# UNIVERSITY OF SOUTHAMPTON

Faculty of Physical Science and Engineering

School of Electronics and Computer Science


# An Investigation of the Factors that Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian University Context


By

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Thesis for the Degree of Doctor of Philosophy

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# University of Southampton

## Abstract

FACULTY OF PHYSICAL SCIENCES AND ENGINEERING
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Advances in information and communication technology (ICT) have created more opportunities for universities to complement the traditional methods of delivering their examinations. In Saudi Arabia, many universities continue the adoption of summative e-assessment by different departments. Nonetheless, the attitude of students to using e-assessment systems is a critical challenge. Understanding the factors that affect students' attitude towards summative e-assessment plays a key role in the success of its adoption. However, the factors that affect the use of technology may vary across cultures in their significance and predictive power. Several studies have examined the use of summative e-assessment by students in different countries, but no research has been conducted in the context of Saudi Arabian universities. This thesis aims to address this gap by investigating the factors affecting students' attitude towards using summative e-assessment in Saudi Arabian universities.

The main contribution of this study is the development of a framework that supports investigation into the factors that influence the attitude of students towards using summative e-assessment in Saudi Arabian universities. A review determined the current gaps within the literature pertaining to students' attitude of summative e-assessment and was the basis of the research questions. A framework was initially developed by reviewing technology theories and related studies. An exploratory mixed methods design was followed, which gathered qualitative and quantitative data. The framework was confirmed by 12 experts, gained from semi-structured interviews, followed by a questionnaire completed by 102 students in a confirmatory study. Further investigation was carried out by applying factor analysis and multiple linear regression to 328 students' perspectives, gathered through an online questionnaire.

The findings of this research were of significant consequence to Saudi Arabian universities in particular, which have sought to adopt summative e-assessment systems with limited success. The research also provides sound evidence to the stakeholders in universities who could change the landscape for assessment systems in Saudi Arabian universities positively. In addition, academic researchers in the field of e-assessment can test the framework developed in different cultural contexts.

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# Declaration of Authorship

I, **Someah Saleh Alangari**

Declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

**An Investigation of the Factors that Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian University Context**

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
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Signed: Someah Saleh Alangari

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# Abbreviations

| | |
|---|---|
| **CAA** | Computer-assisted assessment |
| **CBA** | Computer-based assessment |
| **e-assessment** | Electronic assessment |
| **e-learning** | Electronic learning |
| **FA** | Factor Analysis |
| **ICT** | Information and Communication Technology |
| **ILOs** | intended learning outcomes |
| **IS** | Information System |
| **IT** | Information Technology |
| **JISC** | Joint Information Systems Committee |
| **KMO** | Keiser-Meiyer-Olkin |
| **MLR** | Multiple Linear Regression |
| **NCEL** | National Centre for E-learning and Distance Learning |
| **PAF** | Principal Axis Factoring |
| **PCA** | Principal Component Analysis |
| **TAM** | Technology Acceptance Model |
| **TPB** | Theory of Planned Behaviour |
| **TRA** | Theory of Reasoned Action |
| **UTAUT** | Unified Theory of Acceptance and Use of Technology |

# Chapter 1 Introduction

This chapter introduces the motivation for this thesis, covering the research background, background of the context, rationale of the study, research questions, research objectives and structure of this thesis.

## 1.1 Research Background

Information and communication technology (ICT) has become an integral part of teaching in the educational institutions, significantly contributing to their success and effectiveness. ICT is an essential part of the learning process, which leads to the conclusion that it is also going to be part of the assessment process (Bennett, 2002; Gipps, 2005). E-assessment systems can offer new forms of teaching and learning activities in this digital age (Whitelock, 2009). The term e-assessment is defined as an electronic assessment process which involves the implementation of ICT in the presentation and processing of assessment materials (Ridgway, McCusker, & Pead, 2004). It provides a number of advantages for educational organisations, staff and students (Bull & McKenna, 2003; Gilbert, Whitelock, & Gale, 2011). The intimate association between teaching, learning and assessment has been addressed in the literature (Bloxham, Fry, Ketteridge, & Marshall, 2014). Assessment exemplifies educational goals and has a major effect on educational practice. Unless assessment systems are aligned with educational goals, they will distort curriculum ambitions (Ridgway et al., 2004). Most university assessment emphasises "certification" at the expense of its use to support learning (Bloxham et al., 2014). In the universities context, most assessments are summative; they are used to demonstrate the extent of students' success in meeting course requirements and contribute to the final mark given for the module (Bloxham et al., 2014).

As with any technology used to enhance learning, e-assessment cannot be used to its full extent or considered successful unless it is accepted by its target users (Moccozet, Benkacem, & Burgi, 2017; Tella & Bashorun, 2012). Students' attitude towards summative e-assessment could be considered as relatively minor because lecturers usually impose e-assessment on their students who cannot do otherwise than adapt (Moccozet et al., 2017). Academics are more reluctant to introduce e-assessment if students' attitude are too negative (Moccozet et al., 2017). If summative e-assessment brings pedagogical benefits, then students should be able to positively identify them. If students' attitude are too negative towards summative e-assessment, this may affect their selection of courses, choice of universities and university reputation (Moccozet et al., 2017).

Transforming assessment can have a positive impact on student learning as well as promoting greater confidence in academic standards (Higher Education Academy, 2016). In light of this, it is important for the university to know the attitude of students towards this mode of examination so they can identify where improvement is needed to further enhance the exam delivery method (Tella & Bashorun, 2012). Thus, to improve the students experience of e-assessment, it is important for universities to identify students' attitude. The student attitude is always high on the agenda for any educational establishment. If students do not have a positive attitude towards their learning, which they believe meets their needs and offers value for money, a university is likely to notice a fall in applicants and reputation (Stubbs, 2013).

Some studies concluded that national cultures of the users of a technology manifest diverse impacts on their behaviour, with varying degrees of intensity or importance (Abbasi, Tarhini, Elyas, & Shah, 2015; Lai, Wang, & Lei, 2012; Pituch & Lee, 2006; Tarhini, 2013). For e-assessment, the attitude of students from diverse national cultures is different (JISC, 2007). Students' responses to the shift to e-assessment can vary significantly across cultures (Gikandi, Morrow, & Davis, 2011). Further, the studies on the use of e-assessment carried out across diverse cultures showed that both the significance and the predicting power of certain variables were different (Alkiş, 2010; Dermo,2009; McDonald, 2002; Ricketts & Wilks, 2002; Schneberger, Amoroso, & Durfee, 2007; Tella & Bashorun, 2012; Terzis & Economides, 2011). With the rapid evolution of IT in universities in Saudi Arabia, studies have investigated the effect of online learning on education (Al-Zaidiyeen & Mei, 2010; Alenezi, Karim, & Veloo, 2010; AlFahad, 2009; Alkhalaf, Drew, & Alhussain, 2012; Nassuora, 2012; Rashad & Kandil, 2010). However, research on the use of summative e-assessment in Saudi Arabian universities requires more investigation. Studies on e-assessment have listed different factors that act as barriers to the adoption of e-assessment in the higher education sector: cultural, infrastructural, support, policy and personal limited awareness (Bull, 1999; McCann, 2010; Tomas, Borg, & McNeil, 2015; Whitelock & Brasher, 2006). Studies have also been devoted to e-assessment use (Alkiş, 2010; Dermo, 2009; McDonald, 2002; Ricketts & Wilks, 2002; Schneberger et al., 2007; Sheader, Gouldsborough, & Grady, 2006; Tella & Bashorun, 2012; Terzis & Economides, 2011). However, all these studies have been validated in cultures where values and behaviours differ significantly from those in Saudi Arabia.

## 1.2 Background of the Context

The National E-learning and Distance Learning Centre (NELC) was established by the Ministry of Higher Education in Saudi Arabia in 2006 (Alkhalaf, Drew, & Nquyen, 2010). The NELC encourages

e-learning and distance education in higher education by providing technical support and tools for developing a digital education (Alebaikan & Troudi, 2011). The NELC has funded several projects that aim to enhance blended learning in Saudi Arabian universities and enable faculty members to integrate technologies that fit their course and university's needs (Alebaikan & Troudi, 2011). Blended learning is a combination of online educational materials with traditional place-based classroom methods (Porter, Graham, Spring, & Welch, 2014). Graham (2006) defined it as '*the combination of instruction from two historically separate models of teaching and learning: traditional face-to-face learning systems and distributed learning systems.*' It requires the physical presence of both teacher and student with technology-mediated instruction (Porter et al., 2014). NELC has also established important projects for higher education and distance education, such as a learning management system, "Jusur", and an e-learning educational portal system, "Tajseer" (AlFahad, 2009). Jusur and face-to-face learning are used together as blended learning to deliver knowledge (Al Mulhem, 2014).

The strategy of learning in most Saudi Arabian universities is based on traditional didactics and lecture-based classroom. Recently, some universities have started to adopt distance learning programmes (Alebaikan & Troudi, 2011) and have introduced e-learning programmes to solve the issue of the increased number of students in universities (Alkhalaf, Nguyen, Drew, & Jones, 2013). The first university in Saudi Arabia that employed distance learning programmes was King Abdulaziz University, located in Jeddah, which offers Bachelor degrees through online learning (Alebaikan & Troudi, 2011). Learning management systems, such as Blackboard, have also been used in some universities and institutions to facilitate learning and teaching online (Alebaikan & Troudi, 2011). In 2011, the Saudi Electronic University established blended learning courses, and accepted about 8,000 students in 2012 (Al Mulhem, 2014). Higher education in Saudi Arabia has realised the importance of training faculty members and staff to use technologies in teaching. King Saud University has established a Deanship of Skills Development to implement development programmes to improve skills for staff, and also to support faculty members in the use of the latest instructional techniques (Alebaikan & Troudi, 2011).

Compared to developed countries such as the UK, the progress of e-assessment in Saudi Arabia is still in its infancy (Alsadoon, 2017; Bardesi & Razek, 2014). However, a few universities in Saudi Arabia have started using an e-assessment system for their summative exams. Alsamarai, Amawi, and Ali (2014) investigated the use of summative e-assessment systems by universities in different Arab countries. For Saudi Arabia, they found that King Khalid University was one of the first Saudi universities to integrate technology into their assessments; it has introduced electronic exams in its Colleges of Education, and it has used iPads to deliver e-assessment (Alsamarai et al., 2014). Further, King Abdulaziz University has also launched e-assessment in two disciplines of the Faculty

of Arts and Humanities (Alsamarai et al., 2014; Bardesi & Razek, 2014). They report different challenge regarding to technical issues and university culture (Bardesi & Razek, 2014). In addition, e-assessment has recently been implemented at Saudi Electronic University (Alsadoon, 2017). Alsadoon (2017) emphasis about the importance of examine the students' perceptions of this mode of examination at the university level.

As for university culture in Saudi Arabia, culture was defined by Hofstede, Hofstede, and Minkov, (2010) as a '*collective programming of mind that distinguishes the members of one group or category of people from others*.' Alebaikan and Troudi (2011) pointed out that Saudi Arabian universities face a particular challenge in changing learning strategies and moving to blended learning. Students find difficulty in adopting a new approach to learning that requires a high level of self-discipline and responsiveness (Alebaikan & Troudi, 2011). ICT in an education system has to be built onto the national cultural context, which is more important than the specialised aspects of the technology (Li & Kirkup, 2007). It is important to understand how cultural factors might affect an organisation in adopting and utilising IT successfully (Straub, Loch, Evaristo, Karahanna, & Srite, 2002). For e-assessment uptake, cultural factors continue to matter more than operational factors (Warburton,2009). Cultures differ in five primary dimensions: power distance, individualism/ collectivism, uncertainty avoidance, masculinity/femininity, and time orientation (Hofstede et al., 2010).

Al-Gahtani, Hubona, and Wang, (2007) examined the cultural differences that affected the organisational acceptance of IT in two countries, Saudi Arabia and USA. They found that Saudi Arabia had low individualism and power distance and higher uncertainty avoidance scores than the USA, which might show a strong relationship between social influence and behavioural intentions towards IT in Saudi Arabia. Individualism refers to the degree to which people in a culture prefer to work as individuals rather than with groups (Straub, Keil, & Brenner, 1997). Saudi Arabia is a high power distance culture, which means that individuals are more inclined to respect and follow the expectations of those in important or superior roles (Al Gahtani et al., 2007). Uncertainty avoidance deals with accepting uncertainty and ambiguity, which describes a person feeling uncomfortable with an uncertain and ambiguous situation (Straub et al., 1997). Saudi Arabia is a high uncertainty avoidance culture, which affects students' attitude towards e-assessment more than in other cultures. Therefore, students perceive computer-based assessment to be less useful and harder to use than those in low uncertainty avoidance cultures.

Most higher education institutions, especially in developing countries such as Saudi Arabia, Jordan, and Egypt, are faced with limited research on e-assessment (Al-Hamad & Mohieldin, 2013;

Alsadoon, 2017; Alsamarai, Eljinini, Amawi, & Hameed, 2013; Alsamarai et al., 2014; Bardesi & Razek, 2014; Rashad & Kandil, 2010). This thesis aims to address gaps in the existing literature. The choice of summative e-assessment in Saudi Arabian universities is driven by the lack of research investigating the factors which influence the students' attitude towards summative e-assessment in Saudi Arabian universities.

## 1.3 Rationale of the Research

The need for comprehensive research into e-assessment first became clear from university teaching. E-assessment would have potential benefits for students in terms of learning and assessing. E-assessment can also be used to great effect by teachers, since its use makes this task manageable as most systems automatically track many learning analytics as students use the system. For the institutions, it would offer many advantages over traditional pen and paper exam; details of the benefits of e-assessment are given in Section 2.4.1. This thesis focuses on students as they are the end-users for the systems. To make any system accepted and widely used by its end-users, organisations should understand factors that influence individuals to use the system (Imtiaz & Maarop, 2014).

Some common causes of IT project failure in higher education include: lack of project definition, complexity and lack of end-user involvement. In the definition phase of an IT project, it is important to involve users because this leads to improved quality of the system and an increase in user satisfaction (Jones, 2019). Significant factors in the failure of higher education projects in Saudi Arabia have been addressed by Alenezi, Salim, Gandapur, Javed, and Demba, (2015): user resistance, project managers not understanding users' needs, and a lack of people with appropriate skills. On the other hand, one major criterion for project success identified by Alenezi et al. (2015) is the fit between the project objectives and user satisfaction. Meeting stakeholder needs and expectations is a critical factor in the success of all IT project (Jones, 2019). Successfully implementing an IT project must provide direct benefits to students, faculty and administrators (Jones, 2019). This is why it is important to addresses the factors influencing the attitude of students towards e-assessment projects in Saudi Arabia.

Technology models and theories shed light on the factors that predict the use of technologies. They limit explaining the variance in students' behavioural intentions in educational environments (Jung, Loria,Mostaghel, & Saha, 2008 ; Tselios, Daskalakis, & Papadopoulou, 2011). Even though some studies modified technology models in the e-learning and e-assessment context, most of these were either in North America or Europe. Therefore, the applicability of the findings for Saudi students is questionable because culture can influence research outcomes (Saadé, Nebebe, & Mak,

2009). Therefore, generalising research findings from one culture to another is dubious due to the cultural differences between users. However, these research findings can help indicate what needs to be examined and confirmed with a different cultural user group. It will provide a better understanding of the factors that can affect students' attitude towards summative e-assessment in Saudi Arabian universities.

This thesis aims to fill that gap with a focus on the investigation of the factor influence the attitude of students towards summative e-assessment in Saudi Arabian universities by developing a research framework to support the investigation. It is important to understand the factors that influence the attitude of students towards using such assessment. These factors are not only important to the learning process, but understanding them helps higher education policy makers develop better e-assessment tools (Whitelock, 2006). This research aims to investigate the factors influence students' attitude towards using summative e-assessment in their learning by proposing a framework.

The inspiration for developing a framework of summative e-assessment has been derived from the challenges in Saudi Arabian universities to adopting e-learning and e-assessment systems effectively (Alebaikan & Troudi, 2011; Alkhalaf et al., 2010). A framework is a set of interrelated concepts or a set of specific questions intended to inform a particular domain (Rogers, 2012). In computer systems, a framework is used as a structure to understand the need of institutions and of individuals for a system and how a system's components interrelate (Kituyi & Tusubira, 2013). A conceptual framework is used in this thesis for informing and articulating the design of prototypes and user studies, and evaluating them (Rogers, 2012). It refers to the need for universities to achieve the requirements of success of summative e-assessment by examining the status of students, courses, faculty and technology.

## 1.4 Research Questions

This research seeks to address the main following question: **RQ:** What is an appropriate framework that can be used as a theoretical foundation for the investigation of the factors influence the attitude of students towards summative e-assessment in a Saudi Arabian universities context? Four sub-questions were derived from the main research questions.

**RQ1:** According to literature, what are the factors that constitute the framework?

**SRQ2:** According to experts, what are the factors that affect students' attitude towards e-assessment in Saudi Arabian universities?

**SRQ3:** According to students, what are the factors that affect students' attitude towards e-assessment in Saudi Arabian universities?

**SRQ4:** What factors have significant effects on students' attitude towards e-assessment in Saudi Arabian universities?

Based on the literature review, a framework has been developed and confirmed by conducting a sequential exploratory study using a methodological triangulation technique.

## 1.5 Research Objectives

Based on the research questions, this research aims to contribute to this growing area of research by investigating the factors that affect the attitude of students of summative e-assessment in a Saudi Arabian universities context. This aim can be achieved by fulfilling the following objectives:

To review the literature pertaining to models and theories of technology and review of related work so as to develop and confirm a conceptual research framework in order to support the investigation of the factors which influence the attitude of students towards summative e-assessment in Saudi Arabian universities.

## 1.6 Thesis Structure

**Chapter 1** introduced the research background, context of the study, rationale for the study, research questions, research objectives and thesis structure.

**Chapter 2** reviews the literature of learning theories, assessment and e-assessment. It also presents the benefits, dis-benefits and barriers of e-assessment, and experiences of e-assessment in the UK. It addresses existing theories and models that explain the use of an ICT. It reviews previous studies in students' attitude towards summative e-assessment. Finally, previous models in e-assessment are also discussed.

**Chapter 3** introduces the proposed framework for investigation of the attitude of students towards summative e-assessment in Saudi Arabian universities. It also describes the factors involved in the construction of the research framework in detail.

**Chapter 4** presents the research methodology and research methods that will be applied here. It discusses the confirmatory study used in the initial research for confirming the framework, and presents the methodology applied in the investigation study.

**Chapter 5** presents the confirmatory study. It discusses the results of the mixed method research conducted with experts and students in Saudi Arabian universities. The findings of the interviews and questionnaires are presented and analysed.

**Chapter 6** presents the questionnaire development. The questionnaire is used to investigate the factors influencing the attitude of students towards summative e-assessment. The validity and reliability of the questionnaire are discussed in detail.

**Chapter 7** discusses the investigation study, wherein factor analysis and multiple linear regression are applied.

**Chapter 8** formulates the conclusions and the main concept of the research. It also highlights the contributions of the study. Finally, limitations and directions for future work are suggested.

# Chapter 2 Background and Literature Review

This chapter provides background on learning, assessment and learning outcomes in order to understand the assessment process. It presents the e-assessment concepts and highlights the benefits, dis-benefits and barriers to its adoption. The prevailing theoretical models, developed to predict and understand users of using technologies, are highlighted and their advantages and limitations presented. This chapter also reviews previously published work on e-assessment.

## 2.1 Learning and Assessment

Learning is defined as a change in human capability that happens over time and does not simply occur due to the process of growth (Gagné, 1985). Learning is like any event which happens under observable conditions and can be explained by scientific models and theories (Gagné, 1985). Bigge and Shermis (1999) asserted the importance of having some sort of theory of learning in order to define the framework of learners' actions and learning development. They defined *learning* as a systematic integrated outlook by a learner related to the kind of process for using their environment and themselves to produce the best outcomes (Bigge & Shermis, 1999). Twentieth-century systematic learning theories are classified into the conditioning theories of the behaviourists and the interaction theories known as the cognitive process (Bigge & Shermis, 1999).

Skinner (1938) believed that studying observable behaviour is more effective than studying mental events. He found that understanding behaviour requires looking at the causes of an action and its consequences, which he called *Operant Conditioning*. This term can be described as the use of reinforcement to change a behaviour. The reinforcement can be positive and negative, and should be given after the desired response in order to strengthen behaviour (Skinner, 1938). Skinner (1958) asserted that education must become more efficient by simplified and improved textbooks and classroom techniques.

Laurillard (2001) developed the "Conversational Framework" model of the ideal learning and teaching environment, based on Pask's model of a learning system called "Conversational Theory", which is related to *conversations* between teachers and students that take place in the learning environment. Laurillard's framework comes with ideas of combining a model of the learner with a model of the teacher, as they both determine basic transmission in the learning process (Laurillard, 2001). Traditionally, it has been argued that the Conversational Framework model for learning goes beyond the ideas of the transmission model (Laurillard, 2002). In particular, due to its higher level

of complexity, digital technologies can be incorporated within the model's framework (Laurillard, 2002). It is congruous not only with the ideal outcomes of reflective practice, but also with the objectives of those working in academia or higher education, even if these outcomes are not always achieved in reality (Laurillard, 2002). The transfer of knowledge between students and teachers in higher education operates on two levels (Laurillard, 2002). One of these is the abstract, where new theories and concepts are learnt and students learn to adapt their practical application to these new theories and reflect on how compatible these theories are with their own practical experience. This level is called *discursive* and the other level is called *interactive*. It is a practical level where experimentation takes place. Gilbert and Gale (2008) highlighted the importance of Laurillard's Conversational Framework in that it gives a complete description of the learning process and it shows careful characterisation of the roles of student and teacher in a learning environment. The key point in this framework is the importance of feedback activities in successful and effective teaching (Gilbert & Gale, 2008). In the 1920s, Pressey designed a machine for teaching with an automatic assessment, also known as the Pressey Teaching Machine (Skinner, 1958). This device used a multiple-choice test, whereby students chose the answers by pressing the keys corresponding to their answers. The key point of this machine is that the student cannot move to the next item until the right answer has been chosen. More importantly, Pressey was the first in education to emphasise the importance of immediate feedback and the need for a device to achieve these objectives (Skinner, 1958).

Dietel et al. (1991) described assessment as any method used to enhance understanding of the current knowledge that a student has. Assessment is a powerful learning tool that can enhance learning and education. If assessment design aligns with educational outcomes and instructional methods, it improves the quality of education and supports student learning (Bloxham et al., 2014). On the importance of assessment in the learning process, Buzzetto-More and Julius, (2006) reviewed the literature and found that good assessment serves several objectives and provides advantages for a number of stakeholders. They said that assessment can improve students' learning by identifying their strengths and weaknesses, and by providing them with appropriate feedback, which can improve the effectiveness of learning (Buzzetto-More & Julius, 2006). Well-designed and managed assessment strongly influences students' learning, as it has the power to drive learning more than any other aspect of the student experience (Bloxham et al., 2014). In contrast, Buzzetto-More and Julius (2006) claimed that assessment is a fundamental part of guaranteeing that the institution and teacher accomplishes its learning objectives, as well as a critical method for giving essential evidence for seeking and maintaining learning quality. According to Crisp (2007) assessment can be categorised in the application process as follows:

- **Diagnostic:** This type of assessment is applied at the beginning of learning activities in order to identify the current level of students in the specified subject so that learning activities can be designed accordingly to match students' needs.
- **Formative:** This type of assessment is applied during the process of learning simultaneously with learning activities in order to provide practice for students in the specified subject and aims to increase the level of understanding. It intends to provide the learner with feedback to improve performance in the subsequent tasks.
- **Summative:** This type of assessment is applied at the end of learning process in order to grade students or make judgements about their understanding level of the subject matter. It evaluates the quality of students' performance at the end of the course. This assessment summarises students' achievement, usually in the form of grades, and typically consists of examinations of student learning.

Bloxham et al. (2014) classified assessment into four different types, depending on its purpose.

