hattami, 2017). Accordingly, Al-Hariri and Al-Hattami (2017) claimed

in their study conclusion that 'it is proposed that future studies continue to monitor students' use and attitudes towards technology.' This thesis seeks to make a difference in this respect by analysing the student recognition of the use of Blackboard as an educational resource in Saudi universities served by UOH.

The unified theory of adoption discussed a number of key considerations in terms of technology adoption, including performance expectations, commitment expectations, and social impact and fostering circumstances. However, these models were not commonly used to test the acceptance of the LMS in the Saudi environment. Thus, this study contributes to the testing of this model in the acceptance of the LMS in Saudi Arabia, considering different cultures in the Saudi environment. In addition, the impact mechanisms of UTAUT have been evaluated in diverse and multi-cultural ways, but the human cultural values and norms primarily in Saudi Arabia have not been addressed. The objective of this thesis is to explore these factors and their effect on the adoption of the LMS, primarily in using Blackboard to teach mathematics to undergraduate students at UOH.

Given the recognition of the mediating role of gender in the UTAUT context, Saudi society has a special gender situation. According to Article 155 of the Education Policy in Saudi Arabia, gender mixing is not acceptable at all levels of education except in pre-school (Ministry of Education, 1969). At present, medical colleges are excluded from this bill. Thus, this study assumed that, as a result of this special cultural arrangement in Saudi Arabia, gender could have a significant impact on concerns in the use of technology in educational settings. Several scholars have tested this theory (Al-Sarrani, 2010; Kamal, 2013). The study therefore considers the role of gender in moderation.

In addition, several researchers have stated that UTAUT has undergone a number of extensions in several studies due to the specific technology used in each study, the population of each study and the culture of each population (Alasmari, 2017; Venkatesh, Thong, & Xu, 2012). 'Thus, due to such variations between the experiments, new structures or moderators can arise' (Alasmari, 2017). As a result, and because of the special norms and values in Saudi Arabia, two additional constructs, which are student attitudes and culture, have been proposed as an extension of the UTAUT model. In this regard, Raman, Don, Khalid, and Rizuan (2014) have stated that the attitude of students is considered to be the main determinant in the acceptance of education systems. The main variables related to the UTAUT theory are namely; Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions.

In addition, Chen et al. (1999) argued that culture should be seen as a significant factor in the design of technology to enhance the learning system. However, Saudi society has a number of nuances due to religious patterns and guidelines assumed in the world (Arafeh, 2017). One of the objectives of this study is the impact of this culture on the adoption of new technology in higher education mathematics teaching, specifically in UOH.

Accordingly, most of the previous studies based on the use of the LMS in higher education are focused on Western countries (Nandwani & Khan, 2016; Tarhini, Teo, et al., 2016). This condition indicates a lack of research on the use of the LMS in developed countries in general and in Saudi Arabia in particular. Furthermore, this condition indicates that our interpretation of the use of the LMS and the factors that influence its adoption have been greatly affected by the observations of Western

academics and discoveries. However, this does not mean that such findings are of no use to educators and learners from developing countries in general and Saudi Arabia in particular. Such findings may not provide a deeper and richer picture of the entire process of using LMS in these developing countries due to cultural and societal differences between individuals from different countries. Thus, a contextualised Saudi study on the use and acceptance of the LMS, and the factors that influence its acceptance, is needed to generate appropriate recommendations. As a result of this lack of contextualisation on the use and acceptance of the LMS in Saudi research, this study aims to fill this gap in the literature by analysing the impact of factors in the UTAUT model on the use of the LMS in the context of Saudi higher education, along with the two external factors that have been assumed to fit the attitudes and culture of individuals in Saudi Arabia.

1.4 Research Aim and Objectives

The aim of this study is to achieve the following objectives:

1. To examine the influence of the performance expectancy on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics at UOH in Saudi Arabia.
2. To examine the influence of the effort expectancy on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
3. To examine the social influence on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.

4. To examine the influence of the students' attitude on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
5. To examine the influence of the components of culture on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
6. To examine the relation between the behavioural intention of the UOH undergraduate students and their actual use of the LMS in learning mathematics.

1.5 Research Questions

Derived from the previous problem statement, this study aims to answer the following questions:

1. Does performance expectancy have a significant effect on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics at UOH in Saudi Arabia?
2. Does effort expectancy have a significant effect on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics?
3. Does social influence have a significant effect on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics?
4. Does students' attitude have a significant effect on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics?

5. Do components of culture (universalism, security, stimulation, tradition, hedonism, conformity, achievement, benevolence, power and self-direction) in Saudi Arabia have a significant effect on the behavioural intention of the undergraduate students toward the use of the LMS in learning mathematics?
6. What is the relation between the behavioural intention of undergraduate students and their actual use of the LMS in learning mathematics?

1.6 Research Hypothesis

- H01: Performance expectancy has a significant effect on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
- H02: Effort expectancy has a significant effect on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
- H03: Social influence has a significant effect on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
- H04: Students' attitude has a significant effect on the behavioural intention of the UOH undergraduate students towards the use of the LMS in learning mathematics.
- H05: Culture in Saudi Arabia has a significant effect on the UOH behavioural intention of undergraduate students towards the use of the LMS in learning mathematics.
- H05-1 Universalism has a significant effect on the behavioural intention.
- H05-2 Security has a significant effect on the behavioural intention.

H05-3 Stimulation has a significant effect on the behavioural intention.

H05-4 Tradition has a significant effect on behavioural intention.

H05-5 Hedonism has a significant effect on behavioural intention.

H05-6 Conformity has a significant effect on behavioural intention.

H05-7 Achievement has a significant effect on behavioural intention.