- **Certification:** This involves collecting evidence of students' achievement through summative assessment and examinations for certification purposes, such as gaining a degree. This purpose constitutes assessment of learning.
- **Quality Assurance:** An institution's academic standards are demonstrated through students' assessed work, of which it forms a key accountability process. This purpose also constitutes assessment of learning.
- **Learning:** This emphasises the formative and diagnostic assessment for helping students learn through completing their assignments and gaining feedback. It provides information about student achievement to both teachers and learners, which enables the student to self-regulate their learning and the teacher to respond to the needs of the learner. This purpose constitutes assessment for learning.
- **Lifelong learning:** This purpose is to develop students' ability to self-assess their learning, as an essential skill to being an effective independent learner outside formal education. This purpose is an important subset of assessment for learning.

The goal of *formative* assessment is to monitor student learning to provide ongoing feedback that can be used by the teacher to improve their teaching, and by the students to improve their learning. The goal of *summative* assessment is to evaluate student learning by comparing it with some standard or benchmark (Gardner, 2012; Ridgway et al., 2004). In the higher education context, most assessments are summative, and are used to demonstrate the extent of students' success in meeting course requirements and contribute to the final mark given for the module (Bloxham et al., 2014).

## 2.2 Intended Learning Outcomes (ILOs)

Otter (1992) described learning outcomes as the abilities gained from the process of learning, while Allan (1996) claimed that learning outcomes are distinct from the outcomes that educators expect or desire students to achieve. According to Nusche (2008), since learning outcomes are often defined as something quantifiable, the quality of organisations delivering education can expect to be measured through assessment of the learning outcomes achieved by their students.

Bloom (1956) emphasised the importance of educational objectives in changing and improving the educative process. He addressed the question of whether educational objectives could be classified and developed a taxonomy for classifying students' behaviour that affects the classifying of learning objectives. The complete taxonomy has three major domains, which include cognitive, affective and psychomotor (Bloom, 1956). The Bloom taxonomy focused on the cognitive domain as it was central to the work of current development where it is divided into six categories: knowledge, comprehension, application, analysis, synthesis and evaluation, each of which was further broken into subcategories (Bloom, 1956). He described a classification of levels of intellectual behaviour based on an increasingly complex level that is important in the learning process.

Several authors have reported the importance of Bloom's taxonomy in achieving educational goals (Anderson & Krathwohl, 2001). Krathwohl (2002) described the taxonomy as a framework for classifying educational objectives which are adopted to illustrate what it expects or intends students to learn as a result of the instructional process. He summarised it as a scheme for classifying educational goals as it offers an organisational structure a means of understanding the meaning of the objectives detailed in each category (Krathwohl, 2002). In the 1990s, the taxonomy was updated by Anderson and Krathwohl (2001). They noticed that, in the original, one weakness is the assumption that cognitive processes are ordered on a single dimension of simple-to-complex behaviour. The revised taxonomy separates the noun and verb components of the original knowledge category into two separate dimensions: the knowledge dimension (noun aspect), and the cognitive process dimension (verb aspect) (Anderson & Krathwohl, 2001). They suggested that statements of objectives typically comprise a noun phrase, the subject matter content, a verb phrase and, finally, the cognitive process. For example, the student will be able to remember the law of supply and demand in economics.

The knowledge dimension in the revised taxonomy now covered four categories. The knowledge domain from the original taxonomy contributed three of them, but were renamed and reorganised to recognise the distinctions in cognitive psychology that had developed since the original

taxonomy (Krathwohl, 2002). The three knowledge categories became: Factual, Conceptual, and Procedural (Krathwohl, 2002). The fourth category, Metacognitive Knowledge, provided a distinction that was not recognised at the time of the original taxonomy. Metacognitive knowledge involves knowledge about cognition in general, as well as awareness of, and knowledge about, one's own cognition (Krathwohl, 2002). For the cognitive process dimension, Krathwohl (2002) retained the categories in the original taxonomy with changes to their names and order to reflect the way they are used in statements of objectives: "Knowledge" to "Remember" as mentioned above; "Comprehension" to "Understand" because understanding is a commonly used term in objectives and it was a well-known synonym for comprehending (Krathwohl, 2002). Three categories became "Applying", "Analysing" and "Evaluating", but "Synthesis" was renamed "Creating" and changed places with "Evaluating" (Krathwohl, 2002). In the revised taxonomy, the objective would be represented as a two-dimensional table, called the Taxonomy Table, with the Knowledge dimension as the vertical axis and the Cognitive Process dimension as the horizontal axis (Anderson & Krathwohl, 2001). One of the major differences between the original and the revised taxonomy is that the original consisted of a single dimension whereas the revised taxonomy consisted of two dimensions, which reflects a dual perspective on learning and cognition (Airasian & Miranda, 2002).

For assessment, the two-dimensions of the revised taxonomy guide the processes of stating objectives and guiding instruction, which provides a way to better understand assessment models (Airasian & Miranda, 2002). It offers clearly defined assessments and a stronger connection of assessment to both objectives and instruction (Airasian & Miranda, 2002). The revised taxonomy can be used to analyse the objectives of a unit or a syllabus, help teachers realise the relationship between assessment and learning activities, and examine curriculum alignment (Amer, 2006). It provides a framework within which prospective teachers can judge the effectiveness of their teaching in terms of what students actually learn (Byrd, 2002).

An important theory in the assessment process is constructive alignment, proposed by Biggs and Tang (2007). It represents a marriage between a constructivist understanding of the nature of learning, and an aligned design for outcomes-based teaching education. Constructive alignment is a principle used for teaching and learning activities, and also assessment tasks, and which directly addresses the intended learning outcomes (ILOs) (Biggs & Tang, 2007). There are two basic concepts behind constructive alignment: the "constructive" aspect refers to what the learner does, which is to construct meaning through relevant learning activities. The "alignment" aspect refers to what the teacher does, which is to set up a learning environment that supports the learning activities appropriate to achieving the desired learning outcomes (Biggs & Tang, 2007). Constructive alignment is more than criterion-reference assessment, which aligns assessment to the objectives.

It is expressing the objectives in terms of intended learning outcomes (ILOs), which affects the definition of the assessment task. It is also aligning the teaching methods with the intended outcomes as well as with the assessment tasks (Biggs & Tang, 2007).

On the other hand, the validity of summative assessments is extremely important. The intrinsic validity of the assessment tasks is based on the notion of constructive alignment in a way that can ensure that different elements of the ILOs for a given module are being examined and considered appropriate for learning (Bloxham et al., 2014). Lecturers are required to carefully check that assessment requirements are not only testing what they intend to test, but are also directing students towards appropriate learning (Bloxham et al., 2014). Feedback is the most important aspect of the assessment process in raising achievement (Bloxham et al., 2014). It can help students to self-evaluate and re-direct their efforts towards learning (Gibbs, 2014). It also helps students understand what they need to do to improve and provides them with the confidence that they can control their achievement (Bloxham et al., 2014). Gibbs (2010) addressed a number of the principles concerned, such as how the provision of feedback affects student learning behaviour. He said that feedback should be *appropriate* in relation to students' understanding of what they are supposed to be doing; it should provide *sufficient detail* to understand what exactly is required to improve; it should be *timeously received* by students for further learning or for receiving further assistance. In fact, feedback should address clearly the educational goals of the course (Gibbs, 2014). It is important to encourage students to recognise and use all sources of feedback: one-to-one tutorials, comparison with other students' work, feedback from work-based mentors and in-class informal feedback (Bloxham et al., 2014). However, most summative assessment does not provide in-depth feedback or short feedback comments (Bloxham et al., 2014).

## 2.3 E-learning Transactions

The term "e-learning" was defined by Gilbert and Gale (2008) as the use of IT components in learning and teaching materials, courses and environments. This is known in the UK and Europe by the term "technology-enhanced learning", focusing on social aspects of learning as well as the main concepts of learning. More recently, attention has focused on the provision of effective e-learning models. Gilbert and Gale (2008) developed an e-learning transaction model, shown in Figure 2.1. This model was based on Laurillard's Conversational Framework, as discussed in Section 2.1, which is centred on the idea of transaction between the teacher and the student in the learning and teaching environment (Gilbert & Gale, 2008).

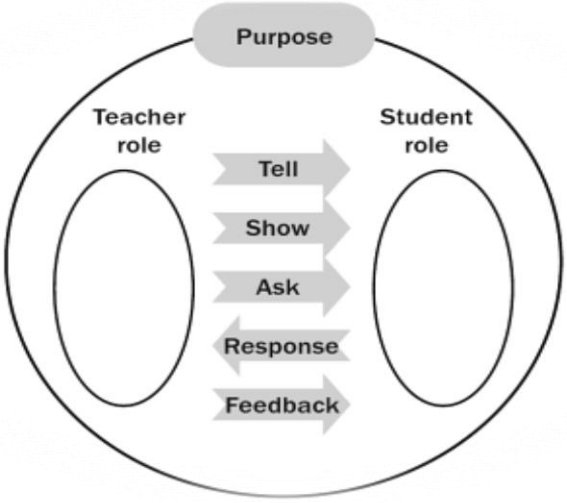


*Figure 2.1 Structure of e-learning Transaction adapted from Gilbert & Gale (2008)*

In presenting this model in a simple and useful way, they captured the basic features of an e-learning transaction. The first element of the model is "purpose", which is used to emphasise the key point that the development and use of any learning materials or teaching assets must be associated with the overall purpose of the transaction (Gilbert & Gale, 2008). They noticed that the "purpose" element in Laurillard's Conversational Framework had some weaknesses in the diagrammatic presentation, which is not particularly well-drawn, and rectified this by clearly identifying it (Gilbert & Gale, 2008). The second element of the diagram identifies the two roles which exist in any learning and teaching process. Gilbert and Gale (2008) intended to confirm that any person could undertake either or both roles at different times in the transaction. They illustrated five key exchanges that happen in e-learning transactions: tell, show, ask student, student response and feedback (Gilbert & Gale, 2008).

## 2.4 E-assessment

E-assessment refers to the use of IT to assess something in particular, for example, educational assessment, health assessment or psychological assessment (Tomas et al., 2015). The term e-assessment is defined as electronic assessment processes which involve the implementation of ICT use in the presentation and processing of assessment materials (Ridgway et al., 2004). In 2007, the Joint Information Systems Committee (JISC) published a report which discussed the important issues related to the state of e-assessment in the UK (JISC, 2007). The JISC (2007) defined e-assessment as end-to-end electronic assessment processes, where ICT is used in all assessment processes starting from input and presentation of assessment activity, recording of learners' responses, and producing feedback. It also noted that e-assessment is seen differently by different

publications, such as computer-based assessment (CBA) and computer-assisted assessment (CAA). CBA refers to use of a computer to deliver and mark the assessment, whereas CAA refers to the use of a computer in part of the assessment process (JISC, 2007). However, Ridgway et al. (2004) clarified e-assessment as taking a number of forms, including automating administrative procedures, digitising paper-based systems, and online testing.

Whitelock (2006) developed a framework of e-assessment activity called “cycles of e-assessment” which identified all stages in the development of an e-assessment system. The framework presented a complete approach to e-assessment development. The cycle starts with the motivational driver, followed by design, and then the creation and evaluation components, as shown in Figure *2.2*. Each component of the cycle builds on the previous component’s outcome (Whitelock, 2006). This "cycles of e-assessment" framework adopts a holistic approach to the development process and can also account for the enablers, the barriers and the cultural debate surrounding e-assessment strategies (Whitelock, 2006).

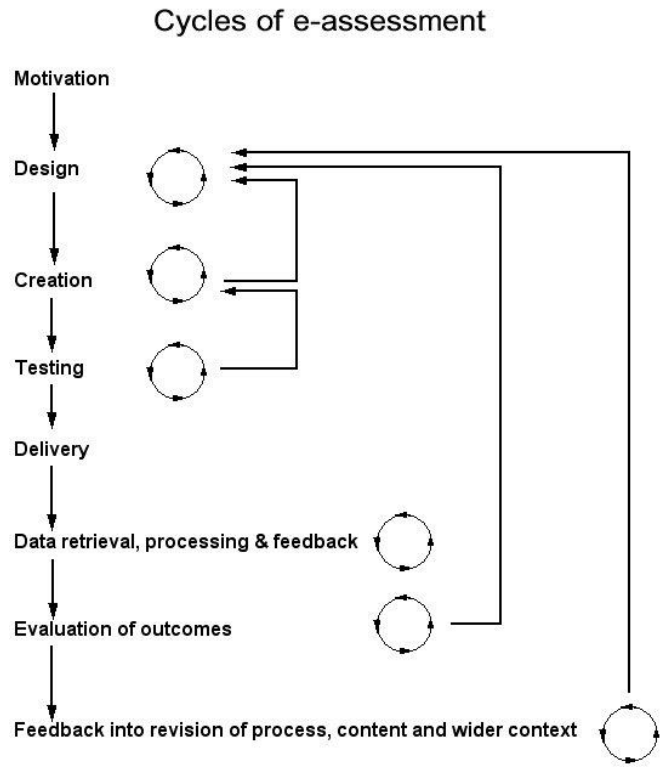


*Figure 2.2 Cycles of e-assessment adapted from Whitelock (2006)*

There is a range of e-assessment software offering a variety of different functions that can be present in e-assessment depending on the type of assessment and the subject being assessed. Therefore, it is difficult to find one that is common to all. The following is a list of the types of questions that are likely in an e-assessment (Wills, Hare, Kajaba, Argles, Gilbert, & Millard, 2008).

- **Multiple-choice questions**

  It is required to choose one out of several responses to a question. It is also designed as drop-down or pull down.

- **True/false and yes/no**

  It is similar to multiple-choice questions with two possible responses. These questions allow quick review of large amounts of material.

- **Multiple responses**

  It is also similar to Multiple-choice questions, but they can be more difficult to answer correctly because the learner can choose one or more correct responses.

- **Matching**

  This type can be used when learners are required to match two related items or concepts.

- **Sequencing/ordering**

  When the learners are required to know a sequence or order. The sequencing questions are used by dragging the responses into the correct order.

- **Hotspot**

  Hotspot questions can be applied in some modules when a learner should to be able to identify or explain parts of a picture or diagram.

- **Judged mathematical expression**

  This is used for modules requiring a number or a mathematical expression as a response.

- **Short answer**

  Short answer or *gap* fill are types of automatically-marked questions that require a short textual response one word, or a short phrase.

- **Free text response or essay**

  Learners have to enter short essay-style answers that can be marked by a teacher or lecturer later.

The JISC (2007) also determined three main types of objective questions which can be used in e-assessment: multiple-choice questions (single or multiple) inputting text (words, numbers or formulae) or manipulating information on the screen (moving items or drawing graphs or diagrams). However, multiple-choice questions would not be appropriate for all subjects or assessments. This is because some subjects require learners to recall and enter information rather than choose a selection of possible responses. In fact, using e-assessment does not mean making the assessment content easier for students, it is important that the e-test is comparable to a "traditional" test, not that it is an on-screen copy of the pencil and paper test. The e-assessment chosen should assess the same knowledge with the same degree of difficulty (JISC, 2007).

Different studies have demonstrated the value of e-assessment for stakeholders in higher education. Academic stakeholders are defined as individuals and organisations with a vested interest in the assessment process, wherein each stakeholder has their own perspective (JISC, 2007). The most important stakeholders in higher education are students, teachers and institutions. To determine the effect of summative e-assessment, four major areas that e-assessment impinged upon were identified: teaching, learning, assessing and administration (Ridgway et al., 2004). The implications of introducing e-assessment for stakeholders and, therefore, the issues they are particularly interested in, have been reviewed in Gilbert et al. (2011). Students would be interested in changing the way they learn and further enhancement of IT skills, while academic staff would be interested in time to develop effective tests, fast feedback on performance to allow problem areas to be dealt with quickly and reduction in marking loads, thus freeing the academics to develop other areas of interest and balance of assessment strategies to test the range of skill levels. Support staff would be interested in time taken for testing system reliability, implementation and delivery of e-assessment and in-depth knowledge of the software used. Managers would be interested in coordination and management of team approach, appointment of additional specialist staff, establishment of a central unit for e-assessment, investment in hardware and software to support delivery of e-assessment to large group, integration with existing assessment procedures and availability of appropriate documents to include new quality assurance procedures (Gilbert et al., 2011). Senior managers and quality assurance specialists' interests tended to be principally concerned for their institutions' reputations regarding the risk of implementing e-assessment in their institutions, whereas learning technologists' interests were in pedagogic fitness for purpose and extending technical boundaries (Warburton, 2009).

### 2.4.1 E-assessment Benefits and Dis-benefits

There are different advantages of using e-assessment for organisations, for staff and for students, depending on their goals. E-assessment can reduce the time of marking for staff, decrease administrative loads and increase the number of students in the organisation, enhance quality feedback and improve assessment methods for students (Bull, 1999; Bull & McKenna, 2003; Gilbert et al., 2011; Redecker & Johannessen, 2013). Bennett (2002) remarked that it will be an anachronism when students do more and more learning with technology, but express this learning through paper testing.

Ricketts and Wilks (2002) observed that students felt the e-assessment examination environment was less stressful than a paper-based assessment, which led to improvements in their exam

performance. They also noticed that dyslexic students found e-assessment examination very helpful and provided specific advantages for them. E-assessment provides a strategy to cope with large numbers of students, perceived increases in student retention and flexibility for distance learning (Whitelock, Mackenzie, Whitehouse, Ruedel, & Rae, 2006). E-assessment is easier at producing results, decreasing the recycling of assessments, which leads to savings of time and financial resources and improved reliability in marking. It can also solve various accessibility issues and prepare students for the digital age (Dermo, 2007; Simin & Heidari, 2013).

A number of dis-benefits have been identified by researchers. E-assessment requires sufficient IT skills and experience among students as well as staff (Debuse & Lawley, 2016). E-assessment is time-consuming for staff and the institution and requires a significant collaboration between all those involved in designing and implementing e-assessment (Simin & Heidari, 2013). Staff need training in assessment principles, IT skills, examination management and design (Simin & Heidari, 2013). It requires a high level of investment, both in technology and in staff and student training, particularly if the assessment is to be used as summative (Chatzigavriil, Fernando, & Werner, 2015). Another concern is the reliability and validity of e-assessment, while technology is not always reliable and information can be lost if the system breaks down (Dermo, 2007; Simin & Heidari, 2013). Some pedagogical disadvantages have been highlighted by Simin and Heidari (2013); for example, in e-assessment the answer to some questions is only right or wrong, and there is no room for explaining the answer or getting partial credit. This does not give teachers the option of understanding the student's line of thinking to get to the answer. Some teachers use only multiple-choice questions, which can be tedious for students. It has been argued that this type of question focuses on testing superficial levels of student learning (Debuse & Lawley, 2016).

### 2.4.2 Barriers to Adopting e-assessment

The adoption of e-assessment systems in higher education has been much slower than predicted (Tomas et al., 2015) and a number of studies have investigated different barriers related to its implementation. Whitelock and Brasher (2006) described personal barriers, referring to academic staff and learners not feeling confident in the security and in the marking of the e-assessment assignments. Staff and students are not very confident or lack the will to accept new methods of e-assessment. In fact, the reliability of e-assessment systems is very important to increasing the motivation to replace traditional assessment with an electronic one (Whitelock & Brasher, 2006).

Another barrier is designing e-assessment questions to foster deep learning, since some experts believe that multiple-choice questions are not a valid mode of assessment (Mogey, 2011; Warburton & Conole, 2003). Warburton and Conole (2003) found that a lack of time for academics

is an obstacle to uptake of e-assessment. The principal barrier to expanding e-assessment practice, identified by Whitelock et al. (2006), are staff time and training. Academic staff and experts require time to develop good questions and understand the tools (Whitelock et al., 2006). There are some risks associated with using this technology, such as system errors and security issues (Bull, 1999). Also, students may not be interested in changing the assessment methods as they feel more familiar with traditional evaluation methods (Donovan et al., 2007). In addition, students are worried about the usability of the systems and the difficulty of accessing them (Donovan et al., 2007).

Organisational barriers can be the organisation culture, training and time. Organisations should pay attention to resistance to change and technophobia, which are found to be the barriers that most impact the uptake of e-assessment (Mogey, 2011; Warburton & Conole, 2003). Much time is required to develop good e-assessment tasks and plan for new assessment practices (Whitelock & Brasher, 2006). Universities should ensure their staff and students are properly trained and their awareness raised about the importance of e-assessment adoption (McCann, 2010; Mogey, 2011; Whitelock & Warburton, 2011).

Technical barriers refer to availability of resources, appropriate technical infrastructure, and technical support in an organisation (Whitelock & Brasher, 2006). Warburton and Conole (2003) found that technical support was the critical success factor for the implementation of e-assessment. An organisation may also face some obstacles in the e-assessment systems, which may lead to decreasing motivation for adoption. Dermo (2007) concluded that these obstacles are risks associated with technical failures, a lack of immediate technical support, technical expertise required of staff and difficulties for administrators.

### 2.4.3 E-assessment in UK Higher Education

This section presents the state of e-assessment in UK higher education because it was a leading country in e-assessment in higher education due to the way it is funded. There is a significant body of literature about the role of electronic assessment in UK higher education. Warburton and Conole (2003) reported that there has been a clear increase of the implementation of e-assessment in the UK higher education sector since 2003. The UK government has invested in many projects to extend the use of e-assessment in higher education (Ridgway et al., 2004) and universities in the UK have adopted different types of e-assessment system, such as multiple-choice and short-answer questions (Gipps, 2005). Research undertaken by Whitelock and Brasher (2006) explored policies and initiatives relating to e-assessment across UK higher education. They considered e-assessment very important for UK education as it forms an integral part of the e-learning movement.

The Joint Information Systems Committee (JISC), an organisation concerned with digital technologies for UK education and research, supports UK post-16 and higher education and research by supplying leadership in the use of ICT for learning, teaching, research and administration (JISC, 2007). The JISC's organisational committee has funded a number of projects on e-assessment practice. In 2007, the JSIC published "Effective Practice with e-assessment" outlining current e-assessment activities in further and higher education in the UK. This report discussed a range of projects and studies, including an e-assessment glossary, and case studies by UK universities such as The Open University, Loughborough University, The University of Dundee and The University of Derby.

The University of Derby developed the Tripartite Interactive Assessment Delivery System (TRIADS) which delivered summative assessments to 10,000 students. The University of Derby enhances staff in all aspects by supporting them in designing questions, quality assurance, monitoring and reporting of results (JISC, 2007). The computer-assisted assessment is still used in the university, whether the test is formative or summative, through the course resources (Blackboard) environment. Summative computer-assisted assessment is normally delivered under exam conditions as an alternative to the end of module paper-based exam (University of Derby, 2019).

The University of Dundee uses formative and summative e-assessments for students in all 15 of its schools. The questions in the e-assessment systems are mostly multiple-choice format, while some include sound and video files. The academic staff at the university can take an optional online course in e-assessment, which forms a part of the university's Postgraduate Certificate in Teaching in Higher Education, in order to provide valuable and effective assessment. This course focuses on the design of questions, feedback and strategies for integrating e-assessment into education (JISC, 2007). In fact, Dr. Linda Morris from the University of Dundee gave a presentation on the use of ExamOnline for higher-level examinations at the eAssessment Scotland Conference, 2014. She illustrated the timeline of E-assessment in the universities; the university's use of ExamOnline has grown each year and today the university licenses ExamOnline for up to 3,000 students in the College of Art, Science & Engineering, the College of Arts & Social Sciences, and the College of Life Sciences (Morris, 2014).

Meanwhile, Loughborough University has been working on large-scale deployment of e-assessment practice, funded by JISC. Loughborough University has used Questionmark Perception in formative and low-stakes summative assessments. In 2006, this project estimated that around 70-80,000 e-assessments had taken place at Loughborough University. Its strategy, a key to the successful implementation of e-assessment, is by training users and increasing awareness of responsibilities between e-assessment teams (JISC, 2007). Currently, most assessments are marked automatically

either by computer or, more likely, using a sheet which will be read by an optical mark reader. The advantages are that marking is quick, accurate and consistent and provides immediate personal feedback on where you need to improve (Loughborough University, 2019).

There is further evidence for increasing e-assessment research across UK universities by many authors, who discuss the challenges and benefits from employing e-assessment tools (Gilbert, Gale, Wills, & Warburton, 2009; Ridgway et al., 2004; Whitelock et al., 2006), and the state of e-assessment in different UK universities, such as Southampton University (Shephard, Warburton, Maier, & Warren, 2006; Wills, Bailey, Davis, Gilbert, Howard, Sclater, & Price, 2009; Wills, Davis, Gilbert, Hare, Howard, Millard, & Sherratt, 2005), King's College London (Whitelock, Gilbert, & Hatzipanagos,2012), and Open University (Jordan, 2012). In fact, the JISC has stopped funding any new assessment project since 2007. In addition, since 2013, the UK has unfortunately not invested in e-assessment projects in higher education. To address this, the ALT's Annual Conference 2019 seeks to foster a critical dialogue on technology in education and its political, social and economic context.

## 2.5 Factors Affecting the Attitude of Students towards Summative e-assessment

Ajzen (2005) defined attitude as '*The degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question*.' Attitude is assumed to be inaccessible to direct observation and must be deduced from measurable responses, which must reflect positive or negative evaluations of the attitude object. These responses can be evaluated and pertain to a given object, such as a person, event, policy and institution (Ajzen, 2005). Attitude is important for technology use; it is a reflection of an individual's perspective of an action and can be strongly predictive of behaviour (Delcourt & Kinzie, 1991; Kim, Chun, & Song, 2009; Tella & Bashorun, 2012). The majority of the studies found that attitude was a vital component that can lead to use technology (Kim et al., 2009; Yang & Yoo, 2004; Zhang & Aikman, 2007). It has been demonstrated that attitude plays a significant role in persuading students towards using e-learning (Shittu, Madarsha, & Ahmad, 2011; Yang & Yoo, 2004). A positive attitude may decrease the negative connotations linked with the examination process, and is consequently a more comfortable testing environment for students (Ogilvie, Trusk, & Blue, 1999). Student beliefs and attitude play a key part in driving IT usage and its success (Bhattacherjee & Premkumar, 2004). Attitude can be affected by different external factors, such as a person, a physical object, a behaviour, or a policy (Ajzen & Fishbein, 1977). This section reviews the theories and models for technology use and related work

on students' attitude towards summative e-assessment in order to construct framework the that can be used as a theoretical foundation for investigation of the factors influence the attitude of students towards summative e-assessment in a Saudi Arabian universities context.

### 2.5.1 Review of Theories and Models for Technology Use

There are numerous models and theories which seek to explain people's varying reactions to new technologies. This section presents prevalent theoretical models that have been developed to predict and understand students' use of using technologies, and highlights their advantages and limitations. Technology theories are about how people accept and adopt some technology for use. The acceptance refers to the attitude of a user towards a technology and which is affected by different factors (Renaud & Biljon, 2008). It is the process whereby a user shows a positive attitude towards the use of technology. Attitude can be described as the critical factor in determining the success or failure of any technology and attitude has been conceptualised as an outcome variable in a psychological process that institutions go through in making decisions about technology (Samaradiwakara & Gunawardena, 2014). The technology theories propose a number of factors that are essential in determining user attitude towards using/accepting a new technology (Renaud & Biljon, 2008). The most commonly used theories are reviewed below, for different settings and particularly in information systems: the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB), the Technology Acceptance Model (TAM), including TAM2 and TAM3, and the Unified Theory of Technology Adoption and Use (UTAUT) (Samaradiwakara & Gunawardena, 2014). With regard to the purpose behind these models and theories, as discussed in Section 1.3, examining them thoroughly will help to understand why there may be different reactions among students at the universities of Saudi Arabia when they use summative e-assessment. The reason why technology theories are included, even though the main focus of this research is the development of a framework, is because of their interconnection, and to clarify the factors affecting the use of technology. It is important to review models and theories in order to understand the use of technology by the users and to construct the research framework. Descriptions of the relevant models and theories are provided in the subsequent sections.

#### A. Theory of Reasoned Action (TRA)

The TRA, proposed by Fishbein and Ajzen (1975), is one of the earliest models developed to explain technology use. It measures behaviour intention from two perspectives: the attitude towards behaviour, and the subjective norms, as shown in Figure 2.3. The attitude describes the personal beliefs and expectations on certain behaviour, whereas subjective norms means the perceived effect of social pressure to perform or not to perform that behaviour (Fishbein & Ajzen, 1975). The

TRA model stresses that an individual's behaviour is affected by their motivation to perform that behaviour. Behaviour intention refers to the person's intention to exhibit a particular behaviour. Even though this theory was developed primarily for social psychology, it has been applied by numerous studies in IS for predicting the behavioural intention to use a given technology (Chuttur, 2009).

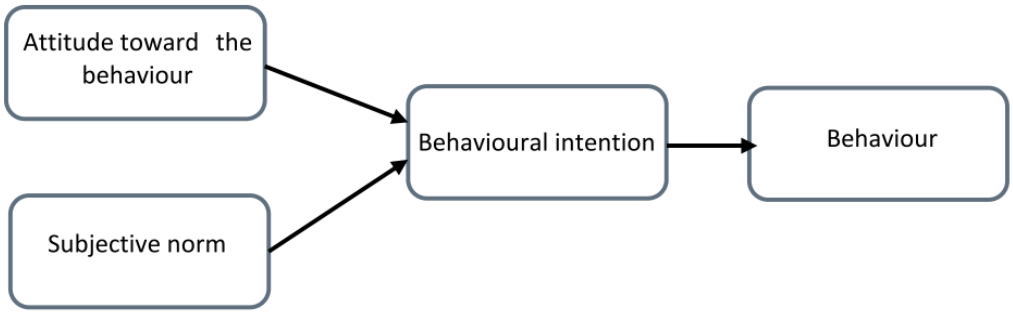


*Figure 2.3 Theory of Reasoned Action (Fishbein & Ajzen, 1975)*

Following critique of TRA, Fishbein and Ajzen (1975) acknowledged their model's limitation concerning the distinction between a goal intention and a behavioural intention (Ajzen, 1985; Sheppard, Hartwick, & Warshaw, 1988). TRA was developed to deal with behaviours and not outcomes that result from behaviours. Therefore, any behaviour that involves irrational decisions, complex skills or social support, cannot be explained by the TRA (Samaradiwakara & Gunawardena, 2014). TRA is recognised as a general model since it does not postulate the beliefs that predict a given behaviour (Bagozzi, 2007; Chuttur, 2009).

**B. Theory of Planned Behaviour (TPB)**

The TPB was subsequently developed by Ajzen (1985) to address the limitations of the TRA. The TPB introduced perceived behavioural control to account for individuals' behaviour under non-volitional control (Ajzen, 1991). A central factor in the theory of planned behaviour is the individual's intention to perform a specified behaviour (Ajzen, 1991; Ajzen & Madden, 1986) as shown in Figure 2.4. The individual's intention in both TRA and TPB refers to the motivational factors that influence behaviour. They show an individual's feeling, such as how hard or easy, the willingness to try, and the effort and time required to perform the behaviour (Ajzen, 1991). This resulted in the perceived behavioural control being added in the TPB as a factor that reflects the ability to perform the behaviour. It plays an important role in this theory, as the achievement of a certain behaviour depends on the combination of motivation (intention) and ability (behavioural control) (Ajzen, 1991). In other words, to achieve a behaviour, the person requires the opportunities and resources, and intends to perform that behaviour (Ajzen, 1991). According to the

TPB, for a person to carry out a behaviour successfully depends on how much effort the person is willing to invest in the level of control, e.g. knowledge and skills (Chuttur, 2009).

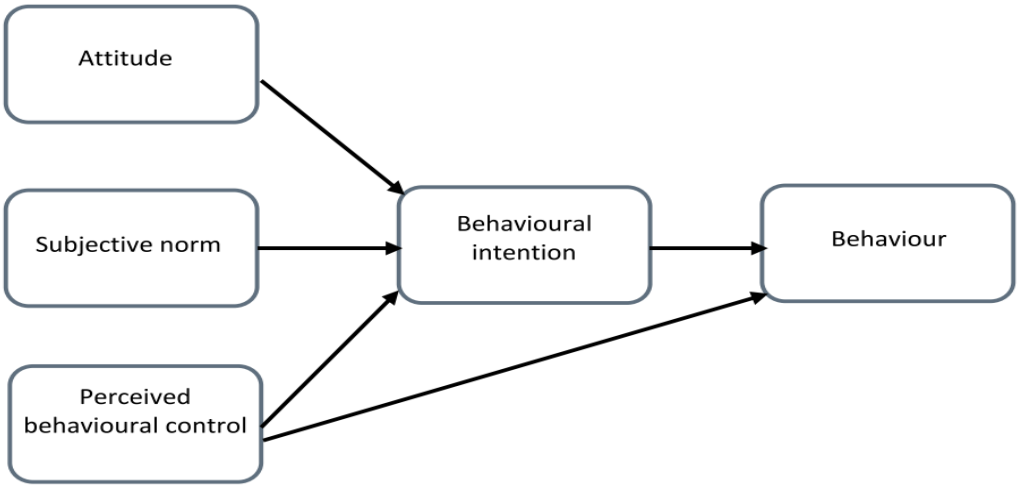


*Figure 2.4 Theory of Planned Behaviour (Ajzen, 1991)*

TPB has also been critiqued, even though it was developed to address the theory of reasoned action's volitional control limitation. Both TRA and TPB assume that individuals must be motivated to perform behaviour. This assumption may cause a problem for the consumer adoption behaviour because there are external barriers that might prevent them from performing the behaviour (Taylor & Todd, 1995). Ajzen (1991) indicated that the determinants of intention are not limited to the three suggested variables, i.e. attitude, subjective norms, perceived behavioural control. TPB only explained 40% of the variance in individuals' behaviour (Samaradiwakara & Gunawardena, 2014). Moreover, TPB was also critiqued for combining all the non-controllable variables affecting individuals' behaviour into one (Taylor & Todd, 1995).

**C. Technology Acceptance Model (TAM)**

The TAM was developed by Davis (1989) to explain and predict technology use. TAM adapted the TRA, but from the perspective of computer acceptance behaviour. It was hypothesised that two specific variables, perceived usefulness (PU) and perceived ease of use (PEU), are the fundamental determinants of user acceptance of technology (Davis, 1989). Perceived usefulness is defined as '*the degree to which a person believes that using a particular system would enhance his or her job performance*' (Davis, 1989), while perceived ease of use defined as '*the degree to which a person believes that using a particular system would be free of effort*' (Davis, 1989). Davis (1989) claimed that perceived usefulness and perceived ease of use strongly influence an individual's intention to use a system, whereby their intention can be explained by their attitude. It also claimed that subjective norms had no effect on intentions (Davis, Bagozzi, & Warshaw, 1989). A diagram of this model is shown in Figure 2.5.

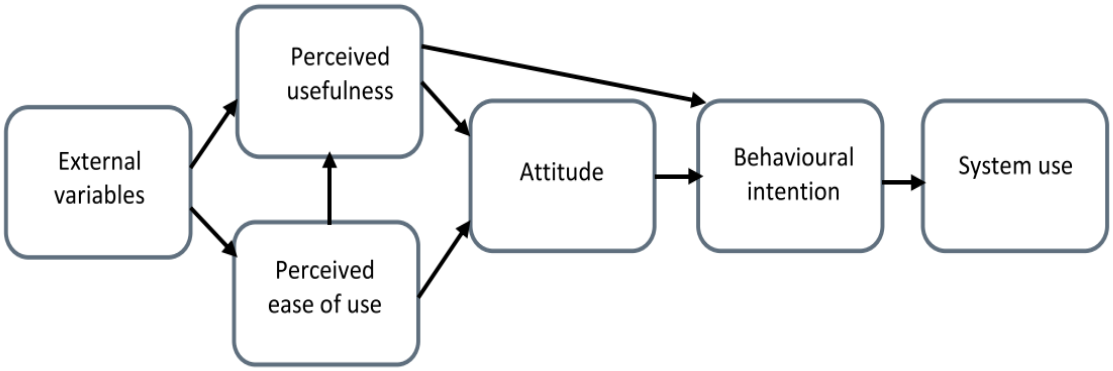


*Figure 2.5 Technology Acceptance Model (Davis et al., 1989)*

TAM is one of the most widely used and validated models within information system research (Bourgonjon, Valcke, Soetaert, & Schellens, 2010; King & He, 2006; Qteishat, Alshibly, Algatawna, & Alma'atiah, 2013). It is considered a simple and reliable model for predicting and measuring user acceptance of technology (Bourgonjon et al., 2010). TAM has been continuously studied and expanded to involve TAM2, which includes subjective norm, image, job relevance, output quality, result demonstrability, experience and voluntariness as other predictors (Venkatesh & Davis, 2000), while TAM3, which was proposed in the context of e-commerce with an inclusion of the effects of trust and perceived risk on system use, noticeably includes more predictors or determinants, such as computer self-efficiency, external control perceptions, computer anxiety, computer playfulness, objective usability , and perceived enjoyment (Venkatesh & Bala, 2008).

As in the case of any theoretical model, TAM has certain limitations. The explanatory power is low and the model consistently explains only 40% of the variance in behavioural intention (Davis et al., 1989; Taylor & Todd, 1995; Venkatesh, Morris, Davis, & Davis, 2003). The model's explanatory power is affected by many variables, such as the participant type, study environment (Sun & Zhang, 2006). However, the explanatory power of the TAM can be improved with the addition of external variables (Salovaara & Tamminen, 2009). Legris, Ingham, and Collerette (2003) stated that TAM and TAM2 are not as useful when they are integrated into a wider model, such as the theory of planned behaviour (TPB), task-technology fit or any other model that includes human and social change process variables. Some researchers have remarked that the TAM is very reliable about user's attitude (personal factors) towards technology, but does not include the effect of social and resource factors (Wu, 2009). The correlations between the TAM variables are inconsistent; for example, the impact of the perceived ease of use on behavioural intention has been cited as significant in certain studies and not significant in others (Al-Aulamie, 2013). TAM has also been

critiqued for not taking into account the possibility that a technology may be initially accepted, but later abandoned, or *vice versa* (Salovaara & Tamminen, 2009).

**D. Unified Theory of Acceptance and Use of Technology (UTAUT)**

This theory was developed by Venkatesh et al. (2003) in an attempt to provide a unified view of users' technology acceptance, based on a comparison of eight models: TRA, TPB, TAM, Innovation Diffusion Theory (IDT), the Motivational Model (MM), a model combining the TAM and TPB, the model of PC utilisation, and the Social Cognitive Theory (SCT) (Venkatesh et al., 2003). This theory is constructed from four variables: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). PE, EE and SI together influence Behavioural Intention, while FC has a direct impact on user behaviour. Performance Expectancy is defined as '*the degree to which an individual believes that using the system will help them attain gains in performance*' (Venkatesh et al., 2003). Effort Expectancy is defined as '*the degree of ease associated with the use of the system'* (Venkatesh et al., 2003). Social Influence is defined as '*the degree to which an individual perceives that important others believe they should use the new system*' (Venkatesh et al., 2003). Facilitating Conditions is defined as '*the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system* (Venkatesh et al., 2003). In addition, UTAUT included moderating variables, gender, age, experience and voluntariness of use, as shown in Figure 2.6.

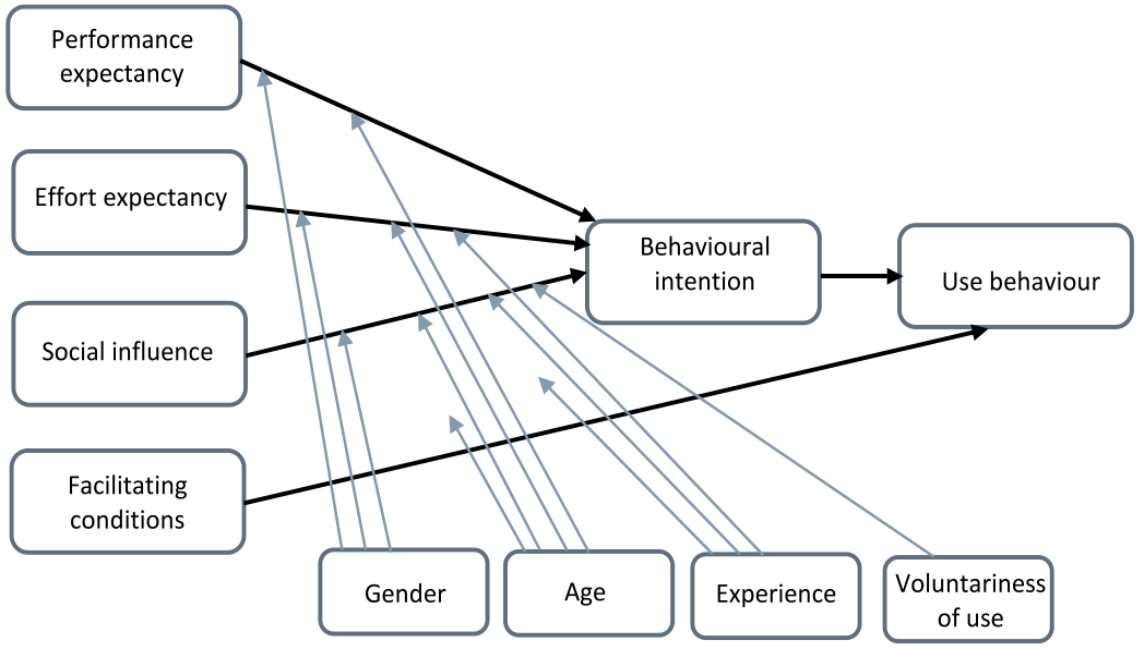


*Figure 2.6 Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)*

UTAUT provides a useful tool for evaluating the likelihood of success with new technology, and helps to explain how individual differences influence technology use. This model enhances the

understanding of technology acceptance and has been used widely by different projects in e-learning (Chiu & Wang, 2008; Marchewka & Kostiwa, 2007; Sumak, Polancic, & Hericko, 2010). It explains some 70% of the variance in behavioural intention (Venkatesh et al., 2003). UTAUT was primarily developed to examine the technology acceptance from employees' perceptions. Thus, it is not known how this theory can be adopted in different settings, such as a consumer context (Salovaara & Tamminen, 2009). UTAUT's limitations are mainly in the relationship between the intention and use of behaviour (Samaradiwakara & Gunawardena, 2014).

### 2.5.2 Review of Related Work on Students' Attitude towards Summative e-assessment

A literature review was carried to survey the factors that influence students' attitude towards summative e-assessment, but found a lack of material pertaining to such factors. The goal of this review is to make better sense of the various research trends and provide proposals for further research. The findings demonstrated that the relevant literature is limited. Several papers adopted technology theories and quantitative survey was the favoured method for researchers. The papers were divided into two groups to review students' use of summative e-assessment, as in Table 2.1, and reviews of e-assessment models which investigate the use of e-assessment by students, as in Table 2.2. The objective of this review is to assess the current state of research on summative e-assessment and identify the questions that need further research. Table 2.1 summarises studies aimed to investigate students' use of e-assessment.

*Table 2.1 Review of studies on students' use of e-assessment*

| **Reference** | **Findings** | **Sample** |
|---|---|---|
| Dermo (2009) | • Positive feelings towards summative e-assessment, especially about stress and learner expectations.<br>• Students thought e-assessment would contribute to their learning, such as feedback.<br>• No significant difference between gender and age in responses of students. | University of Bradford, UK |
| Tella and Bashorun (2012) | • Student attitudes were generally more positive towards computer-based exams.<br>• Increased students' performance in learning.<br>• Not comfortable with technical problems. | University of Ilorin, Nigeria |
| Sheader et al. (2006) | • Training for the e-assessment was very helpful.<br>• Over half the students preferred e-exam to paper-based exams.<br>• e-exam was less time-consuming and easier to submit the answers.<br>• Some technical problems in logging into the systems. | University of Manchester, UK |

| Reference | Findings | Sample |
|---|---|---|
| Ogilvie et al. (1999) | • Students had positive attitudes towards computer-based exams.<br>• Enjoyable and efficient.<br>• Reduced the exam time.<br>• Much more comfortable testing environment for students. | Medical University in South Carolina, USA |
| Ricketts and Wilks (2002) | • User interfaces for e-assessment affected the students' performance and their attitudes.<br>• Screen design was an important factor that influenced students to accept e-assessment.<br>• Students appreciated the speed of marking and feedback of e-assessment. | University of Plymouth, UK |
| McDonald (2002) | • Impact of individual factors in the performance of e-exam.<br>• Computer experience and familiarity.<br>• Computer anxiety, confidence and attitude. | Review paper |

A study was conducted at the University of Bradford with students who had taken part in formative and summative online assessment using Questionmark Perception in 2007–2008 across the full range of disciplines at the university. The summative assessments contained mostly multiple-choice and short-answer questions, but took place under formal examination conditions in large computer clusters. Dermo (2009) investigated the factors affecting student perceptions of e-assessment among students and a survey was designed to measure the students' attitude towards e-assessment. Students were asked about their feelings during e-assessment, such as: stress, comfort, concentration, their expectations and their preferences. In addition, the survey set out to discover whether the attitude differed according to age and gender. Students had a positive feeling towards e-assessment, which demonstrated no significant difference in responses between gender and age between students. E-assessment enabled the university to deliver feedback to a large number of students and save instructors time in marking tests (Dermo, 2009).

Tella and Bashorun (2012) assessed the attitude of undergraduate students towards computer-based tests at the University of Ilorin, Nigeria. A questionnaire investigated students' attitude, preferences, anxiety level and their achievements. Students had a positive attitude towards computer-based exams compared to traditional exams. On the other hand, students reported some limitations in computer-based exams, such as shortage of computers, lack of experience and skills, loss of data in the process of writing the exam and the slowness of the network (Tella & Bashorun, 2012).

The University of Manchester School of Computer Science developed computer software (short-answer question assessment) to assess 300 students (Sheader et al., 2006). This project aimed to compare computer-based assessment (CAA) and paper-based assessment to determine if the CAA

had more benefits for students and staff, before introducing CAA wholesale in the university. The university was attempting to tackle increasing numbers of students each year, and help staff members without impacting student learning. Students received a short training session with printed written instructions, following which the questions were set to harvest their opinion of CAA. Students remarked that the training was adequate and over the half of them preferred CAA to paper-based exams. Students identified some problems, such as logging on. However, this can be overcome by improved versions of the CAA software (Sheader et al., 2006). Learning environment was also found to influence students' attitude towards using computers for assessment. A study conducted by Ogilvie et al. (1999) at the Medical University of South Carolina reported that students found a computer-based exam was more helpful and less time-consuming than a paper exam, and decreased their negative feelings associated with the examination process.

Ricketts and Wilks (2002) investigated the performance of computer-based assessment by students in first-year Biology at the University of Plymouth. This study focused on the effect of the user interface of the web-based assessment on the students' performance. They tracked the students' results over two years and showed how a change in questions in the interface could make a difference in students' performance, even when the same questions were presented to students. The result was that the presentation of questions which required scrolling the page to reveal was less acceptable than those in which questions were presented one at a time. In other words, the mode of presentation of e-assessment was the most important factor influencing students' attitude.

McDonald (2002) reviewed the individual differences, such as computer experience, computer anxiety and computer attitude, that affect the equivalence of computer-based assessment and paper-based assessment. McDonald (2002) argued that experience of using computers influenced students' performance on computerised tests. Students' attitude towards computer-based assessment was typically shaped by previous experience and computer anxiety/confidence. In fact, these factors overlap; when a student has had a good computer experience, it will reduce their computer anxiety, and result in a more positive attitude towards the computer. This study concluded that the individual differences have a significant effect on the equivalence between these two types of assessment. However, these effects will not remain static due to the spread of technology (McDonald, 2002).

In order to identify the factors that affect students at Saudi Arabian universities, relevant literature about technology adoption and experience in different universities around the world is investigated. The Technology Acceptance Model was found to be the most used technology model

adopted for e-learning systems in general, and for e-assessment in particular (Imtiaz & Maarop, 2014). TAM is considered a simple and useful model in predicting the individual's intention to use various types of technology, using just two factors (Lee, 2010). However, some researchers found that TAM is not sufficient to explain different issues that face adopting of e-learning, so have extended it by adding some variables related to both human and social context (Lee, 2006; Legris et al., 2003). In the area of e-assessment, an extended TAM model has been used by some researchers with constructs from TPB and UTAUT (Alkiş, 2010; Amoroso, & Durfee, 2007; Schneberger et al., 2007; Terzis & Economides, 2011). Table 2.2 reviews e-assessment models in the literature and shows that each study investigated different factors where TAM emerged as the most frequently adopted theory. The studies have only been carried out in a few geographic regions. The review and analysis of the previous studies allowed us to understand the current research directions in the summative e-assessment use from the students' perspective. From this review, it was clear concerning the role of attitude in relation to students' use of summative e-assessment. This review shows that individual's attitude towards a computer can likewise be influenced by different factors. The review was useful for detecting the research gaps that can be addressed through further research. Based on the findings, it can be concluded that substantial efforts are needed to investigate the topic from different perspectives and angles.