H05-8 Benevolence has a significant effect on behavioural intention.

H05-9 Power has a significant effect on behavioural intention.

H05-10 Self-direction has a significant effect on behavioural intention.

H06: Gender is positively moderated by the relationship between influencing factors and the UOH behavioural intention of the undergraduate students towards the use of the LMS in learning mathematics.

H07: Behavioural intention is positively related to the UOH undergraduate students' actual use of the LMS in learning mathematics.

1.7 Significance of the Research

As mentioned, the primary objective of this study is to examine the impact of a number of antecedent variables on the acceptance of the LMS in learning mathematics at public universities in Saudi Arabia, represented by the UOH. The intention of the analysis is to explore the mediating role of student behavioural interests in the interaction between the antecedent variables and the use of the LMS. Once this goal is achieved, using LMS has the potential to implement significant theoretical and practical practices which need to be considered. Furthermore, this work is expected to contribute to the larger analytical body of research that has been conducted on LMS in general and in the context of higher education in particular. In

addition, the research is also expected to contribute to the educational process in Saudi public universities in general and in UOH in particular by producing valuable conclusions and suggestions that could contribute positively to the process of using the LMS in these universities, which would, in effect, improve the education process in Saudi Arabia. The following section deals with two types of significance.

1.8 Research Limitation

The limitation of this study is divided into two main streams, the first is basically on the aim of the study, which is to address the acceptability determinants of the LMS in mathematics in Saudi Arabia. However, the population of this study consists of the students of the parliamentary year at UOH. So the first limitation is based on the location and the respondent of the study. Secondly, another limitation of this study is that it concerns only the adoption of the blackboard at UOH in specific. In addition, to the selection of UTAUT theory as a main influencer factor on the adoption of this new technology implemented in addition to the Culture and attitude of the students as extra in depended factors that were suggested by the literature to be combined with the UTAUT to deliver a broaden vision of the impact on the adoption of LMS.

1.9 Operational Definitions

This section defines the summary of the thesis sections to demonstrate the flow of the thesis. This thesis consists of six sections.

1.9.1 Learning Management System (LMS)

Learning Management System (LMS) is one of the most representative e-learning or blended learning applications that can be open-source and freely available software, whereas others are commercial products that can be used to post syllabi, announcements, homework assignments and projects, as well as course notes and slides for students to access online (Xu & Mahenthiran, 2016). In this study LMS refers to blackboard which is used in UOH as the main eLearning platform. The Blackboard must be used by students of the UOH for all subjects, including mathematics, at all

levels. Nevertheless, this study is concerned only with mathematics and predatory rates.

1.9.2 Performance Expectancy

Performance expectations are a construct in the UTAUT model that refers to students' belief in learning technology to benefit them in learning task performance (Alasmari, 2017). In the context of this study, performance expectations are defined as the degree to which UOH students believe that using Blackboard in learning mathematics will help them to perform their studies.

1.9.3 Effort Expectancy

Effort expectation is another structure in the UTAUT model that corresponds to the degree of ease of use of learning technologies (Alasmari, 2017). In the context of this study, commitment expectation applies to the degree of ease with which Saudi students in UOH use Blackboard.

1.9.4 Social Influence

Social influence is another construct in the UTAUT model that refers to an individual's perception of other important people in his/her life who believe in the importance of his/her use of learning technology (Alasmari, 2017). In the context of this study, the construction of social influence refers to the influence of important people (such as lecturers, tutors or friends) in the life of UOH Saudi students on their use of Blackboard in their learning activities.

1.9.5 Behavioural Intention

Behavioural intent is the degree to which individuals decide whether or not to perform a specific behaviour (Alasmari, 2017). In the context of this study, behavioural intent applies to the conscious decision of UOH Saudi students to use or not use Blackboard.

1.9.6 Facilitating Conditions

Facilitating requirements apply to the degree to which a person feels that the existing resources in his/her organisation facilitates the use of LMS technology (Alasmari, 2017). In this study the facilitating conditions refers to the students believes that the existing resource and infrastructure in his university facilitate and support the usage of LMS.

1.9.7 Students' Attitudes

According to (Mazana et al., 2019) , 'Attitudes are evaluative responses to people, objects and events.' This includes beliefs and positive and negative feelings about the object of attitude. In this study, students' attitudes relate to the assessment reactions and opinions of UOH students about using Blackboard in their mathematics learning.

1.9.8 Culture

Chen et al. (1999) argued that tradition should be considered a significant factor in the implementation of technologies to improve the learning system. Saudi society has many nuances due to religious patterns and guidelines that the country believes in (Arafah, 2017). In this study, culture relates to the cultural influence in

Saudi Arabia on the adoption of new technologies in higher education mathematics, particularly in UOH.

1.9.8.1 Universalism

The view that the values, concepts, and behaviors characteristic of diverse cultures can be viewed, understood, and judged according to universal standards. Such a view involves the rejection, at least in part, of cultural relativism. Also called cultural absolutism.

1.9.8.2 Security

Refers to the set of values, shared by everyone in an organisation, that determine how people are expected to think about and approach security. Getting security culture right will help develop a security conscious workforce, and promote the desired security behaviours you want from staff

1.9.8.3 Stimulation

Intercultural simulation is an educational activity designed to provide constructive encounters between people of more than one cultural or ethnic group. ... Further, intercultural competence suggests the ability of an individual to adapt verbal as well as nonverbal messages to various cultural contexts.

1.9.8.4 Tradition

Traditions are often the most externally-facing parts of a culture. They show the personality, colour, and heritage of a culture. They help you know what to do and when (and what not to do). They give you a glimpse into a person's culture, but to truly understand a culture, you need to spend time listening and learning.