*Table 2.2 Review of e-assessment models*

| **Study** | **Sample** | **Theory Used** | **Factors** |
|---|---|---|---|
| Schneberger et al. (2007) | Students at Appalachian State University in Boone, N.C. | TAM and external factors. | Perceived Usefulness.<br>Perceived Ease of Use.<br>Level of support.<br>Attitude towards behaviour. |
| Alkiş (2010) | Students at Middle East Technical University, Turkey. | TAM and individual difference factors. | Perceived Usefulness.<br>Perceived Ease of Use.<br>Self-efficacy.<br>Attitude.<br>Anxiety.<br>Behavioural intention. |
| Terzis and Economides(2011) | Students at University of Macedonia, Greece. | TAM and external factors. | Perceived Usefulness.<br>Perceived Ease of Use.<br>Self-efficacy.<br>Social Factor.<br>Perceived Playfulness.<br>Content.<br>Goal Expectancy.<br>Facilitating Conditions.<br>Attitude towards behaviour.<br>Behavioural intention |

## 2.6 Summary

This chapter presented a background of learning theories and assessment, along with the importance of assessment in the learning process. The importance of feedback activities for successful and effective teaching and learning was shown. Assessment plays a key role in the learning process and the role of summative assessment for measuring students' achievement has been emphasised. An overview of e-learning and e-assessment was presented. The benefits, dis-benefits and barriers to adopting e-assessment systems were explained. The most commonly-used technology theories were presented followed by review and analysis of the relevant works. The reviewed studies highlighted a research gap, arising as a result of the limited research on investigation of the attitude of students towards summative e-assessment, especially in the context of Saudi Arabian universities. As explained in Section 1.2, there is a need to study the students' attitude to assist the development and growth of e-assessment in Saudi Arabian universities. Also, as explained in Section 1.3, there is a need for a new framework to address the research questions in Section 1.4. In addition, as presented in Section 2.4.2, this thesis considered the issues regarding barriers of e-assessment, which could be considered to the proposed research framework.

# Chapter 3 Proposed Research Framework

In this chapter, a conceptual framework is proposed, drawing upon technology models and theories and previous studies on students' use of summative e-assessment, to investigate the students' attitude towards summative e-assessment in Saudi Arabian universities.

## 3.1 Construction of the Framework

As discussed in Section 1.3, this thesis focuses on the development of a framework for support the investigation of the students' attitude towards summative e-assessment in Saudi Arabian universities. The research framework was constructed in four stages, as shown in Figure 3.1. Stage one involved reviewed technology models and theories to collect the factors which influence people's use of technology as discussed in Section 2.5.1. This can help to identify affecting factors which contribute to the use of technology with respect to e-assessment. Stage two also reviewed previous studies that have been investigated in the summative e-assessment domain, as discussed in Section 2.5.2. The studies were sourced from articles on students' perceptions and attitudes towards summative e-assessment systems. Stage three is filtering the related factors by excluding unrelated factors and removing repeated factors. The factors collected during the previous two stages were filtered by removing repeated factors and excluding factors that shared the same concept. Finally, stage four involves the final representation of the construction process of the framework comprising the factors that support the investigation for this thesis. It was apparent from previous studies of e-assessment that the students' attitude depends on a range of factors: technology-related, society-related, organisation-related and individual-related.

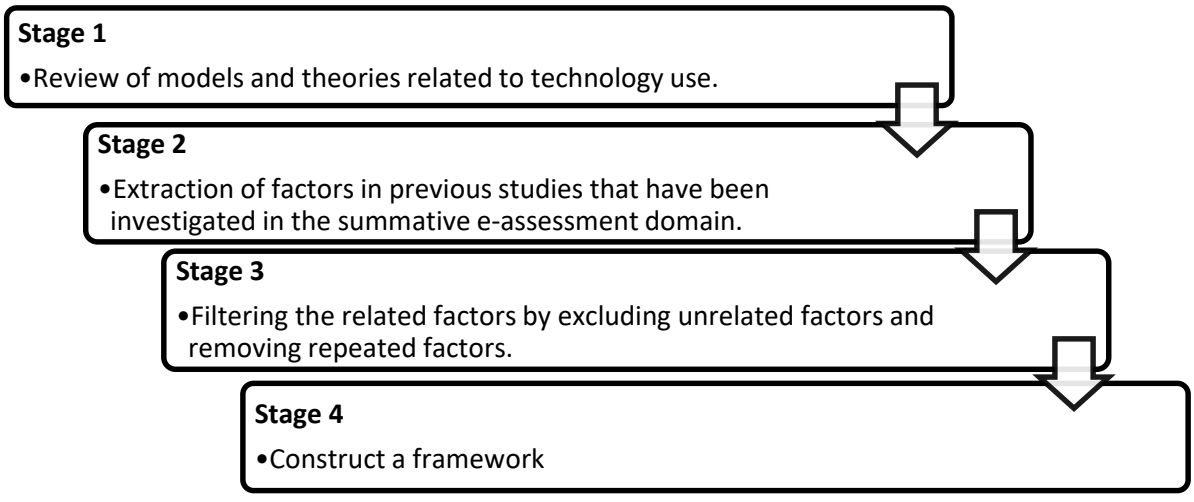


*Figure 3.1 The stages of the proposed framework construction*

## 3.2 The Proposed Research Framework

This section presents the proposed research framework in order to support the investigation of the factors influencing the attitude of students towards summative e-assessment. This thesis focuses on the investigation of the attitude of students towards summative e-assessment in principle. It is important to note that the attitude of a student towards summative e-assessment in principle might be quite different from their attitude towards summative e-assessment using a specific computer system. Thus, in practice, good e-assessment is affected by the type of platform used by the university, but, conversely, the environment and hosting platform may have a negative effect, leading to failure of the project. Similarly, other stakeholders, such as teachers might also show different attitude and approaches to e-assessment, depending on whether they were considering it in principle or instantiated as a specific computer system in practice. In addition, the attitude of a student towards summative e-assessment might be quite different from their attitude towards formative or diagnostic e-assessment. The framework was constructed in order to support the investigation of the attitude of students towards summative e-assessment in principle, which does not cover any specific computer system. The attitude of students towards formative, diagnostic or a specific computer system is addressed in the future work of the framework in Section 8.4.

In light of the literature review, the factors which may contribute to understanding students' attitude towards summative e-assessment in Saudi Arabian universities were identified. The technology-related factors are represented by: Perceived Usefulness, Perceived Ease of Use, Accessibility, Content, and Perceived Playfulness. Self-efficacy is an individual-related factor, Facilitating of Examination is an organisation-related factor, while Social Influence was chosen as a culture-related factor. These factors are now described.

### 3.2.1 Effect of Perceived Usefulness (PU) on Attitude (AT)

Perceived Usefulness is defined as '*the degree to which a person believes that using a particular system would enhance his/her job performance'* (Davis, 1989). Perceived usefulness is related to the person's belief in the benefits of using a system to perform a specific task (Drennan, Kennedy, & Pisarski, 2010; Teo, 2008). It has been agreed that there is a strong effect by perceived usefulness on behavioural intentions to accept an e-assessment system (Alkiş, 2010; Imtiaz & Maarop, 2014; Schneberger et al., 2007; Terzis & Economides, 2011). This means that students are likely to accept e-assessment if they think that this type of assessment will improve their knowledge and better understanding of their course. Here, perceived usefulness is defined as the ability of e-assessment to assist students in effectively learning and expanding their knowledge or skills. With respect to e-

assessment, it is assumed that students are likely to develop a positive attitude towards summative e-assessment if they find e-assessment to be useful for learning.

### 3.2.2 Effect of Perceived Ease of Use (PEU) on Attitude (AT)

Davis, (1989) defined perceived ease of use as '*the degree to which a person believes that using a particular system would be free of effort'.* Any system free of difficulty or great effort has to be accepted by the users (Drennan et al., 2010). Research on e-assessment validated the significant, positive effect of perceived ease of use on the attitude towards e-assessment (Alkiş, 2010; Imtiaz & Maarop, 2014; Schneberger et al., 2007; Terzis & Economides, 2011). This factor is used here to identify whether students find e-assessment tools easy to use. The ease of use factor is valuable particularly because the development of any information technology is subject to improvement. Therefore, the designers of e-assessment systems should take into account the ease of use factor. For e-assessment, it is supposed that students are likely to develop a positive attitude towards summative e-assessment if they find the e-assessment systems easy to use.

### 3.2.3 Effect of Self-Efficacy (SE) on Attitude (AT)

This refers to a judgement of the individual's capability of using computers in diverse situations (Compeau & Higgins, 1995). Studies have examined the influence of computer self-efficacy on users' readiness to accept new technology (Chu, 2010; Delcourt & Kinzie, 1991; Yang, 2012). In general, it has been demonstrated that higher e-learning performance can be developed and predicted by higher self-efficacy (Chu, 2010; Liaw, 2008; Yang, 2012). Self-efficacy is an important factor which influences students' attitude towards e-assessment. Students with high self-efficacy are more likely to believe that they can deal with the computer efficiently, so they might perform better in exams. Thus, they will be much more confident and less anxious than others (Imtiaz & Maarop, 2014; Maqableh, Taisir, Ra'ed, & Mohammed, 2015; Terzis & Economides, 2011). For e-assessment, it is supposed that students are likely to develop a positive attitude towards summative e-assessment if they believe that they can deal with the computer efficiently.

### 3.2.4 Effect of Perceived Playfulness (PP) on Attitude (AT)

Perceived Playfulness refers to the individual's subjective experience of interaction with the situation, which was proposed by Moon and Kim (2001). They extended the TAM by introducing Perceived Playfulness as a new factor to explain the user's intrinsic motivation in World Wide Web acceptance. They assert that perceived playfulness influences a user's acceptance towards using the World Wide Web and should be a consideration in the design of the system. They saw

playfulness as having three dimensions (Moon & Kim, 2001): *Concentration* describes a user's attention and interaction with the system; *Curiosity* of the user during their interaction with the system; *Enjoyment* or interest by the user in their interaction with the system. In the context of e-assessment, perceived playfulness is included because e-assessment systems should hold the student's concentration, curiosity and enjoyment to be successful (Maqableh et al., 2015; Terzis & Economides, 2011). It is predicted that students' attitude to using summative e-assessment systems would be influenced by their attitudes of playfulness.

### 3.2.5 Effect of Social Influence (SI) on Attitude (AT)

This is defined as the degree to which an individual perceives the importance of others' opinions when using a new system (Venkatesh et al., 2003). Social influence can be affected by other people's beliefs, such as peer influence and superiors' influence (Taylor & Todd, 1995). When students have not yet used these systems, they are expected to consider the opinions of their friends, and even seniors (Thompson, Higgins, & Howell, 1991). Here, social influence plays a significant part in the success in the adoption of e-assessment (Terzis & Economides, 2011). Some research has claimed that campus culture is a critical factor in successful implementation of e-assessment (McCann, 2010; Warburton, 2009). It is supposed that students' attitude towards summative e-assessment would be affected by friends' opinions, lecturers' support and university culture.

### 3.2.6 Effect of Facilitating of Examination (FE) on Attitude (AT)

The organisation plays a key role in making any new technology successful by providing various types of support to the users (Venkatesh et al., 2003). This help depends on the technology's requirements. The term Facilitating of Examination refers to the degree to which an individual believes that support for using e-assessment systems will be available, both before and during exams. Students will feel much more comfortable when the support during exams is available and visible. Terzis and Economides (2011) found a significant relationship between IT support and perceived ease of use in computer-based exams. They stressed that the university should provide an expert during e-exams to overcome students' queries about the use of the system or even about the content of the question (Maqableh et al., 2015; Terzis & Economides, 2011). The importance of student training in e-exam systems was mentioned by Sheader, Gouldsborough, and Grady (2006). A training session must be given to students to show them how to use the system, to decrease the anxiety associated with exam time. It is assumed that the availability of help (such as a lecture or

IT staff), and training for the systems, are necessary to increase students' confidence in taking e-exams (Maqableh et al., 2015).

### 3.2.7 Effect of Content (CO) on Attitude (AT)

The factor 'Content' was proposed as one of the determinants of End-User Computing Satisfaction (Doll & Torkzadeh, 1988). Wang (2003) developed a comprehensive model, and a questionnaire, for measuring learner satisfaction with e-learning systems. He identified e-learner satisfaction with four dimensions: content, user interfaces, learning community and personalisation. The Content is concerned with whether the system provides sufficient, useful content and fits a learner's needs (Sun, Tsai, Finger, Chen, & Yeh, 2008; Wang, 2003). Terzis and Economides (2011) used the 'Content' factor to develop a Computer-Based Assessment model with two dimensions, course content and question content. They stated that 'Content' is an important factor that impacts students' behavioural intention to use computer-based assessment (Terzis & Economides, 2011). In this thesis, Content is a factor used to describe the effect of the assessment content in three dimensions. 'Course type' is used to examine the effect of course content (difficult or easy, interesting or boring, useful or not useful) in accepting e-assessment (Terzis & Economides, 2011). Secondly, 'Question Style', i.e. questions should be clear, understandable and related to the course's content to be accepted by students (Davies, 2001; Nicol, 2007; Terzis & Economides, 2011). This research proposes 'Feedback Process' as a third dimension to assess how feedback can affect students' attitude towards summative e-assessment. Feedback should be clear, fair, balanced and relevant to the assessment to be accepted by learners (Howard, 1987; Iahad, Dafoulas, Kalaitzakis, & Macaulay ,2004; Ypsilandis, 2002).

### 3.2.8 Effect of Accessibility (AC) on Attitude (AT)

Accessibility arises in different technology models as one of the important factors that influence the technology's success (Green, Nacheva, & Pearson, 2008; Lin & Lu, 2000; Park, 2009; Thong Hong, & Kar-Yan, 2002). The accessibility of an e-assessment is described as the extent to which the e-assessment system (the physical environment, test software and the administration system) can be accessed by people with disabilities or special access requirements using appropriate assistive technologies (such as screen readers, screen magnifiers, Braille readers, and speech recognition software) (Ball, 2006).

The JISC TechDis project commissioned the report for guidance "Accessibility in e-assessment Guidelines" (Ball, 2006). Ball (2009) later highlighted the major issues arising from the TechDis report (Ball, 2009). Accessibility focuses on design or adjustments created for disabled users, with

sometimes little benefit to other users. E-assessment should be more accessible than paper-based assessment due to the variety of formats which are available in electronic systems (Ball, 2009). The guidelines reiterated that e-assessment must be fair for all users through accessibility measures. The question type in multiple forms (e.g. written, graphics, video) should be presented in different methods of access, such as alternative text and sound (Ball, 2006). One example of e-assessment in the UK with some accessibility features is the Rogō system, adopted at the University of Nottingham. The impact of a student's disability can be reduced in Rogō by adding some adjustments within the interface, such as typeface and font size and colours (University of Nottingham, n.d.). The effects of the accessibility of e-assessment have not been investigated previously in the context of the factors influencing the attitude of students towards e-assessment. This thesis is the first effort that supposes that students are likely to develop a positive attitude towards the use of summative e-assessment in their course if they consider the accessibility. Here, e-assessment accessibility refers to the degree of ease with which all students can access, use and answer e-exams efficiently. Accessibility will affect students' attitude towards summative e-assessment, especially students with special needs in different stages. The proposed research framework in this thesis is summarised in Table 3.1.

*Table 3.1 The proposed research framework*

| Factor | Dimensions | Factor description | Supported technologies | Supported e-assessment |
|---|---|---|---|---|
| **Perceived Usefulness (PU)** | • Effectiveness<br>• Improves the quality of learning | Individual believes that summative e-assessment can enhance perform-ance, improve knowledge and better understanding of the course. | Davis (1989);<br>Teo (2008);<br>Drennan et al. (2010) | Schneberger et al. (2007);<br>Alkiş (2010);<br>Terzis and Economides (2011);<br>Imtiaz and Maarop (2014) |
| **Perceived Ease of Use (PEU)** | • Easy to learn and free of effort<br>• Clear and understandable | Individual believes that taking an exam on a computer is easy, free of effort and does not require specific skills. | Davis (1989);<br>Drennan et al. (2010) | Schneberger et al. (2007);<br>Alkiş (2010);<br>Terzis and Economides (2011);<br>Imtiaz and Maarop (2014) |

| Factor | Dimensions | Factor description | Supported technologies | Supported e-assessment |
|---|---|---|---|---|
| **Self-Efficacy (SE)** | • Ability to perform specific task<br>• Confidence in using computer | Individual believes they can accomplish tasks using a computer. | Delcourt and Kinzie (1991); Compeau and Higgins (1995); Liaw (2008); Alenezi et al. (2010); Chu (2010); Yang (2012) | Terzis and Economides (2011); Imtiaz and Maarop (2014); Maqableh et al. (2015) |
| **Perceived Playfulness (PP)** | • Concentration<br>• Curiosity<br>• Enjoyment | Systems should hold users' attention, interaction, concentration, curiosity and enjoyment. | Moon and Kim (2001); Wang et al. (2009) | Terzis and Economides (2011); Maqableh et al. 2015) |
| **Social Influence (SI)** | • Friends opinion<br>• lecturers support<br>• University culture | Consider opinions and beliefs of their friends.<br>The impact of lecturers actions and support.<br>The influence of university culture in accepting a new technology. | Thompson et al. (1991); Taylor and Todd (1995); Straub et al. (1997); Straub et al. (2002); Venkatesh et al. (2003); Al-Gahtani et al. (2007); Li and Kirkup (2007); Alebaikan and Troudi (2011) | Warburton (2009); McCann (2010); Terzis and Economides (2011) |
| **Facilitating of Examination (FE)** | • Support students during exam time<br>• Training before exam | Experts have to be available during e-assessment to overcome students' queries.<br>Training session should be given to the students to increase their confidence in taking e-assessment. | Thompson et al. (1991); Taylor and Todd (1995); Venkatesh et al. (2003) | Sheader et al. (2006); Terzis and Economides (2011); Maqableh et al. (2015) |

| Factor | Dimensions | Factor description | Supported technologies | Supported e-assessment |
|---|---|---|---|---|
| **Content (CO)** | • Course Type<br>• Question Style<br>• Feedback Process | Course content (easy, difficult, interesting or boring).<br>Question style (clear, understandable and related to the course's content).<br>Feedback (immediate, useful and sufficient). | Howard (1987);<br>Doll and Torkzadeh (1988);<br>Wang (2003) | Davies (2001);<br>Ypsilandis (2002);<br>Iahad et al. (2004);<br>Nicol (2007);<br>Terzis and Economides (2011) |
| **Accessibility (AC)** | • Question presented in different formats<br>• Assistive technology | Multiple forms (e.g. written, graphics, sound)<br>Screen readers, screen magnifiers and speech recognition software. | Lin and Lu (2000);<br>Thong et al. (2002);<br>Park (2009) | Ball (2006);<br>Green et al. (2008) |

This work has not included any moderating factors; that age can affect students' attitude towards e-assessment was mentioned in some studies, but it was found that age has no clear effect between students (Dermo, 2009; Schneberger et al., 2007). In Saudi Arabian higher education, students' ages mostly range between 19-24 years (Alamri, 2011). Thus, this factor will not be examined here. Some studies have found that gender can affect individual perceptions and relationships in the e-learning domain (Ong & Lai, 2006), and in e-assessment (Wen & Tsai, 2006). Others found no significant differences between men's attitude and women's attitude towards e-assessment (Dermo,2009). The literature review showed students' experience in using computer to be an important factor in develop a positive attitude towards e-assessment (McDonald, 2002; Schneberger et al., 2007; Wen & Tsai, 2006). This work assumes that students have similar backgrounds and experience of using computers.

## 3.3 Summary

This chapter provided the proposed framework of this research. The framework consists of eight factors which are Perceived Usefulness, Perceived Ease of Use, Self-Efficacy, Perceived Playfulness, Social Influence, Facilitating of Examination, Content and Accessibility. These factors are used to explain students' attitude towards summative e-assessment in Saudi Arabian universities. The description of each factor was provided to clarify the possibility of its influence on students' attitude towards summative e-assessment. We believe these factors provide institutions with the requirements to design a suitable summative e-assessment system in the context of Saudi Arabian universities.

# Chapter 4 Research Methodology

This chapter discusses the methods used to carry out the research. First to be addressed is a survey of research methods in Section 4.1, followed by data collection in Section 4.2 and analysis methods in Section 4.3. Research questions and research plan are summarised in Section 4.4, followed by the research plan employed in the confirmatory study in Section 4.5. Section 4.6 deals with the research plan employed in the investigation study, research ethics are presented in Section 4.7 and a summary of the chapter is given in Section 4.8.

## 4.1 Research Methods

This section describes the research methods used in this thesis to facilitate the confirmatory study and the investigation study. It explains the research methods considered, the rationale for the chosen method and the application of the chosen methods applied. The research design refers to a strategy applied to understand the research problems and how the research questions should be investigated (Creswell, 2013). Identifying a suitable design for the research will provide a logical approach to carrying it out. Each research design has its own requirements, and by understanding the scenario and how each design can achieve its aims, the most appropriate research design can be adopted. There are three types of research design: quantitative, qualitative and mixed methods (Creswell, 2013).

### 4.1.1 Qualitative Research

Qualitative strategies are procedures which are characterised by focus on qualitative data “words”, such as interviews (Recker, 2013). Qualitative research involves the collection, analysis and interpretation of data that cannot easily be presented as numbers (Anderson, 2010). It provides one way of understanding human opinions, attitudes, actions and decisions (Creswell & Clark, 2007). Different tools can be applied as a qualitative method, interviews being the most common strategy for collecting qualitative data (Creswell, 2013). Three types of interviewing strategy have been used in different disciplines (Cohen, 2011).

- **Unstructured interview:** This is a conversation of open-ended questions between the interviewees and interviewer to explore different issues on the research topic (Cohen, 2011). A benefit of the unstructured interview is that it can generate rich data that may give a deep understanding of the topic (Preece, Rogers, & Sharp, 2015). However, as the elements of the proposed factors are only to be confirmed, this approach is not appropriate here.

- **Structured interview:** The interviewer asks a set of predetermined, usually closed, questions with fixed choice answers. The structured interview is useful when the researcher understands the topic and specific questions can be identified (Preece et al., 2015). Since additional factors are sought, this type of interview is not appropriate here.
- **Semi-structured interview:** This combines the structured and unstructured interviews and uses both open-ended and closed questions. The interviewer starts by asking pre-planned questions and follows by other questions emerging from the conversation in order to collect more detail (Preece et al., 2015). Open-ended questions are also cited as the best where the research is exploratory, and closed questions for confirming elements of the research and for measurements, and it is considered the best for application here.

### 4.1.2 Quantitative Research

Quantitative strategies are procedures used to confirm a research study, such as an experiment or a questionnaire, characterised by a focus on quantitative data (Recker, 2013). The questionnaire is one of the most widely used tools for gathering information about characteristics, attitudes, perceptions or opinions (Creswell, 2013). Two types of questionnaire can be used to collect data, self-administered and interview-administered. In the former, the respondents complete the questionnaire themselves, whereas an interview-administered questionnaire allows the researcher to ask and record the respondents' answers (Bourque, Fielder, & Fink, 2003). The data gathered are analysed using statistical techniques and results obtained are generalised to the population (Recker, 2013).

### 4.1.3 Mixed Methods Research - Triangulation

Mixed methods are procedures that use a combination of qualitative and quantitative strategies in either sequential or concurrent style, characterised by a focus on both "Numbers and Words" data (Recker, 2013). Mixed methods research is an attempt to justify the use of multiple approaches in answering research questions rather than restricting the choice of the researchers to confirm their research (Johnson & Onwuegbuzie, 2004). **Triangulation technique** is one of the most popular in mixed methods research and refers to the use of a combination of two or more methodologies in a study of the same phenomenon, to confirm the research (Jick, 1979). Jick (1979) highlighted the importance of applying triangulation to this research, such as:

- The strength of the multi-method design provides more confidence and accuracy in the results.
- It can provide new ways of capturing a research problem.

- It may also help to discover new elements not mentioned in the theory or model, which leads to a richer explanation of the research problem.

Four different types of triangulation can be used to gather data depending on the goal of the study:

- **Data Triangulation:** Different sources are used, e.g. time, space and person, to collect the research data (Guion, 2002). This can be obtained from in-depth interviews (Thurmond, 2001).
- **Investigator Triangulation:** More than one investigator is used to assess the study, e.g. observer, interviewer or data analyst (Guion, 2002). The idea of using more than one investigator is to increase the credibility in gathering, reporting and analysing the data (Thurmond, 2001).
- **Methodological Triangulation:** Multiple qualitative and quantitative methods are used, such as interviews, surveys and focus group. If the results from each method are similar, then the study is validated (Guion, 2002). This is a widely-used, popular method which will be applied here.
- **Theoretical Triangulation:** Multiple professional perspectives, theories or hypotheses are used to examine a single set of information (Thurmond, 2001).

By applying the triangulation technique to the research, the weakness of any single method can be avoided (Cohen, 2011; Sandelowski, 2000). The majority of researchers have used mixed methods techniques to expand the research scope (Sandelowski, 2000). In addition, different strategies can be applied within mixed methods, as described by Creswell (2013), such as sequential mixed methods, where the finding of one method is expanded using another method. The research can start with qualitative data for exploratory purposes, and then follow up with quantitative data, such as survey with a large sample, so that the results of the qualitative data can be generalised to a population.

## 4.2 Data Collection

### 4.2.1 Pre-Test

To determine the effectiveness of the questionnaire, it is necessary to pre-test it before actually using it. Pretesting can help to determine the strengths and weaknesses of questionnaire concerning question format, wording and order (Bourque et al., 2003). It is important to conduct a pre-test before the main run to make sure that the proposed method is understandable before conducting the real study (Preece et al., 2015). As suggested by Preece et al. (2015), getting comments from peers and colleagues can be quick and inexpensive. According to Hertzog (2008), a sample of 10 or fewer may suffice to conduct a pre-test.

### 4.2.2 Population and Sample Size

The quality of the research is judged by the suitability of the methodology and the appropriateness of the sampling (Cohen, 2011). It is important to determine the individuals from whom data is to be collected (Cohen, 2011). Probability and nonprobability are two sampling techniques for research (Cohen, 2011). Probability sampling is a method that uses some form of random selection, such as simple random sampling and stratified random sampling (Creswell, 2007). Nonprobability sampling is a method in which the researcher selects samples based on their subjective judgement, and is widely used in qualitative research (Cohen, 2011). The sample size is the number of respondents chosen to take part in the study (Cohen, 2011). There is no clear answer for how to determine the sample size, since it depends on different factors, such as the purpose of the research, the level of accuracy, the number of items and whether the research takes a qualitative, quantitative, or mixed methods approach (Cohen, 2011). However, in quantitative research, the larger the sample the better, depending on the type of statistical test being undertaken (Cohen, 2011). A wide range of recommendations on sample size in factor analysis have been proposed (MacCallum, Widaman, Zhang, & Hong, 1999). The most common guideline for applying sample size in factor analysis depends on the number of items (MacCallum et al., 1999). A number between five and 10 participants per item is recommended (Devellis, 2003; Kass & Tinsley, 1979).

The sample size in qualitative research has been much discussed (Bhattacherjee, 2012; Guest, Bunce, & Johnson, 2006; Sandelowski, 2000). Saturation has become the standard in defining the sample size in qualitative research (Guest et al., 2006). However, there are no specific guidelines for determining the sample size required to reach saturation. Guest et al. (2006) found that data saturation is reached when no new knowledge can be extracted, which is often achieved within the first twelve interviews.

### 4.2.3 Questionnaire Design

After completing the questionnaire design, it was necessary to ensure that the statements in a questionnaire accurately measure the factors in the proposed framework. Validity and reliability tests are a very important phase in obtaining accurate results from the questionnaire (Cohen, 2011). Validity and reliability tests are independent of each other (Field, 2013), while both are free to vary independently, reliability places an upper limit on validity, that is, an questionnaire cannot have a validity coefficient whose value is higher than its reliability coefficient. There are different

methods of establishing validity and reliability, but, here, the tests were conducted in two stages, before and after data collection.

**A. Validity of the Questionnaire**

Validity is defined as the degree to which a questionnaire measures what it is supposed to measure (McKenzie, Clark, & Brey, 1999). Here it mainly refers to face validity, which indicates whether the question measures what it is supposed to measure (Cohen, 2011). The validation of the questionnaire is the most important step for any developer (Straub, Boudreau, & Gefen, 2004), and it involves two stages, development and judgement (Lynn, 1986). The development stage is achieved with a literature review and by consulting the views of experts in order to identify the aim of the questionnaire and the important factors. The judgement quantification stage is to determine the number of experts that state the questionnaire is valid for the research objective (Lynn, 1986). By using experts to advise on the content of the questionnaire, the overall quality of the scale items will be improved (Rubio, Berg-Weger, & Tebb, 2003).

**B. Reliability of the Questionnaire**

Reliability analysis is important when using multiple measurement items for each factor. It ensures that these items are consistent and the results of the study will be reliable. Two reliability tests are widely used: internal consistency and test-retest reliability (Cohen, 2011). Internal consistency is the extent to which the items are interrelated and internally consistent within a specific construct, whereas test-retest reliability refers to conducting the same test with the same group on different occasions (Cohen, 2011). In the initial data analysis stage, the internal consistency reliability test was applied by using Cronbach's alpha (α) coefficient test (Artino, La Rochelle, Dezee, & Gehlbach, 2014). Cronbach's alpha is used to measure the internal consistency of the item scores within a scale. It is a function of the inter-item correlations and the total number of items on a particular scale (Artino et al., 2014). Cronbach's alpha values normally range between 0 and 1. The closer Cronbach's alpha coefficient is to 1 the greater the internal consistency of the items in the scale (Artino et al., 2014), as shown in Table 4.1 (Hair, Black, Babin, & Anderson, 2010; Pallant, 2013).

*Table 4.1 Evaluation of the values of Cronbach's alpha reliability*

| Value of Cronbach's alpha reliability | Evaluation |
|---|---|
| $\alpha \geq 0.90$ | Excellent |
| $0.90 > \alpha \geq 0.80$ | Good |
| $0.80 > \alpha \geq 0.50$ | Acceptable |
| $\alpha < 0.50$ | Poor |

## 4.3 Analysis Methods

### 4.3.1 Thematic analysis

Thematic analysis is common within qualitative research and helps explore the interview data based on the selected "theme" from the research question. It is used to examine and record patterns or themes within data (Braun & Clarke, 2008). Themes do not rely on "quantifiable measures" but, rather, on whether they highlight and address the prime principles of the research questions (Braun & Clarke, 2008). The thematic process can be conducted either by the deductive approach or the inductive approach (Maguire & Delahunt, 2017). Inductive thematic analysis requires coding and structuring the data while reading and interpreting the dataset, without considering a pre-existing coding frame or previous theory. In contrast, deductive thematic analysis codes the data in the light of existing theoretical frameworks (Braun & Clarke, 2008). Both inductive and deductive analyses were used here, where the coding and theme development was directed by the content of the data as well as by the existing concepts and theories (Maguire & Delahunt, 2017). Thematic analysis offers several advantages, including flexibility, is easier for those unfamiliar with qualitative analysis, and provides a description of the dataset (Braun & Clarke, 2008). The process of coding can be done manually or with the aid of software (Braun & Clarke, 2008).

### 4.3.2 Correlations Analysis

Correlations analysis was used to determine the value of the correlation coefficient, which led to understand the relationship between the factors. This value is between number -1 to 1 where value of 0 indicates no relationship at all and correlation of value 1 presents the perfect positive relationship and value -1 presents the perfect negative relationship. However, the negative relationship refers to the direction of the relationship not to the strength (Cohen, 2011). The relationship guideline by Cohen, (2011) suggests the following:

- Small $r = 0.10$ to $0.29$
- Medium $r = 0.30$ to $0.49$
- Large $r = 0.50$ to $1$

These guidelines apply whether or not there is a negative sign on the front of the *r* value. The negative sign refers only to the direction of the relationship, not the strength (Field, 2013).

### 4.3.3 Repeated Measures ANOVA

Analysis of variance (ANOVA) is an important method in exploratory and confirmatory data analysis (Gelman, 2005). It is a collection of statistical models used to analyse the differences among group means in a sample (Gelman, 2005). The ANOVA is based on the law of total variance, where the observed variance in a particular variable is partitioned into components attributable to different sources of variation. ANOVA provides a statistical test of whether two or more population means are equal, and, therefore, generalises the t-test beyond two means (Tabachnick & Fidell, 2007). A test result (calculated from the null hypothesis and the sample) is called statistically significant if it is deemed unlikely to have occurred by chance, assuming the truth of the null hypothesis. A statistically significant result, when a probability (*p*-value) is less than a pre-specified threshold (significance level), justifies the rejection of the null hypothesis, but only if the a priori probability of the null hypothesis is not high (Tabachnick & Fidell, 2007). In univariate analysis, different standard methods for deriving tests all point to Fisher's *F* test. There are four major test statistics, Wilks' Lambda, Pillai's Trace, the Hotelling-Lawley Trace, and Roy's Greatest Root (Tabachnick & Fidell, 2007). When a multivariate test is significant, it should then be followed up with ordinary univariate tests to see "*which dependent variable the results came from*" (Abdi, 2007). This is a reasonable exploratory strategy, and more conservative is to follow up with Bonferroni corrected, Sidak correction (Abdi, 2007).

### 4.3.4 Factor Analysis (FA)

Factor analysis is a statistical technique which aims to simplify complex sets of data by identifying the correlations (matrices) between items (Kline, 1994). This method works by grouping together items that have something in common (Kline, 1994). It contains a group of statistical procedures which are designed to determine the number of different constructs assessed by the measures. These unobservable constructs are referred to as *common factors* (Hair et al., 2010). The main purpose of using factor analysis is to summarise data so that relationships and patterns can be easily interpreted and understood (Hair et al., 2010). It is also used to assess factors which influence responses to observed items (Hair et al., 2010).

Factor extraction is performed as one of the steps in this analysis. It involves determining the smallest number of factors (or components) that can best represent the interrelations among the sets of items. Several techniques are used for extracting the factors, such as principal component analysis (PCA), principal axis factoring (PAF), and others (Hair et al., 2010). The technique chosen depends on the objective of the research. The key difference between them is that the goal of PCA is to reduce the measured items to a smaller set of composite components that capture as much

information as possible, while the goal of PAF is to find the latent structure of the dataset by uncovering common factors (Hooper, 2012). PCA is most frequently used as it is the default method of most statistical software. If a researcher has developed a questionnaire and is interested in reducing the number of items, then PCA is useful (Taherdoost, Sahibuddin, & Jalaliyoon, 2004). PCA is used here because the technique considers the total variance and can account for the maximum portion of the total variance represented in the original set of items (Hair et al., 2010). To determine how many factors are extracted, eigenvalues (or Kaiser criterion) or scree plot are two approaches (Field, 2013), both with limitations. They work by considering a matrix of correlations and try to explain all the variances in that matrix (Kline, 1994). The PCA method was chosen, since this work intends only to determine what groupings exist, and whether the original assumption of proposed factors is supported (Field, 2013). When factor extraction has been done, factor rotation must be performed to make the result more meaningful, which involves interpreting the items loaded on these factors (or components) (Suhr, 2006).

The suitability of conducting factor analysis on the data should first be checked (Kline, 1994). A number of issues must be considered when determining the suitability of the data, such as the sample size, data screening and the strength of the relationships among the items (Kline, 1994). The Kaiser-Meyer-Olkin (KMO) test is used to measure the adequacy of the sampling, followed by factor extraction, which involves finding the minimum number of factors that can be identified to best represent the interrelations among the set of items (Hair et al., 2010). There are two types of factor rotation, the orthogonal, in which the factors are uncorrelated, and the oblique, in which the factors are correlated (Byrne, 2016). Orthogonal rotation provides solutions which are easier and simpler to interpret (Field, 2013); however, by making the rotation orthogonal, it is assumed that the factors are uncorrelated and unrelated, whereas oblique rotation provides factors that are correlated. The orthogonal solution provides one matrix, the rotated component matrix, while the oblique rotation provides two matrices, the pattern matrix and the structure matrix. In oblique rotation, the pattern matrix contains the factor loadings after the rotation, while the structure matrix describes the relationship between the factors. The interpretation is mainly completed from the pattern matrix, whereas the structure matrix is useful for the purpose of double checking (Field, 2013). In addition, from the orthogonal rotation, the oblique rotation provides another table, which is a correlation matrix between the factors. If the factors are independent, then it is expected that the correlation matrix should be an identity matrix (all factors have a correlation coefficient of zero) (Field, 2013) as discussed in Section 4.3.2.

### 4.3.5 Multiple Linear Regression (MLR) Analysis

Multiple linear regression (MLR) is used to analyse the relationship between a single dependent variable with several independent variables (Hair et al., 2010). Multiple regression analysis enables researchers to weight the relationship between two or more explanatory independent variables and an explained dependent variable (Cohen, 2011). Multiple regression would be used to answer a different research question. The focus of regression would be the question of what the best combination of independent variable would be to affect the dependent variable. MLR regression works by adding and removing factors from a multi-factor regression, based on their statistical significance. The process starts with a single factor model and then adds factors until it identifies a model with the highest explanatory power from the available factors. If a factor does not have sufficient explanatory power, then it is removed from the model (Hair et al., 2010).

MLR regression is a useful tool for identifying which factors to include when building a factor model (Draper & Smith, 1998). As this work is interested in representing which factors could influence attitude, MLR was the most suitable as it involves testing the multiple independent-dependent relationships. MLR establishes a causal relationship between three or more metric variables: one continuous dependent variable and two or more independent variables. In contrast to correlation analysis, which does not indicate directionality of effects, multiple linear regression analysis assumes that the independent variables have an effect on the dependent variable (Byrne, 2010). SPSS 24 software was applied to analyse data; this was due to the ease of use and free availability of this software and the fact that its structures met the requirements of this research.

## 4.4 Research Questions and Research Plan

Research designs were applied to address the main research question and its research sub-questions. The main research question is:

**RQ:** What is an appropriate framework that can be used as a theoretical foundation for the investigation of the factors influence the attitude of students towards summative e-assessment in a Saudi Arabian universities context?

Four sub-questions were derived from the main research questions. The text below describes the research sub-questions, along with the methods used to address these questions, as well as the purpose for applying those methods.

**Sub Research Questions:**

**Confirmatory Study**. A sequential triangulation method (Section 4.1.3) was used to investigate this sub-question.

**SRQ1:** According to literature, what are the factors that constitute the framework?

The method used was to review previous studies of summative e-assessment in order to identify the factors affecting students' attitude towards using summative e-assessment.

**SRQ2:** According to experts, what are the factors that affect students' attitude towards e-assessment in Saudi Arabian universities?

The method used was interviewing, these interviews were conducted with 12 experts in e-assessment in Saudi Arabia. The interviews were analysed through the use of inductive and deductive thematic analysis, as reported in Section 5.1.

**SRQ3:** According to students, what are the factors that affect students' attitude towards e-assessment in Saudi Arabian universities?

The method used was an online questionnaire, 102 students from Saudi Arabian universities responded to the questionnaire. The responses to the questionnaire were analysed inferential statistical analysis and reported in Section 5.2

**Investigation Study.**

**SRQ4:** What factors have significant effects on students' attitude towards e-assessment in Saudi Arabian universities?

The method used to answer this question was through factor analysis and MLR regression. In order to collect the data, a questionnaire was designed based on the results of SRQ2 and SRQ3 (Section 6.1) and then the content was validated (Section 6.2) before being distributed. The data from the 328 students who responded to the questionnaires was put through factor analysis in order to further understand the dimensions and meanings of the items in thequestionnaire. Then a multiple linear regression was conducted in order to identify the factors that have a significant influence on students'attitude.

## 4.5 Research Plan Employed in the Confirmatory Study

A mixed methods approach was used in the confirmatory study by using a methodological triangulation technique as discussed in Section 4.1.3, to confirm the factors which affect students' attitude towards summative e-assessment in Saudi Arabian universities.

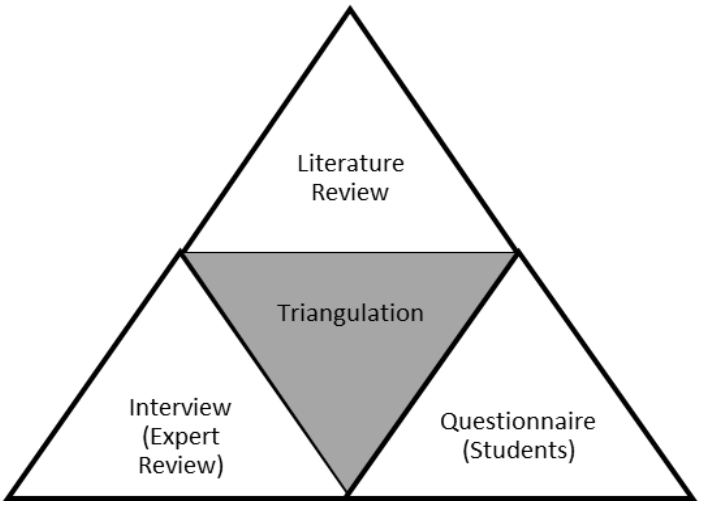


*Figure 4.1 Methodological triangulation to confirm the framework*

A review of literature and related work was described in Chapter 2. The aim of the confirmatory study was to gather data from a group of experts and students in order to review and confirm the initial framework. In the confirmatory study, the review of related theories and literature, expert reviews and student questionnaires, were conducted sequentially, as shown in Figure 4.2.

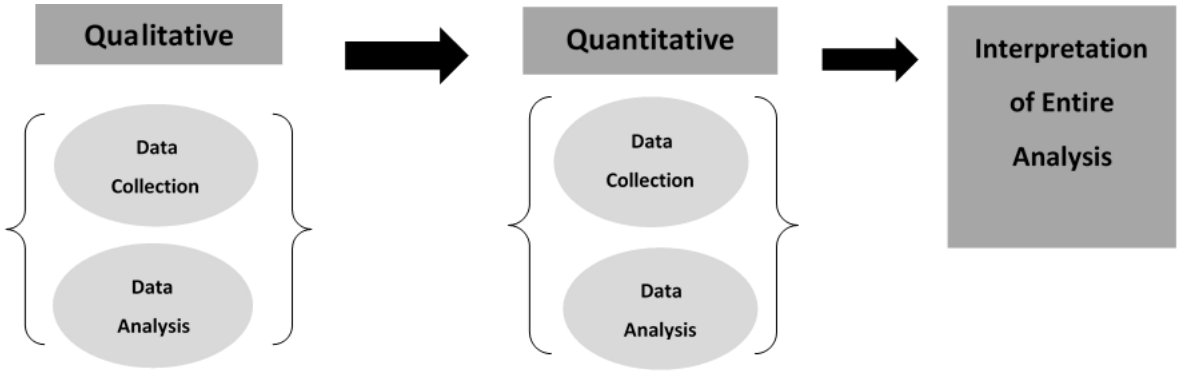


*Figure 4.2 Sequential exploratory design*

### 4.5.1 Step 1- Expert Interview

The aim of interviewing the experts was to confirm the factors in the initial framework and discover other important factors not mentioned. A semi-structured interview (see Section 4.1.1) was used to gather data related to the research question. The interviewer started by asking pre-planned

questions and these were followed by questions emerging from the conversation in order to collect more detail for the research. The expert interview guide is provided in Appendix A.1.

**A. Pilot Test**

A pilot session (see Section 4.2.1) was used to test the interview questions and was carried out with four Arabic speakers computer science researchers from the University of Southampton. The interviewees were asked about the interview questions. Following the pilot session, some of the spelling needed to be revised.

### B. Expert participant recruitment, selection and agreement to participate

The experts were recruited from six public sector universities in Saudi Arabia. Universities in Saudi Arabian use various e-assessment systems, such as Question Mark Perception in King Abdulaziz University and Prince Nora bint Abdul Rahman University, Blackboard in King Khalid University and Imam Abdurrahman Bin Faisal University and learning management system as in King Saud University and Saudi Electronic University. Recruiting from this range of public institutions gave the opportunity to select a relevant accessible sample from universities where e-assessment is used, including experts from both the oldest and the newest universities in the country.

The experts were selected by purposive sampling, which is useful for accessing "knowledgeable people" who have in-depth knowledge about a particular issue, by virtue of their professional role or experience (Cohen, 2011). The experts' information was accessed from their work profiles and university sites. Two categories of expert were selected: those in university leadership roles with responsibility for initiatives concerning strategies to support e-assessment, such as director of e-assessment projects, and those university lecturers who had conducted e-assessment on their courses. The selection of the experts included both lecturers, members of e- assessment committees, dean of e-learning, e-assessment administrators and e-assessment consultants. The experts were selected for their knowledge and experience in e-assessment. All had two years or more experience in e-assessment.

Initially, 20 experts were invited by email to participate in an interview. Only 14 of them responded and two later cancelled their participation. The interviews were then conducted with remaining 12 e-assessment experts from the six public universities. There were 12 interviews, enough to obtain saturation of the comments, as discussed in Section 4.2.2. Table 4.2 presents the job description for the interviewees of this study.

*Table 4.2 Expert interviewees involved in this study*

| Expert | Job Description | Years of Experience |
|---|---|---|
| 1 | Lecturer and a member of e- assessment committee | 3 |
| 2 | Lecturer and a member of e- assessment committee | 4 |
| 3 | Dean of e-learning | 5 |
| 4 | Technical support specialist for e- assessment systems | 5 |
| 5 | Lecturer and a member of e- assessment committee | 3 |
| 6 | E-assessment administrator | 2 |
| 7 | Dean of e-learning | 4 |
| 8 | Lecturer and a member of e- assessment committee | 3 |
| 9 | Dean of e-learning | 3 |
| 10 | Dean of e-learning | 5 |
| 11 | E-assessment consultant | 4 |
| 12 | E-assessment consultant | 5 |

An invitation letter was sent to the participants, describing the research aims along with the participant information sheet that stresses the voluntary aspect of the participation, anonymity, and confidentiality in dealing with the participants' data plus a copy of the consent form. The participant information sheet and consent form are presented in Appendix A.5 and A.6.

The experts returned the signed consent form to signal that they agreed to participate in the interviews. Once the consent form was received and participation had consent too, the list of interview questions was sent to the participants. Seeing the list of question beforehand provided the experts with an opportunity to decide to take part as well as to prepare them for the interviews. Once an expert expressed an interest in taking part in this study, a meeting was arranged. One day before the interview, a reminder about the interview was sent to the participants. The interviews were conducted between July and August 2016 and were scheduled for over four weeks. As permission had first been sought from each interviewee before starting the interview. The experts were asked for their opinion about the importance of the proposed factors, and then to provide any other important factors for the study.

**C. Interview Analysis**

The interviews were analysed by applying manually thematic analysis. This method was chosen because the interviews were not conducted in formal Arabic, which made it difficult to use software

that does not support informal language. The data were manually transcribed from digital recordings; however, the answers were not translated to avoid the meanings being lost. The themes that emerged were then translated from Arabic into English.

### 4.5.2 Step 2- Online Questionnaire

The questionnaire used in the confirmatory study was designed and distributed to students in Saudi Arabian universities. As described in Section 4.1.2 a self-administered questionnaire was chosen to confirm the updated framework resulting from the experts' review. The confirmation questionnaire consisted of two parts. The first asked basic demographic information, and the second questions were specific to the data gathering. A five-point Likert-type scale was used, from strongly agree = 5 to strongly disagree = 1. It consisted of 19 closed questions covering the proposed factors. The questionnaire was available in both Arabic and English. The detailed questions are provided in Appendix A.7.

**A. Questionnaire Sample**

It is necessary to show the chance of making type I and type II errors in advance of the study. The probability of accruing a type I error (rejecting the null hypothesis when it is actually true) is called α (alpha); also known as the level of statistical significance (Banerjee,Chitnis, Jadhav, Bhawalkar, & Chaudhury, 2009). Type II errors (failing to reject the null hypothesis when it is actually false) is called β (beta) (Banerjee et al., 2009). Statistical power analysis, "G*power software", was used to calculate the minimum sample size (Faul, Erdfelder, Lang, & Buchner, 2007). The central limit theorem, when applied to questionnaires, suggests that the sample size should be over 30. Therefore, if the power calculation is below 30, the central limit theorem is used (Anderson, 2010). The minimum size of 23 was suggested from the following configuration in Table 4.3.

*Table 4.3 Minimum number of students required according to G*Power software*

| **Statistical Test** | **Means: Difference from constant (one sample test)** |
|---|---|
| Tails | Two |
| Effect size (d) | 0.8 |
| Error probability (α) | 0.05 |
| Power (1 – β error probability) | 0.95 |
| Minimum sample size | 23 |

**B. Participants Selection**

This study was conducted with students at Saudi Arabian universities. The questionnaire was sent to three universities and different departments: King Abdulaziz University (College of Computer Sciences, and College of Education), Princess Nora bint Abdul Rahman University (College of Education, and College of Sciences), and King Saud University (College of Science, and College of Education). The questionnaire was sent to the lecturers by email who were asked to distribute them to their students, of whom 102 responded, whereas 54 students had no experience of e-assessment.

**C. Pilot Test**

A pilot test was conducted to see if the respondents understood the directions for completing the questionnaire and each of the questions. This included the wording of the questions and clarity on where to mark the responses. The questionnaire was checked by three Arabic speakers at the University of Southampton. The procedure used in the pilot test was the same as at the full scale, using a paper-based questionnaire and, later, face-to-face discussion. Based on their feedback, certain refinements and changes were made to make the questions more understandable.

**D. Questionnaire Procedure and Analysis**

The questionnaire was distributed in November 2016 over five weeks. The questionnaire was generated by using the University of Southampton iSurvey application. The students were reached by the lecturers in the universities. The online questionnaire allowed the coverage of a wide geographical area of Saudi Arabia. The questionnaire content was displayed across different pages. The first page explained the research topic and the purpose of doing the study. Each participant was asked to tick a box if they agreed to take part in this study. The questionnaire was analysed using repeated measures ANOVA (see Section 4.3.3).

## 4.6 Research Plan Employed in the Investigation Study

For the investigation study, an explanatory research methodology was applied in order to investigate how the proposed factors influence the attitude of students towards summative e-assessment. With this explanatory approach, the data were collected using a questionnaire to investigate the influence of the proposed factors of students' attitude.

### 4.6.1 Sample Size

Using the method of five participants per item, as described in Section 4.2.2, since there are 33 items, 165 subjects would be the minimum number of participants for efficient factor analysis. The sample for this study was 328 students from three Saudi Arabian universities.

### 4.6.2 Context of Study and the Participants

This study was conducted with students at Saudi Arabian universities. The quantitative data were collected in December and January 2017 using an online questionnaire. As discussed in Section 4.2.2, students were selected using the *accidental sampling* technique. This is a type of nonprobability sampling where the population selected is easily accessible to the researcher. The questionnaire was sent to three different universities or different departments from the participants in Section 4.5.2, namely: King Abdulaziz University (College of Sciences, and College of Art), Imam Abdurrahman Bin Faisal University (College of Education, and College of Sciences), and Saudi Electronic University (College of Education, and College of Sciences). The questionnaire was sent to the universities' lecturers by email, who were asked to distribute them to their students, of whom 328 responded. All the respondents had experience in e-assessment.

### 4.6.3 Questionnaire Design and Analysis

The questionnaire for the investigation study, including its validity and reliability, is discussed in detail in Chapter 6. The reliability of the questionnaire was undertaken using the metric Cronbach's alpha reliability values, while the validity of the questions used face validity, as described in Section 4.2.3. Analysis of the questionnaire was through factor analysis as described in Section 4.3.4 and multiple linear regression as described in Section 4.3.5. The analysis of the questionnaire presented in Chapter 7.

## 4.7 Research Ethics

Prior to conducting the field study, ethical approval was sought and obtained from the University of Southampton Ethics Committee. The references for the ethics approval are:

- For the confirmation study, the ethics approval number is ERGO/FEPS/21170, the participant information sheet and the informed consent are shown in Appendix A.5 and A.6, respectively.

- For the questionnaire development, the ethics approval number is ERGO/FEPS/ 30943, the participant information sheet and the informed consent are shown in Appendix B.1 and B.2, respectively.
- For the investigation study, the ethics approval number is ERGO/FEPS/30836, the participant information sheet is shown in Appendix C.1.

## 4.8 Summary

This chapter gave an overview of the research methods used to answer the research questions. It first discussed the advantages and disadvantages of qualitative, quantitative and mixed methods. A summary of the methodologies used to answer the research questions was presented. The research methodologies employed for the confirmation study were then discussed in detail. The methods chosen for this confirmation stage were semi-structured interviews with experts in e-assessment, and a structured online questionnaire distributed to students, both in Saudi Arabian universities. Following the confirmation of the proposed framework, a questionnaire was designed to investigate the factors that influence the attitude of students towards summative e-assessment in the Saudi Arabian universities followed by application of factor analysis and multiple linear regression.

# Chapter 5 Findings of the Confirmatory Study

This chapter presents the findings of the confirmatory study. The experts' review was conducted to confirm the factors in the proposed framework. Then, a questionnaire was distributed to the students for confirmation. The findings from both the interview and the questionnaire are discussed in this chapter.

## 5.1 Findings of the Experts' Interviews

The purpose of the experts' interview was to explore their opinions on the eight factors in the proposed framework (see Section 3.2) and identify whether there were any further important factors. **Gathering the data:** the steps to gather the information is described in (Section 4.5.1) below is a summary of the process.

The first step in gathering the data was to identify the experts, this process of expert selection is described in Section 4.5.1-part B. The second step was to contact the experts. After contacting the participants by email, the interviews were scheduled over four weeks according to the most convenient times for the participants. The procedure for contacting the experts is described in Section 4.5.1-part B.

The final step in gathering the data was to conduct the interviews. All interviews were conducted by Skype and broadcast on speakerphone so that the session could be recorded using a digital recorder to ensure of everything uttered a full record was made for transcribing only, as described in Section 4.5.1-part B. The interviews lasted approximately 45 minutes. The interview started with a general introduction to the purpose of the interview. The experts were then shown this list of factors and were asked about the importance of each factor and asked to give their justification for their response. The interview guide is presented in Appendix A.1.

**Analysis of the data:** After conducting all interviews and gathering the data from the experts, analysis of the qualitative data was carried out using the thematic analysis approach.

Analysis step 1: Before applying manual thematic analysis to code the raw data, the interviews were first transcribed from digital recordings by transferring each participant's spoken answers to Arabic text, written up by hand and then typed in MS Word. The rationale for using Arabic transcripts is that they help the Arabic- speaking researcher understand the data deeply and easily. The Arabic transcripts was then translated into English, being careful to be faithful to the meaning, as some of the utterances made by the interviewees might not be relevant to the interview guide or research

question. For accuracy, the transcripts were cross-checked with the audio recordings before being analysed. The number of words in the corpus is around 1628 words.

Analysis step 2 (deductive): deductive thematic analysis codes the data in the light of existing theoretical frameworks as described in Section 4.3.1. The transcript text was annotated for positive or negative comments about each of the factors, as well as additional information about a factor or changes to a factor. The deductive analysis was applied through the creation of parent nodes representing the main themes (the main factors discussed within the interviews) and analysis. The number of codes were developed and the number of transcript words were categorized with the codes are provided in Appendix A2.

Analysis step 3 (inductive): inductive thematic analysis requires coding and structuring the data while reading and interpreting the dataset, without considering a pre-existing coding frame or previous theory as described in section 4.3.1. Therefore, in this step, the transcript was examined against the existing coding for comments that suggested new factors or changes to the structure of the framework, these are referred to as sub-themes. The number of additional codes were developed and the number of additional transcript words were categorized with the codes are provided in Appendix A3.

Analysis step 4: Iterating through steps 2 and 3, this also allowed the researcher to refine the themes and sub-themes until reaching satisfactory themes and sub-themes. The final number of codes, sub-codes, and themes and the final number of transcript words coded against these codes and themes are provided in Appendix A4.

**Reporting the findings:** Once the themes and sub-themes had been identified these were presented in the thesis as section 5.1. Reporting step 1 was to collate all the responses per theme and sub-theme and then to summaries the experts' comments per theme and sub-theme. Reporting step 2: was to choose the quotes that best supported the expert's argument (positive or negative), sometimes two or three quotes were needed to express the views of the experts. The following sub-sections presents the findings of the experts' interviews.

### 5.1.1 Perceived Usefulness

This was seen by all the experts as an important factor in students' attitude towards summative e-assessment. A common view among the experts was that summative e-assessment should support learning. All experts agreed that Perceived Usefulness is an important factor for students' attitude towards summative e-assessment. Below are some of their supporting statements.

'Students will not like any technology if they feel is not useful for their education.' (Expert 4)

'Most students think about how useful the technology is to their learning and how it can affect their grade.' (Expert 5)

Expert 2 specified that students look for the usefulness as a way of improving their grades.

Experts 3 and 9 mentioned that, in general, the type of questions in an e-assessment is more useful than for a paper-based exam, e.g. in Geography, students can click on a map to identify a place, which they thought was more useful for students as a way of enhancing critical thinking than a traditional exam.

'Since summative e-assessment was adopted at my university, I have seen an improvement in students' grades.' (Expert 6)

### 5.1.2 Perceived Ease of Use

There was no doubt amongst any of the respondents that the Ease of Use of an e-assessment system is an important factor which affects students' attitude towards e-assessment. All agreed that Perceived Ease of Use is an important factor for students' attitude. Below are some of their supporting statements.

Experts 4, 6, 7, 8, 10 and 12 mentioned that students would prefer e-assessment if the system was easy to use.

"I think the most important factor is the degree to which the system is easy to use by students." (Expert 1)

'As long as the system is easy to use, it would be accepted.' (Expert 5)

Most of the experts believed that ease of use is one of the important features, particularly for students who are not familiar with technology. Expert 3 mentioned that students preferred an e-exam to a paper-based exam as they found the e-assessment system was easy, and they preferred to navigate between questions and to see the order of questions on the other side of the page.

'System navigation should be clear.' (Expert 11)

### 5.1.3 Self-Efficacy

All agreed that Self-Efficacy is an important factor for students' attitude towards summative e-assessment. Below are some of their supporting statements.

‘Nowadays, students who use computers regularly feel confident in taking an e-exam.’ (Expert 2)

‘Students do not feel anxious in exams as they have to often use technologies.’ (Expert 9)

‘Students use technology in everyday life, which makes taking exam by computers easy for them.’ (Expert 5)

Experts 1, 3, 5, 7 and 11 mentioned that students are likely to use e-assessment if the system does not require more effort compared with a paper-based assessment.

### 5.1.4 Perceived Playfulness

There was no overall agreement that Perceived Playfulness was an important factor for students’ attitude towards summative e-assessment. Below are some of their supporting statements.

‘I think the usability of the e-assessment system is more important than enjoyment of the system.’ (Expert 3)

‘The interface of the e-assessment system should be user-friendly to be acceptable. However, the exam would never be enjoyable.’ (Expert 6)

Experts 1, 3, 5, 7 and 11 mentioned that this factor is not considered an important factor. However, they asserted that the design of system should be easy to use.

### 5.1.5 Social Influence

This factor spotlights the influence of friends, lecturers and university culture on students’ attitude towards e-assessment. All experts strongly agreed on the importance of Social Influence regarding the students’ attitude towards e-assessment. Below are some of their supporting statements.

‘I strongly agree on the influence of friends; we are running a workshop every academic year for new students to meet current students and chat about the assessment on their courses.’ (Expert 4)

Two experts mentioned the influence of lecturers of students’ attitude:

‘It depends on lecturers’ attitude towards using e-assessment on their courses. If the lecturer is excited about using this method to assess the students, and understands the e-exam systems well, they will reflect positively to the students.’ (Expert 3) ‘Yes, the lecturers can affect the students positively and also negatively.’ (Expert 5)

Regarding university culture, Experts 9 and 11 mentioned that the university culture is a very important factor in terms of attitude towards e-assessment.

'University culture is a key factor in attitude towards e-assessment. For example, in the universities, where the technology is used a lot, students find using e-assessment is interesting.' (Expert 5)

### 5.1.6 Facilitating of Examination

This factor addresses the importance of IT support in students' attitude towards e-assessment. It also covers the importance of providing a training session for students before running the e-exam for the first time. All agreed that these are important in terms of students' attitudes. Below are some of their supporting statements.

Experts 3 and 4 mentioned that training students is one of the conditions at their university, which they are required to do before they run any e-exam, to raise the level of students' confidence.

Experts 5 and 10 mentioned that it is very important for lecturers to provide an introduction before running an e-exam, to describe how the system works.

Expert 12 mentioned that it is important to provide a short video to illustrate all important information that students need to know before an e-exam, and that students can access at any time.

Experts 2 and 11 mentioned that students feel much more comfortable when they find support around them.

'The availability of IT support during the exam affects students' attitude towards summative e-assessment.' (Expert 4)

### 5.1.7 Content

The Content includes course type, question styles and feedback process. All agreed that Content was important for students' attitudes. Below are some of their supporting statements.

'Students' attitude towards using summative e-assessment depends on the type of course.' (Expert 3)

Experts 6 and 7 emphasised that most students did not like doing mathematics exams on a computer as they found it difficult to write the mathematical equations.

Experts 8 and 10 agreed that students were less enthusiastic in taking e-assessment on science courses such as mathematics and physics.

Experts 4 and 10 mentioned that students preferred multiple-choice questions more than typing answers.

'The questions in an e-assessment are usually a mix of multiple-choice, true/false and typing. Some students do not find typing questions useful, as the keyboard slows them up. So, the lecturer tries to avoid this type of question.' (Expert 12)

'Giving a variety of types of question make e-assessment more acceptable.' (Expert 1). 'The most attractive thing about e-assessment for students is the quick result they receive.' (Expert 2).

'In our systems, students receive the result straight after they click on submit, and can view their answer and see the wrong answer; students love that.' (Expert 3)

'The feedback in our system is just the result.' (Expert 2)

### 5.1.8 Accessibility

The experts confirmed the importance of considering Accessibility in students' attitude towards summative e-assessment. The Accessibility factor measures how important it is to present questions in different formats and using assistive technology for students with special needs, to make e-assessment accessible for all students. The experts were asked two questions to confirm the Accessibility factor. Below are some of their supporting statements.

'Yes, presenting the questions in different formats, such as sound or video with subtitles, is important for disabled students.' (Expert 5)

'It depends on the course. We are using sound on the English language course in the Listening unit.' (Expert 10)

'From my experience, the e-exam has given confidence to people with special needs. In the traditional exam, students with disabilities, such as blind students, need someone who can read the questions for them.' (Expert 3)

'There is a special lab with assistive technology for students with special needs.' (Expert 2)

'We have successful experience on e-assessment with disabled people. We provide a Mac device which contains the assistive application that students need to help them take the e-assessment.' (Expert 1)

'At my university, we plan to adopt assistive technology labs for e-assessment in different colleges.' (Expert 7)

### 5.1.9 Other Factors Suggested

The experts were asked to provide additional factors. The two factors suggested are given below.

- **University Infrastructure**

All experts emphasised the effect of technical issues on students' attitude towards summative e-assessment.

'The university should check their computers and network before each exam, as some students have had a bad experience due to the network.' (Expert 5)

'As I have worked in IT support in e-assessment exams for three years, I would say students are worried about the slowness of some computers and the potential loss of the network.' (Expert 4)

Experts 2 and 9 mentioned that technical issues affect students' attitude towards e-assessment.

Experts 1, 6 and 12 mentioned that the infrastructure of the university should be considered an important factor influencing students' attitude towards summative e-assessment.

Experts 3, 4 and 7 mentioned that technical issues that occur in some exams had a negative effect on ALL students, even those who had not suffered any technical issues before.

Experts 5 and 8 strongly recommended examining the effect of university infrastructure on students' attitude towards e-assessment.

Experts 8, 10 and 11 mentioned that exams labs should be fully prepared before running e-assessment, which includes computer hardware, software and a good network.

Since all experts mentioned that university Infrastructure was important, it has been added to the proposed framework under the Facilitating of Examination.

- **Anxiety**

Experts 8 and 11 mentioned that the degree of anxiety affects students' attitude towards summative e-assessment. They noticed that anxiety occurs due to technical issues and lack of

support during an e-exam. The experts found that anxiety occurs because of the technical issues. Thus, Anxiety has been added to the proposed framework for further investigation with students.

## 5.2 Results of Confirmation Questionnaire

The experts confirmed that all the proposed factors were considered important factors that influence students' attitude towards summative e-assessment in Saudi Arabian universities, except Perceived Playfulness. Perceived Playfulness was, thus, removed from the proposed factors. However, the experts identified additional factors: University Infrastructure and Anxiety were added to the proposed framework. The University Infrastructure was added in the proposed framework as a dimension under Facilitating of Examination. The online questionnaire was then distributed to a group of students at Saudi Arabian universities and was completed by 102 students, as discussed in Section 4.6.2. The purpose of the questionnaire was to confirm the factors in the proposed framework, which are Perceived Usefulness, Perceived Ease of Use, Self-Efficacy, Anxiety, Social Influence, Facilitating of Examination, Content, and Accessibility. Nineteen items were used to confirm the proposed factors and their dimensions. The questionnaire was divided into two sections: demographic information, and closed questions relevant to e-assessment factors, and is presented in Appendix A.7.

### 5.2.1 Demographic Information

The demographic information on the respondents to the questionnaire is shown in Table 5.1. This profile will help when interpreting the results of the quantitative analysis, particularly the unexpected results.

*Table 5.1 Demographics of the confirmation questionnaire*

| Variable | Group | Number | % |
|---|---|---|---|
| **University** | King Abdulaziz University | 40 | 39.2 |
| | Imam Abdurrahman Bin Faisal University | 38 | 37.3 |
| | Saudi Electronic University | 24 | 23.5 |
| **Discipline** | Natural Science (NS) | 64 | 62.7 |
| | Social Science (SS) | 38 | 37.3 |
| **Gender** | Male | 16 | 16.7 |
| | Female | 86 | 84.3 |
| **Experience** | Used e-assessment systems before | 48 | 47.1 |
| | Never used e-assessment systems | 54 | 52.9 |

### 5.2.2 Analysis of the Proposed Factors

The second section of the questionnaire was used to collected students' opinions about the factors in the proposed framework. Students were asked to rate the importance of these factors. Nineteen questions covered the proposed factors. The responses to these questions were based on a five-point Likert scale, with 1 denoting 'Strongly Disagree', 2 denoting 'Disagree', 3 denoting 'Neutral', 4 denoting 'Agree', and 5 denoting 'Strongly Agree'.

*Table 5.2 Repeated measures one-way ANOVA on 19 items*

| **Multivariate Tests** | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
|---|---|---|---|---|---|
| Pillai's Trace | 0.85 | 25.48 | 18 | 84 | < 0.001 |
| Wilks' Lambda | 0.16 | 25.48 | 18 | 84 | < 0.001 |
| Hotelling's Trace | 5.46 | 25.48 | 18 | 84 | < 0.001 |
| Roy's Largest Root | 5.46 | 25.48 | 18 | 84 | < 0.001 |

Since there were multiple comparisons, a repeated measure one-way analysis of variance (ANOVA) was then used on the 19 questions, as discussed in Section 4.3.3. There was a statistically significant difference in the mean rating of these 19 items indicated by Wilks' Lambda =0.16, $F$ (18, 84) = 25.48, $p < 0.001$, as shown in Table 5.2. This suggests that suitable adjustments to the confidence interval must be made. The results of that are shown in Table 5.3, which examines the 95% confidence intervals, suitably adjusted by the Sidak correction, against the neutral point of 3. Sidak correction is an alternative $p$-value adjustment for multiple comparison tests. It is applied because it is more powerful and less conservative than the Bonferroni correction, producing a family wise type I error rate of exactly α when assuming each comparison is independent of the others and all null hypotheses are true (Abdi, 2007).

*Table 5.3 Confidence Levels against the value of "3"*

| | | | **95% Confidence Interval** | | |
|---|---|---|---|---|---|
| **Item** | **Mean** | **Std. Error** | **Lower Bound** | **Upper Bound** | ***p*** |
| 1 | 4.20 | 0.07 | 4.05 | 4.34 | < 0.05 |
| 2 | 4.50 | 0.06 | 4.39 | 4.61 | < 0.05 |
| 3 | 3.32 | 0.09 | 3.15 | 3.50 | < 0.05 |
| 4 | 4.35 | 0.08 | 4.20 | 4.51 | < 0.05 |
| 5 | 2.70 | 0.12 | 2.46 | 2.93 | > 0.05* |
| 6 | 3.34 | 0.10 | 3.16 | 3.53 | < 0.05 |
| 7 | 3.40 | 0.11 | 3.18 | 3.62 | < 0.05 |
| 8 | 3.84 | 0.10 | 3.64 | 4.04 | < 0.05 |
| 9 | 4.22 | 0.08 | 4.07 | 4.38 | < 0.05 |
| 10 | 4.06 | 0.09 | 3.88 | 4.23 | < 0.05 |
| 11 | 4.65 | 0.06 | 4.53 | 4.76 | < 0.05 |
| 12 | 4.02 | 0.09 | 3.85 | 4.19 | < 0.05 |
| 13 | 4.49 | 0.06 | 4.37 | 4.61 | < 0.05 |

| Item | Mean | Std. Error | 95% Confidence Interval | | *p* |
|---|---|---|---|---|---|
| | | | Lower Bound | Upper Bound | |
| 14 | 4.27 | 0.07 | 4.12 | 4.41 | < 0.05 |
| 15 | 4.10 | 0.10 | 3.90 | 4.29 | < 0.05 |
| 16 | 4.32 | 0.07 | 4.18 | 4.47 | < 0.05 |
| 17 | 4.52 | 0.07 | 4.39 | 4.65 | < 0.05 |
| 18 | 4.56 | 0.06 | 4.44 | 4.68 | < 0.05 |
| 19 | 4.27 | 0.10 | 4.07 | 4.46 | < 0.05 |

*Item was found to be not statistically significant

Statistical significances for each item were then determined by looking at whether the neutral point was within ($p > 0.05$, not significant) or outside ($p < 0.05$, significant). A proposed item was to be included in the framework as long as its mean value ≥ 3. Items were considered statistically significant if their *p*-values < 0.05. Most of the items in Table 5.3 were deemed statistically significant as the mean value of each item was more than 3, except item number 5 which related to Anxiety. The remaining 18 items were found to be statistically significant as their *p*-values were less than the significance level, except for Anxiety. Full detail of the statistical analysis is presented in Appendix A.8.1.

### 5.2.3 How Different Perspectives Affected Responses

This section examines whether or not the demographic data affected participants' responses. The demographic data were university, gender, discipline and experience of e-assessment. The demographic data were tested by repeated measures of one-way multivariate analysis of variance (MANOVA). This is a procedure for comparing multivariate sample means. As a multivariate procedure, it is used when there are two or more dependent variables, and is typically followed by significance tests involving individual dependent variables separately. It helps to answer whether the changes in the independent variable(s) have significant effects on the dependent variables (Carey, 1998). Table 5.4 presents the result of how the university affected the responses, from the three universities, King Abdulaziz University (N = 40), Imam Abdurrahman Bin Faisal University (N = 38), and Saudi Electronic University (N = 24). It shows that there were no statistically significant effects on the participants' responses between universities; Wilks' Lambda = 0.68, $F$ (36, 17) = 0.98, $p = 0.508$.

*Table 5.4 How university affected the responses*

| Multivariate Tests | | Value | *F* | Hypothesis df | Error df | *p* |
|---|---|---|---|---|---|---|
| University | Pillai's Trace | 0.35 | 0.99 | 36 | 17 | 0.492 |
| | Wilks' Lambda | 0.68 | 0.98 | 36 | 17 | 0.508 |

| | Multivariate Tests | Value | *F* | Hypothesis df | Error df | *p* |
|---|---|---|---|---|---|---|
| | Hotelling's Trace | 0.43 | 0.97 | 36 | 16 | 0.524 |
| | Roy's Largest Root | 0.25 | 1.13 | 18 | 83 | 0.338 |

Table 5.5 presents the result of how the discipline affected the responses, from Natural Science (NS) (N = 64) and Social Science (SS) (N = 38). It shows that there were no statistically significant effects on the participants' responses between NS and SS; Wilks' Lambda = 0.89, $F$ (18, 83) = 0.60, $p$ = 0.889.

*Table 5.5 How discipline affected the responses*

| Multivariate Tests | | Value | *F* | Hypothesis df | Error df | *p* |
|---|---|---|---|---|---|---|
| Discipline | Pillai's Trace | 0.12 | 0.60 | 18 | 83 | 0.889 |
| | Wilks' Lambda | 0.89 | 0.60 | 18 | 83 | 0.889 |
| | Hotelling's Trace | 0.13 | 0.60 | 18 | 83 | 0.889 |
| | Roy's Largest Root | 0.13 | 0.60 | 18 | 83 | 0.889 |

Table 5.6 presents the result of how gender affected the responses, from male (N = 16) and female (N = 86). It shows that there were no statistically significant effects the participants' responses between male and female; Wilks' Lambda = 0.84, $F$ (18, 83) = 0.86, $p$ = 0.622.

*Table 5.6 How gender affected the responses*

| Multivariate Tests | | Value | *F* | Hypothesis df | Error df | *p* |
|---|---|---|---|---|---|---|
| Gender | Pillai's Trace | 0.16 | 0.86 | 18 | 83 | 0.622 |
| | Wilks' Lambda | 0.84 | 0.86 | 18 | 83 | 0.622 |
| | Hotelling's Trace | 0.19 | 0.86 | 18 | 83 | 0.622 |
| | Roy's Largest Root | 0.19 | 0.86 | 18 | 83 | 0.622 |

Table 5.7 presents the result of how experience of e-assessment affected the responses, from used before (N = 48) and never used (N = 54). It shows that there were no statistically significant effects on the participants' responses between those who had used and had not used e-assessment; Wilks' Lambda = 0.88, $F$ (18, 83) = 0.65, $p$ = 0.851.

*Table 5.7 How experience affected the responses*

| Multivariate Tests | | Value | *F* | Hypothesis df | Error df | *p* |
|---|---|---|---|---|---|---|
| Experience | Pillai's Trace | 0.12 | 0.65 | 18 | 83 | 0.851 |
| | Wilks' Lambda | 0.88 | 0.65 | 18 | 83 | 0.851 |
| | Hotelling's Trace | 0.14 | 0.65 | 18 | 83 | 0.851 |
| | Roy's Largest Root | 0.14 | 0.65 | 18 | 83 | 0.851 |

A full description of the statistical analysis can be found in Appendix A.8.2.

## 5.3 Summary

This chapter confirmed the factors of the proposed framework in two steps. Interviews were carried out with 12 experts in e-assessment to review the factors in the proposed framework. The experts agreed about the importance of all factors, except for Perceived Playfulness, and, consequently, this factor was removed. The experts identified two further factors, which were Anxiety and University Infrastructure. The updated framework was distributed to 102 students where 52.9 % of students had no experience of e-assessment. They confirmed that all the factors are important in the attitude of students towards summative e-assessment, except Anxiety, which then was removed. The updated framework thus contains Perceived Usefulness, Perceived Ease of Use, Self-Efficacy, Social Influence, Facilitating of Examination, Content, and Accessibility, as shown in Table 5.8.

*Table 5.8 The confirmed research framework*

| Factor | Dimensions |
|---|---|
| **Perceived Usefulness (PU)** | • Effectiveness<br>• Improves the quality of learning |
| **Perceived Ease of Use (PEU)** | • Easy to learn and free of effort<br>• Clear and understandable |
| **Self-Efficacy (SE)** | • Ability to perform specific task<br>• Confidence in using computer |
| **Social Influence (SI)** | • Friends opinion<br>• Lecturers support<br>• University culture |
| **Facilitating of Examination (FE)** | • Support students during exam time<br>• Training before exam<br>• University Infrastructure(hardware, software and network) |
| **Content (CO)** | • Course Type<br>• Question Style<br>• Feedback Process |
| **Accessibility (AC)** | • Question presented in different formats<br>• Assistive technology |

# Chapter 6 Research Questionnaire Design

This chapter presents the development of the questionnaire used to investigate the factors affecting the students' attitude towards summative e-assessment. After designing the questionnaire, the validity and reliability phase was carried out to ensure that the statements in the questionnaire measured the factors accurately, including: content validity, expert correlation, pre-test and pilot study.

## 6.1 Questionnaire Design

The objective of the questionnaire is to investigate the factors affecting the students' attitude towards using summative e-assessment. The questionnaire can also be used as an instance of the framework whose future use might help stakeholders evaluate summative e-assessment systems. As discussed in Section 4.1.2, questionnaire methods are useful for gathering data about opinions, attitudes and beliefs (Artino et al., 2014). The resulting questionnaire included both demographic information and response metrics. In addition, ethical approval was obtained from the University of Southampton before distributing the questionnaire to the participants (see Section 4.7). The questionnaire was written in Arabic and translated in English for the purpose of the study. The online delivery of the questionnaire comprised four pages and a brief introductory page. The latter consisted of a welcome statement, a description of the factors, and consent information. The remaining pages covered, first, demographic information; this was designed to collect general information about the participant, such as name of their university, discipline, gender and experience. Then, the questionnaire items; this question asked how far the respondent agreed with the statements regarding influence on their attitudes towards summative e-assessment at their universities. At the end of the questionnaire was a facility for students to leave any comments about the study. This allowed to understand any points raised about the state of e-assessment in Saudi Arabian universities.

## 6.2 Development of the Questionnaire Items

The guideline on how to develop items for a questionnaire was provided by Devellis (2003), and is used below.

**Step 1:** The purpose of this step was to define the construct and to determine whether the construct already existed. The guideline suggests clearly defining what needs to be measured. The prior

relevant studies and interview and questionnaire findings were used for operationalising the theoretical constructs. By using the confirmed factors in Section 5.3, the seven factors applied to the design of the questionnaire were: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Self-Efficacy (SE), Social Influence (SI), Facilitating of Examination (FE), Content (CO) and Accessibility (AC). In addition, Attitude (AT) was introduced in the questionnaire in order to answer SRQ2 which intended to investigate the effect of the seven factors on the attitude.

**Step 2:** After the constructs were defined, a pool of items to be measured was generated. Several measurement items were self-developed while other items were adapted from the previous research to fit the context of the current research. As for the number of items to be included in the initial pool, the more, the better. Factor analysis requires at least two items per construct for models containing two or more constructs (Kline, 1994). Nevertheless, having only two items per construct may raise problems in the analysis, particularly when using a small sample (Kline, 1994). Therefore, using a minimum of three to five items per factor is recommended so as to avoid such problems in the analysis (Kline, 1994). Thus, all the factors in this study were designed with more than four items. Thus, 59 items to be measured were generated. For each factor, question statements were created. Some statements expressed the same idea, but in a different way. Validity and reliability were then carried out to assess these items.

**Step 3:** This involved determining the format for measurement. The Agree-Disagree Likert scale is extremely popular in rating questions on opinions, attitudes, or beliefs, knowledge and awareness (Revilla, Saris, & Krosnick, 2014). All factors were measured with a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree (Likert,1932). Each of the five responses would have a numerical value that measure of the attitude under investigation. Tables 6.1 to 6.8 illustrate the items of the factors in the proposed framework.

*Table 6.1 Items of Perceived Usefulness (PU)*

| **Item** | **Code** | **Reference** |
|---|---|---|
| Using e-assessment is useful on my course. | PU1 | Davis (1989); Alkiş (2010) |
| E-assessment helps improve my learning. | PU2 | Davis (1989); Alkiş (2010); Terzis and Economides (2011); |
| E-assessment enhances the quality of learning. | PU3 | Davis (1989); Alkiş (2010); Terzis and Economides (2011) |
| E-assessment gives me quick feedback, which helps me on my course. | PU4 | Dermo (2009); Alsadoon (2017) |
| E-assessment allows me to demonstrate my knowledge in more ways than paper-based exams. | PU5 | Hillier (2014) |
| E-assessment can do things paper-based exams cannot. | PU6 | Self-developed |

| Item | Code | Reference |
|---|---|---|
| E-assessment is more useful than paper and pencil testing. | PU7 | Self-developed |

*Table 6.2 Items of Perceived Ease of Use (PEU)*

| Item | Code | Reference |
|---|---|---|
| Taking e-assessment is easier than a paper-based exam. | PEU1 | Self-developed |
| The e-assessment system is easy to use. | PEU2 | Davis (1989); Schneberger et al. (2007); Terzis and Economides (2011) |
| Interacting with the e-assessment system does not require a lot of mental effort. | PEU3 | Davis (1989) |
| The instructions for the e-assessment system are clear. | PEU4 | Davis (1989); Dermo (2009) |
| Learning to use the e-assessment system would be easy for me. | PEU5 | Davis (1989); Terzis and Economides (2011) |
| It is easy to navigate the e-assessment system. | PEU6 | Schneberger et al. (2007); Dermo (2009); Alkiş (2010) |

*Table 6.3 Items of Self-Efficacy (SE)*

| Item | Code | Reference |
|---|---|---|
| I do not need advanced skills when I use the e-assessment system. | SE1 | Compeau and Higgins (1995); Alsadoon (2017) |
| I could use the e-assessment system even if I had no prior experience on similar systems. | SE2 | Compeau and Higgins (1995); Alkiş (2010) |
| I am able to use the e-assessment system. | SE3 | Compeau and Higgins (1995) |
| I could complete a job or task using the computer if someone showed how to do it first. | SE4 | Compeau and Higgins (1995); Terzis and Economides (2011) |
| I was fully able to use the computer before I used e-assessment. | SE5 | Compeau and Higgins (1995) |
| I can use the e-assessment system without any assistance. | SE6 | Compeau and Higgins (1995) |

*Table 6.4 Items of Social Influence (SI)*

| Item | Code | Reference |
|---|---|---|
| The opinion of my friends about e-assessment is important to me. | SI1 | Taylor and Todd (1995) |
| The IT support at my university is helpful in the use of e-assessment. | SI2 | Thompson et al. (1991) |
| My teacher is very supportive of the use of e-assessment at my university. | SI3 | Thompson et al. (1991) |
| The senior management in the university is helpful in the use of e-assessment systems. | SI4 | Thompson et al. (1991); McCann (2010); Terzis and Economides (2011) |
| In general, my university has supported the use of e-assessment. | SI5 | Thompson et al. (1991); Terzis and Economides (2011) |

*Table 6.5 Items of Facilitating of Examination (FE)*

| Item | Code | Reference |
|---|---|---|
| When I need help during the e-assessment exam, someone is there to help me. | FE1 | Schneberger et al. (2007); Terzis and Economides (2011) |
| Support staff are available to help me at any time I use e-assessment. | FE2 | Terzis and Economides (2011) |
| An e-assessment training course is available to me before an exam. | FE3 | Thompson et al. (1991); Awad (2016) |
| An online instruction guideline for using e-assessment is available to me at any time. | FE4 | Thompson et al. (1991); Venkatesh et al. (2003) |
| The e-assessment training course is clear. | FE5 | Self-developed |
| University preparation, such as computer hardware and communications network, was sufficient for the e-assessment. | FE6 | Self-developed |
| Overall, the e-assessment environment infrastructure at my university is efficient. | FE7 | Self-developed |
| I receive help from IT technical support while doing e-assessment. | FE8 | Schneberger et al. (2007); Dermo (2009) |
| I receive help from my instructor while doing e-assessment. | FE9 | Thompson et al. (1991); Dermo (2009) |
| Usually, I need assistance when using e-assessment for the first time. | FE10 | Alkiş (2010) |

*Table 6.6 Items of Content (CO)*

| Item | Code | Reference |
|---|---|---|
| E-assessment is appropriate for all subjects. | CO1 | Dermo (2009); Terzis and Economides (2011); Hillier (2014); Alsadoon (2017) |
| E-assessment is more useful for some courses than others. | CO2 | Alkiş (2010);Terzis and Economides (2011); Hillier (2014) |
| My subject area is too complex to be dealt with by online multiple-choice questions. | CO3 | Dermo (2009) |
| E-assessment helps extract results quickly. | CO4 | Awad (2016) |
| The feedback I have received from e-assessment is sufficient. | CO5 | Self-developed |
| I would like to be able to type answers in e-assessment. | CO6 | Self-developed |
| E-assessment needs to include a variety of question types in order to test my knowledge fully. | CO7 | Self-developed |
| E-assessment questions are useful for my course. | CO8 | Terzis and Economides (2011) |
| My typing speed significantly influences my completion time. | CO9 | Tella and Bashorun (2012) |
| The content of feedback in e-assessment improves my learning. | CO10 | Alkiş (2010); Terzis and Economides (2011) |

*Table 6.7 Items of Accessibility (AC)*

| Item | Code | Reference |
|---|---|---|
| E-assessment is appropriate for all students. | AC1 | Awad (2016); Alsadoon (2017) |
| E-assessment is more accessible than paper-based exams. | AC2 | Dermo (2009) |
| My university provides assistive technology, such as screen readers, for students with special needs to help them take e-assessment. | AC3 | Self-developed |
| It is important to present questions in different formats, e.g. images, audio and video, for students with special needs. | AC4 | Self-developed |
| E-assessment favours some students more than others. | AC5 | Self-developed |
| E-assessment is easy to read on the screen. | AC6 | Self-developed |
| Text-sizing and contrast controls within assessments are important to aid participants with low/partial vision. | AC7 | Self-developed |
| Navigation of assessments via keyboard and/or alternate devices, to accommodate participants who are unable to use a mouse, is important to meet the needs of participants with disabilities. | AC8 | Self-developed |

*Table 6.8 Items of Attitude (AT)*

| Item | Code | Reference |
|---|---|---|
| I consider the decision to use e-assessment is a positive one. | AT1 | Ajzen and Fishbein (1977); Davis (1989) |
| I like the idea of using e-assessment at my university. | AT2 | Ajzen and Fishbein (1977); Davis (1989); Alkiş (2010) |
| I would like to see e-assessment implemented further in departmental modules. | AT3 | Alkiş (2010); Hillier (2014) |
| Overall, using e-assessment in my course is a wise decision. | AT4 | Ajzen and Fishbein (1977); Davis (1989) |
| I prefer typing rather than handwriting answers. | AT5 | Self-developed |
| In general, I was a positive towards using the e-assessment system. | AT6 | Alkiş (2010) |
| I would like e-assessment to replace paper-based exams at my university. | AT7 | Tella and Bashorun (2012) |

## 6.3 Questionnaire Validity and Reliability

The questionnaire was validated and then tested for reliability. This involved three steps. First, the questionnaire was checked for content validity in order to refine the items. Then, a pre-test was conducted to assess the clarity of the instructions and formatting of the questionnaire. The final step was a pilot study to establish the validity and reliability of each factor in the questionnaire. The validity and the reliability of the questionnaire are now presented in detail.

### 6.3.1 Content Validity

Using an informal face validation technique, different approaches for assessing content validity (face validity) have been discussed (Tojib & Sugianto, 2006). An example is content validity ratio (CVR) found in Lawshe (1975). CVR is a method used to assist researchers in decisions to retain or delete an item from the questionnaire through the calculation of its CVR (Tojib & Sugianto, 2006). This method is quick and easy to perform and offers practicality in terms of time and cost (Tojib & Sugianto, 2006). The experts are requested to specify whether an item is necessary for operating a construct in a set of items, or not, by scoring each item from 1 to 3 representing “essential, useful but not essential, and not necessary”. The CVR varies between 1 and –1, where the higher score indicates increasing agreement of the experts on the necessity for an item (Lawshe, 1975). If more than half the experts indicate that an item is essential, that item has at least some content validity. The CVR values obtained for each item were examined for their significance employing the standard table provided by Lawshe (1975). If the estimated CVR value was equal to or above the standard value, then the item was accepted, otherwise, it was eliminated. The minimum number of experts required to rate each item should be five. Greater levels of content validity exist as a larger proportion of experts agree that an item is essential. For a CVR to be considered important, the level of agreement among experts must be greater than 50% (Lawshe, 1975).

Here, the CVR responses were gathered from seven experts in e-assessment. The approach of CVR involves the use of an evaluation document, a table containing the questionnaire items, which the experts have to respond to by choosing one of a three-point scale:

- essential (coded 3)
- useful but not essential (coded 2)
- not necessary (coded 1)

The results of the experts' "essential" responses were used to calculate the CVR as follows (Lawshe, 1975).

$$CVR = \frac{\left(N_e - \frac{N}{2}\right)}{\left(\frac{N}{2}\right)}$$

Where $N_e$ is the number of experts who indicated the item was "essential", while $N$ is the total number of participating experts. For the CVR to be considered "essential", transformation from the percentage saying "essential" had to be more than 50% (Lawshe, 1975).

- When fewer than half say "essential", the CVR is negative.
- When half say "essential" and half do not, the CVR is 0.
- When all say "essential", the CVR is computed to be 1, (It is adjusted to 0.99 for ease of manipulation).
- When the number saying "essential" is more than half, but less than all, the CVR is somewhere between 0 and 0.99.

**A. Participants and Procedure**

After designing the questionnaire, the next step was to select the panel of experts eligible to review the questionnaire. As discussed in Section 4.5.1, the criteria of participant selection were reviewed and experts were chosen, then emails were sent to them inviting them to take part in this study. The experts' information was accessed from their universities profiles and based on their interests and current research. Seven experts in e-assessment were chosen to review the questionnaire. The experts involved here were different to the experts involved in the confirmatory study. A minimum of three experts would be sufficient and no more 10 experts are recommended (Lynn, 1986). After receiving the experts' agreement, a further email was sent to them including the participant information sheet explaining their task, thanking them, a consent form to be signed, and the document for reviewing the questionnaire, see Appendix B.1, B.2 and B.3. After reviewing, the documents were sent back by all experts, and their responses coded on an Excel spreadsheet.

**B. Results**

The results of the CVR in Table 6.9 showed that, from a pool of 59 items, only 36 items were essential. Based on Lawshe (1975), with seven experts, a minimum CVR of 0.50 is required to satisfy the 50% level. The CVR for each item is shown in Table *6.9* and demonstrates that 23 items were lower than 0.50, thereby not satisfying the 50% level. Thus, these items were removed from the questionnaire, as more than half the experts agreed they were not essential for this study.

*Table 6.9 Result of Content Validity Ratio for questionnaire' items*

| Factor | CVR item 1 | CVR item 2 | CVR item 3 | CVR item 4 | CVR item 5 | CVR item 6 | CVR item 7 | CVR item 8 | CVR item 9 | CVR item 10 | Total items | Significant items |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PU** | 1 | 0.71 | –0.43 | 1 | –0.43 | –0.43 | 1 | | | | 7 | 4 |
| **PEU** | 0.71 | 0.71 | 0.71 | –0.43 | 1 | –0.43 | | | | | 6 | 4 |
| **SE** | 0.71 | 0.71 | 0.71 | –0.14 | –0.14 | 1 | | | | | 6 | 4 |
| **SI** | 0.71 | 0.71 | 0.71 | –0.43 | 0.71 | | | | | | 5 | 4 |
| **FE** | 0.71 | 1 | 0.71 | –0.43 | –0.43 | 0.71 | 0.71 | –0.14 | –0.43 | 0.71 | 10 | 6 |
| **CO** | 0.71 | 0.71 | –0.71 | –0.43 | 0.71 | –0.71 | 0.71 | 0.71 | –0.43 | 0.71 | 10 | 6 |
| **AC** | 1 | 0.71 | 0.71 | –0.14 | –0.71 | –0.14 | 0.71 | –0.43 | | | 8 | 4 |
| **AT** | 0.71 | –0.71 | 0.71 | –0.43 | –0.43 | 0.71 | 1 | | | | 7 | 4 |
| | | | | | | | | | | **Total** | **59** | **36** |

The result of CVR showed that the experts agreed that 36 items are important on investigate students' attitude towards using e-assessment. The number of items for each factor was as follows: Perceived Usefulness (PU) (4 items), Perceived Ease of Use (PEU) (4 items), Self-Efficacy (SE) (4 items), Social Influence (SI) (4 items), Facilitating of Examination (FE) (6 items), Content (CO) (6 items), Accessibility (AC) (4 items) and Attitude (AT) (4 items).

### 6.3.2 Expert Correlation and Mean Difference

It is important to test how experts' responses correlated with each other and find difference in means of the experts' correlations. Some experts may give lower, higher, or biased ratings, so it is important to see whether there were differences in the means. With this test, experts found to have given too low, high, or biased ratings may be excluded from the expert validation and review, since biased responses could cause undesired results. Table 6.10 presents the overall experts' correlation.

*Table 6.10 Overall experts' correlation*

| **One-Sample Statistics** | | | |
|---|---|---|---|
| | **N** | **Mean** | ***p*** |
| Overall Experts' Correlation | 21 | 0.44 | <0.001 |

In this test, the correlations for each expert were individually conducted, as shown in Appendix B.4, to find difference in means of the experts' correlations. The overall correlations were calculated using t-tests given by the inter-experts' correlation, the correlations of seven experts being shown in Appendix B.4.1. The summarised result in Table 6.10 shows that there were significant positive correlations within the experts, N = 21, $p$ <0.001. Detailed statistical tests of the overall expert correlation can be found in Appendix B.4.2.

*Table 6.11 Differences in means of the experts*

| **Multivariate Tests** | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Expert | Pillai's Trace | 0.21 | 1.35 | 6 | 30 | 0.266 |
| | Wilks' Lambda | 0.79 | 1.35 | 6 | 30 | 0.266 |
| | Hotelling's Trace | 0.27 | 1.35 | 6 | 30 | 0.266 |
| | Roy's Largest Root | 0.27 | 1.35 | 6 | 30 | 0.266 |

Table 6.11 shows that there was no difference in means of expert responses tested by a repeated measures one-way ANOVA, as discussed in Section 4.3.3. Wilks' Lambda = 0.79, $F$ (6,30) = 1.35, $p$= 0.266. The repeated measures one-way ANOVA are shown in Appendix B.4.3; the expert means were drawn as a profile plot as shown in Figure 6.1.

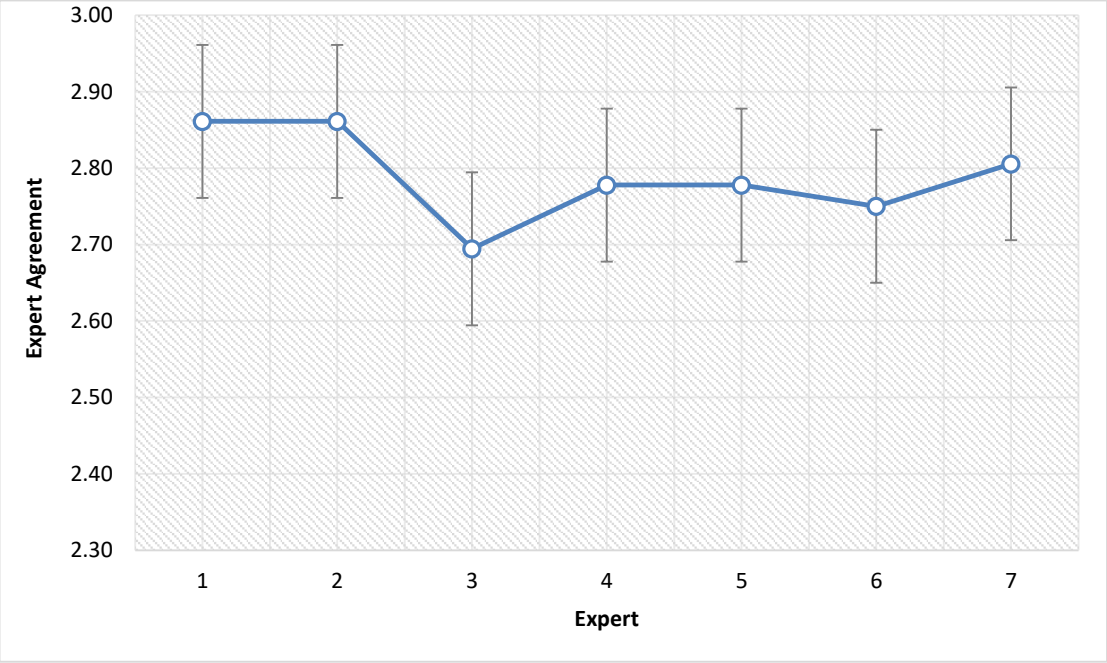


*Figure 6.1 Means of expert ratings with confidence Interval*

It can be seen in Figure 6.1 that expert 3 shows lower ratings on average. Despite the difference in means found, there were no exclusions in this expert validation and review as the gap in mean differences was not too big. The measurement questionnaire items in this thesis are presented in Table 6.12.

*Table 6.12 The measurement questionnaire items*

| No | Item |
|---|---|
| **PU1** | I find using e-assessment is useful on my course |
| **PU2** | I believe e-assessment helps improve my learning |
| **PU3** | I find e-assessment gives me quick feedback, which helps me on my course |
| **PU4** | I think e-assessment is more useful than paper and pencil testing |
| **PEU1** | Learning to use e-assessment system would be easy for me |
| **PEU2** | The e-assessment system is easy to use |
| **PEU3** | I find taking e-assessment is easier than a paper-based exam |
| **PEU4** | Interacting with the e-assessment system does not require a lot of mental effort from me |
| **SE1** | I am able to use the e-assessment system |
| **SE2** | I could use the e-assessment system even if I had no prior experience on similar systems |
| **SE3** | I do not need advanced skills when I use the e-assessment system |
| **SE4** | I can use the e-assessment system without any assistance |
| **SI1** | The opinion of my friends about e-assessment is important to me |
| **SI2** | The IT support at my university is helpful in the use of e-assessment |
| **SI3** | My teacher is very supportive of the use of e-assessment at my university |
| **SI4** | In general, my university supports the use of e-assessment |
| **FE1** | Support staff are available to help me at any time I use e-assessment |
| **FE2** | I usually need assistance when using e-assessment for the first time |
| **FE3** | E-assessment training courses are available to me before the e-assessment exam |
| **FE4** | When I need help during the e-assessment exam, someone is there to help me |
| **FE5** | University preparation, such as computer hardware and communications network, was sufficient for the e-assessment |
| **FE6** | Overall, the e-assessment environment infrastructure at my university is efficient |
| **CO1** | I think e-assessment is appropriate for all subjects |
| **CO2** | E-assessment is more useful for some courses than others |
| **CO3** | I find e-assessment questions are useful for my course |
| **CO4** | E-assessment needs to include a variety of question types in order to test my knowledge fully |
| **CO5** | The content of feedback during e-assessment would improve my learning |
| **CO6** | I find the feedback I have received from e-assessment is sufficient |
| **AC1** | I think e-assessment is appropriate for all students |
| **AC2** | I believe e-assessment is more accessible than a paper-based exam |
| **AC3** | My university provides assistive technology such as screen readers for students with special needs to help them take e-assessment |
| **AC4** | Text-sizing and contrast controls within assessments is important to aid participants with low/partial vision |
| **AT1** | I consider the decision to use e-assessment is a positive one |
| **AT2** | I would like to see e-assessment implemented further in departmental modules |
| **AT3** | I would like e-assessment to replace paper-based exams at my university |
| **AT4** | In general, I was positive towards using the e-assessment system |

### 6.3.3 Pretesting the questionnaire

Since the targeted students are in Saudi Arabian universities, the questionnaire was distributed in Arabic. It was then pre-tested before conducting the pilot study. Six Arabic-speaking researchers from the University of Southampton (computer science group) were involved in assessing it for clarity of instructions and formatting, checking item wording and ease of administration as discussed in Section 4.2.1. An online version of the questionnaire was presented to each participant. Participants were asked to complete the questionnaire and provide feedback and suggestions to improve it. The aim was to check that the questionnaire was clear and understandable, as was the response format, size and layout. The participants added comments, including re-ordering some items in each construct and correction of some grammar for clarity. As a result, some changes were made in spelling and typographical errors, and in the order of items, but no major change was made to the questionnaire.

### 6.3.4 Pilot Study

In a pilot study, a smaller version is carried out before the actual investigation is done, to assess the feasibility, reliability and validity of the proposed design (Thabane, Ma, & Chu, 2010). It is important to estimate internal consistency and test the reliability of the questionnaire prior to a large study. A sample of 30 has been suggested as the minimum acceptable level for a pilot study (Hertzog, 2008). Fifty students from Saudi Arabian universities, mainly Taif University and the University of Jeddah, participated in this pilot study. These two universities were not involved in the confirmatory study (see Section 4.5.2/B) and investigation study (see Section 4.6.2). The results of the pilot study are detailed below.

**A. Reliability Analysis**

The reliability test in the pilot study showed that Cronbach's alpha for all 36 items was 0.94. This value indicates an excellent level of internal consistency and reliability for the questionnaire (Hair et al., 2010). In addition, each factor has shown a large enough alpha value. As a result, no items were eliminated from any of the factors.

*Table 6.13 Reliability of the factors in the pilot study*

| Factor | Items | Cronbach's alpha | Reliability result |
|---|---|---|---|
| Perceived Usefulness | 4 | 0.89 | Good |
| Perceived Ease of Use | 4 | 0.74 | Acceptable |
| Self-Efficacy | 4 | 0.82 | Good |
| Social Influence | 4 | 0.53 | Acceptable |
| Facilitating of Examination | 6 | 0.68 | Acceptable |

| Factor | Items | Cronbach's alpha | Reliability result |
|---|---|---|---|
| Content | 6 | 0.69 | Acceptable |
| Accessibility | 4 | 0.68 | Acceptable |
| Attitude | 4 | 0.92 | Excellent |

The result of the reliability test for each factor is presented in Table 6.14 and the Cronbach's alpha reliability values are discussed in Section 4.2.3/B. Cronbach's alpha value above 0.50 indicates an acceptable level of internal consistency. The highest level of internal consistency was shown by Attitude, followed by Perceived Usefulness and Self-Efficacy, which both show a good internal consistency. Perceived Ease of Use, Social Influence, Facilitating of Examination, Content and Accessibility all show an acceptable level of internal consistency.

**B. Internal Consistency for Factors**

This section presents the description of the internal consistency for each factor.

- **Internal consistency for Perceived Usefulness factor (PU)**

The Cronbach's alpha indicated the internal consistency was good for the four items in the PU factor. Based on Table 6.14, all items were highly correlated with each other, so the items were retained.

*Table 6.14 Descriptive statistics for Perceived Usefulness factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| PU1 | 7.16 | 10.09 | 0.74 | 0.56 | 0.87 |
| PU2 | 7.08 | 9.91 | 0.80 | 0.67 | 0.85 |
| PU3 | 7.28 | 10.36 | 0.71 | 0.54 | 0.88 |
| PU4 | 6.98 | 8.26 | 0.83 | 0.70 | 0.84 |

- **Internal consistency for Perceived Ease of Use factor (PEU)**

The Cronbach's alpha indicated the internal consistency was acceptable for the four items in the PEU factor. Based on Table 6.15, all items were sufficiently correlated with each other, so all the items were retained.

*Table 6.15 Descriptive statistics for Perceived Ease of Use factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| PEU1 | 5.46 | 5.35 | 0.62 | 0.58 | 0.65 |

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| PEU2 | 5.42 | 4.90 | 0.59 | 0.59 | 0.64 |
| PEU3 | 5.16 | 4.13 | 0.54 | 0.30 | 0.68 |
| PEU4 | 4.96 | 4.89 | 0.44 | 0.23 | 0.73 |

- **Internal consistency for Self-Efficacy factor (SE)**

The Cronbach's alpha indicated the internal consistency was good for the four items in the SE factor. Based on Table 6.16, the corrected item-total correlation for every item was more than 0.30, so the items were retained.

*Table 6.16 Descriptive statistics for Self-Efficacy factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| SE1 | 5.20 | 4.32 | 0.58 | 0.34 | 0.80 |
| SE2 | 4.80 | 3.51 | 0.69 | 0.49 | 0.75 |
| SE3 | 4.88 | 3.33 | 0.67 | 0.45 | 0.76 |
| SE4 | 4.86 | 4.04 | 0.65 | 0.44 | 0.77 |

- **Internal consistency for Social Influence factor (SI)**

The Cronbach's alpha indicated the internal consistency was acceptable for the four items in the SI factor. Based on Table 6.17, item SI1 had an item-total correlation lower than 0.30 (0.28). However, the corresponding value for Cronbach's alpha if that item was deleted (0.53) indicates no increase in total reliability. Therefore, the item was retained.

*Table 6.17 Descriptive statistics for Social Influence factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| SI1 | 6.66 | 4.63 | 0.28 | 0.12 | 0.53 |
| SI2 | 7.04 | 3.71 | 0.43 | 0.20 | 0.35 |
| SI3 | 6.94 | 4.34 | 0.35 | 0.36 | 0.44 |
| SI4 | 7.26 | 4.52 | 0.40 | 0.35 | 0.41 |

- **Internal consistency for Facilitating of Examination factor (FE)**

The Cronbach's alpha indicated the internal consistency was acceptable for the six items in the FE factor. Based on Table 6.18, item FE3 had an item-total correlation lower than 0.30 (0.26). However, the corresponding value for Cronbach's alpha if that item was deleted (0.68) indicates no increase in total reliability. Therefore, the item was retained.

*Table 6.18 Descriptive statistics for Facilitating of Examination factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| FE1 | 12.36 | 12.23 | 0.43 | 0.51 | 0.63 |
| FE2 | 12.08 | 11.99 | 0.55 | 0.55 | 0.59 |
| FE3 | 11.54 | 13.07 | 0.26 | 0.33 | 0.68 |
| FE4 | 11.30 | 10.99 | 0.51 | 0.44 | 0.60 |
| FE5 | 12.42 | 12.53 | 0.42 | 0.57 | 0.63 |
| FE6 | 12.30 | 12.70 | 0.36 | 0.54 | 0.65 |

- **Internal consistency for Content factor (CO)**

The Cronbach's alpha indicated the internal consistency was acceptable for the six items in the Content factor. Based on Table 6.19, item CO2 had an item-total correlation lower than 0.30 (0.28). However, the corresponding value for Cronbach's alpha if that item was deleted (0.70) indicates it will slightly increase, but the total alpha value is sufficient. Therefore, all items were retained.

*Table 6.19 Descriptive statistics for Content factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| CO1 | 10.98 | 11.24 | 0.34 | 0.52 | 0.70 |
| CO2 | 11.74 | 15.58 | 0.28 | 0.38 | 0.70 |
| CO3 | 11.54 | 10.17 | 0.65 | 0.47 | 0.56 |
| CO4 | 11.68 | 13.73 | 0.35 | 0.21 | 0.67 |
| CO5 | 11.58 | 10.41 | 0.77 | 0.70 | 0.54 |
| CO6 | 11.38 | 11.50 | 0.63 | 0.61 | 0.59 |

- **Internal consistency for Accessibility factor (AC)**

The Cronbach's alpha indicated the internal consistency was acceptable for the four items in the AC factor. Based on Table 6.20, item AC4 had an item-total correlation lower than 0.30 (0.22). However, the corresponding value for Cronbach's alpha if that item was deleted (0.66) indicates it will slightly increase, but the total alpha value is sufficient. Therefore, all items were retained.

*Table 6.20 Descriptive statistics for Accessibility factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| AC1 | 6.82 | 5.13 | 0.73 | 0.65 | 0.41 |

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| AC2 | 6.94 | 5.28 | 0.57 | 0.57 | 0.53 |
| AC3 | 6.68 | 6.05 | 0.40 | 0.26 | 0.65 |
| AC4 | 7.82 | 8.27 | 0.22 | 0.03 | 0.66 |

- **Internal consistency for Attitude factor (AT)**

The Cronbach's alpha indicated the internal consistency was excellent for the four items in the Attitude factor. Based on Table 6.21, all items were highly correlated with each other, so all the items were retained.

*Table 6.21 Descriptive statistics for Attitude factor*

| Factor | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Squared multiple correlate | Cronbach's alpha if item deleted |
|---|---|---|---|---|---|
| AT1 | 6.86 | 12.61 | 0.78 | 0.73 | 0.91 |
| AT2 | 6.68 | 10.42 | 0.91 | 0.85 | 0.87 |
| AT3 | 6.42 | 10.57 | 0.78 | 0.72 | 0.92 |
| AT4 | 6.86 | 12.49 | 0.86 | 0.80 | 0.89 |

## 6.4 Summary

This chapter addressed the research questionnaire through three steps to ensure its validity and reliability. The first step was the validation study; the questionnaire had 57 items within eight factors at this juncture. Seven experts were chosen to review the items against the criterion of essentiality. The result of their ratings was applied to the CVR formula. This resulted in the pool of 57 being reduced to 36 items, which had an acceptable CVR value. The agreements between experts were tested statistically and showed that the items are statistically significant. The significant items were then pre-test performed with six Arabic researchers to check the grammar was clear and understandable, as was the response format, questionnaire size and layout; there were some changes made to correct spelling and typographical errors. Cronbach's alpha value showed that the questionnaire has an excellent reliability, with a score of 0.90. The questionnaire was written in Arabic and the English version is also presented for the purpose of the study. The final version of the questionnaire (Arabic and English) is presented in Appendix B.5.

# Chapter 7 Result of the Investigation Study

The questionnaire designed in Chapter 6 was distributed in a larger scale study. The population of the study are students at Saudi Arabian universities, as shown in Section 4.6.2. This chapter investigates which factors will strongly influence students' attitude towards using summative e-assessment, by undertaking factor analysis and multiple linear regression. As presented in Section 4.3.4, factor analysis was conducted to further understand the dimensions and meanings of the items in the questionnaire, and summarises the relationships between data and groups of these items. It is also employed to reduce large sets of items into smaller sets of underlying components, called *factors*. Following the results obtained through factor analysis, multiple linear regression (MLR) was conducted, as shown in Section 4.3.5, in order to answer SRQ2 in Section 1.4, to investigate which factors will strongly influence students' attitude towards summative e-assessment in Saudi Arabian universities. The questionnaire analysis is presented in Section 7.1, followed by the results of factor analysis in Section 7.2. The multiple linear regression results are discussed in Section 7.3, and the analysis of difference in perspectives from the demographics in Section 7.4. Analysis of the open-ended questions is given in Section 7.5. Finally, discussion of the findings is presented.

## 7.1 Questionnaire Analysis

As discussed in Section 4.6.2, 328 students at Saudi Arabian universities participated in this study. Data missing from the data collected data are first addressed. The remainder presents the results of the questionnaire, including demographic data, and its internal reliability by using SPSS software.

### 7.1.1 Missing Data

One of the concerns in any study applying a questionnaire is missing data. The questionnaire was designed carefully to answer all the questions and to exclude missing values. There were no missing data in the submission of the main questionnaire. 328 valid completed questionnaires remained for further analysis.

### 7.1.2 Demographic Data Analysis

The demographic information from the respondents is shown in Table 7.1. This profile can help in interpreting the results of the quantitative analysis, particularly the unexpected results.

*Table 7.1 Demographics of the investigation questionnaire*

| Variable | Group | Number | % |
|---|---|---|---|
| **University** | King Abdulaziz University | 125 | 38.1 |
| | Imam Abdurrahman Bin Faisal University | 99 | 30.2 |
| | Saudi Electronic University | 104 | 31.7 |
| **Discipline** | Natural Science (NS) | 173 | 52.7 |
| | Social Science (SS) | 155 | 47.3 |
| **Gender** | Male | 160 | 48.8 |
| | Female | 168 | 51.2 |
| **Experience** | Used | 328 | 100 |
| | Not used | 0 | 0 |

### 7.1.3 Reliability Analysis

As mentioned in Section 4.2.3/B, reliability was measured by applying Cronbach's alpha through SPSS software to assess inter-item correlation and item-to-total correlation values for 36 items. The overall Cronbach alpha value was 0.94, which demonstrated excellent internal consistency of the items. The Cronbach's alpha values for each factor are shown in Table 7.2 and range between 0.60 (acceptable) and 0.90 (excellent). The Cronbach's alpha for Attitude was 0.92, which indicates excellent. The factors Perceived Usefulness, Perceived Ease of Use and Self-Efficacy were above 0.80, which indicates good internal consistency of items, while the factors Facilitating of Examination, Content, Social Influence and Accessibility ranged between 0.60 and 0.70, which indicates acceptable internal consistency. The descriptive statistics for each factor are presented in Appendix C.2.

*Table 7.2 Reliability result for the factors*

| Factor | Items | Cronbach's alpha | Reliability result |
|---|---|---|---|
| Perceived Usefulness | 4 | 0.88 | Good |
| Perceived Ease of Use | 4 | 0.80 | Good |
| Self-Efficacy | 4 | 0.85 | Good |
| Social Influence | 4 | 0.64 | Acceptable |
| Facilitating of Examination | 6 | 0.73 | Acceptable |
| Content | 6 | 0.75 | Acceptable |
| Accessibility | 4 | 0.67 | Acceptable |
| Attitude | 4 | 0.92 | Excellent |

## 7.2 Result of Factor Analysis

This section presents the results of the factor analysis, including assessment for suitability of data in Section 7.2.1, data screening in Section 7.2.2, factor extraction in Section 7.2.3, factor rotation in Section 7.2.4 and interpretation of factors in Section 7.2.5.

### 7.2.1 Initial Considerations: Assessment for Suitability of Data

The suitability and appropriateness of conducting factor analysis on the data must first be checked. Two main issues must be considered when determining the suitability of the data, the sample size and the strength of the relationships among the items, using the Kaiser-Meyer-Olkin (KMO) measure. These are discussed below.

**A. Sample Size**

The reliability of factor analysis depends on the sample size. As discussed in Section 4.3.4 and Section 4.6.1, the most common guideline for applying sample size in factor analysis depends on the number of items (MacCallum et al., 1999). Between five and 10 participants are recommended per item (Devellis, 2003; Kass & Tinsley, 1979; ). In this work, the sample size was 328, which is considered sufficient to run the factor analysis.

**B. Strength of Relationships between the Items**

The Kaiser-Meyer-Olkin (KMO) measure was used to verify the sampling adequacy and ranged from 0 to 1 (Kaiser, 1970). Values between 0.50 and 0.70 are mediocre, values between 0.70 and 0.80 are good, values between 0.80 and 0.90 are great, and values above 0.90 are superb (Kaiser, 1970). The result of the KMO was 0.93 and the Bartlett test of sphericity was significant ($p$ <0.001), as shown in Table 7.3. This rated the correlation as superb for performing factor analysis.

*Table 7.3 KMO measure and Bartlett's test result*

| **KMO and Bartlett's test** | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.93 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 7141.60 |
| | df | 53 |
| | *p* | < 0.001 |

### 7.2.2 Data Screening: Correlations between Items

A further step must be applied before proceeding with factor analysis. The data need to be checked to establish whether they contain any items that should be excluded from the analysis. This is carried out by looking into Item-total statistics which provides correlations between Items. Factor

analysis should not be conducted with items that correlate very highly with other items (Field, 2013). In this situation, it is important for looking into inter items correlation matrix which provides inter-correlations between items. As presented in Appendix C.2, items CO2 and FE3 were not correlated strongly with other items and also had low reliability. The descriptive reliability result in Appendix C.2 showed that item CO2 should be removed because it had low correlation with other items $r = 0.09$. The reliability result for item CO2 showed that deleting this would improve the reliability of the Content factor. Based on the Cronbach's alpha, removal of CO2 would improve the overall reliability of this factor. This factor had six indicative items, and removing one would not affect the validity of the content being measured. Item FE3 was also removed because it had low correlation with other items $r = 0.08$. The reliability result for item FE3 showed that deleting this would improve the reliability of the Facilitating of Examination factor. However, if FE3 were deleted, the reliability result would also increase if FE4 were deleted. Both FE3 and FE4 measure the Facilitating of Examination factor, which has six indicative items. The items also refer to the same metric as FE5 and FE6, whose removal would not affect the concept being measured. The reliability test was run again after removal of CO2, FE3 and FE4, which showed excellent overall Cronbach's alpha value. The descriptive statistics for 33 items (after the three items) are given in Appendix C.3.

### 7.2.3 Factor Extraction: Summarising Items

After the three items were removed as discussed in Section 7.2.2, the factor analysis was run with 33 items. This section provides the results of the factor extraction which is performed as one of the steps in factor analysis. In factor analysis, "factor extraction" involves determining the smallest number of factors that can best represent the interrelations among the sets of items. As discussed in Section 4.3.4, principal component analysis (PCA) was applied here. The results of factors extraction are presented in Table 7.4.

*Table 7.4 Items code and extraction*

| | Initial | Extraction |
|---|---|---|
| PU1 | 1 | 0.69 |
| PU2 | 1 | 0.71 |
| PU3 | 1 | 0.71 |
| PU4 | 1 | 0.68 |
| PEU1 | 1 | 0.68 |
| PEU2 | 1 | 0.72 |
| PEU3 | 1 | 0.56 |
| PEU4 | 1 | 0.55 |
| SE1 | 1 | 0.71 |
| SE2 | 1 | 0.70 |
| SE3 | 1 | 0.70 |

| | Initial | Extraction |
|---|---|---|
| SE4 | 1 | 0.61 |
| SI1 | 1 | 0.52 |
| SI2 | 1 | 0.63 |
| SI3 | 1 | 0.59 |
| SI4 | 1 | 0.55 |
| FEI | 1 | 0.56 |
| FE2 | 1 | 0.65 |
| FE5 | 1 | 0.84 |
| FE6 | 1 | 0.80 |
| CO1 | 1 | 0.66 |
| CO3 | 1 | 0.59 |
| CO4 | 1 | 0.67 |
| CO5 | 1 | 0.55 |
| CO6 | 1 | 0.60 |
| AC1 | 1 | 0.66 |
| AC2 | 1 | 0.79 |
| AC3 | 1 | 0.53 |
| AC4 | 1 | 0.53 |
| AT1 | 1 | 0.76 |
| AT2 | 1 | 0.75 |
| AT3 | 1 | 0.73 |
| AT4 | 1 | 0.73 |
| Extraction Method: PCA | | |

In order to determine how many factors were extracted, eigenvalues (or Kaiser's criterion) and scree plot were produced (Tabachnick & Fidell, 2007). The former will extract and retain the factors that have eigenvalues greater than 1 for further investigation. The eigenvalue of a factor represents the amount of the total variance explained by that factor. Table 7.5 summarises the factors that have eigenvalues greater than one (Factors 1 to 6). The eigenvalues total column shows the eigenvalue for each factor. The eigenvalues % of variance column shows how much variance each factor explains, while the eigenvalues cumulative % column shows the amount of variance accounted for by all previous factors added together. The 6 factors explained 64.64 % of the total variance.

*Table 7.5 Eigenvalues and total variance explained*

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| **Factor** | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 12.50 | 37.89 | 37.89 | 12.50 | 37.89 | 37.89 |
| 2 | 2.95 | 8.95 | 46.83 | 2.95 | 8.95 | 46.83 |
| 3 | 2.30 | 6.97 | 53.81 | 2.30 | 6.97 | 53.81 |
| 4 | 1.37 | 4.14 | 57.94 | 1.37 | 4.14 | 57.94 |
| 5 | 1.17 | 3.54 | 61.48 | 1.17 | 3.54 | 61.48 |
| **6** | **1.04** | **3.15** | **64.64** | **1.04** | **3.15** | **64.64** |
| 7 | 0.91 | 2.74 | 67.38 | | | |
| 8 | 0.86 | 2.61 | 69.99 | | | |
| 9 | 0.79 | 2.39 | 72.38 | | | |
| 10 | 0.76 | 2.31 | 74.69 | | | |

| Factor | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 11 | 0.67 | 2.04 | 76.73 | | | |
| 12 | 0.64 | 1.94 | 78.67 | | | |
| 13 | 0.61 | 1.85 | 80.52 | | | |
| 14 | 0.57 | 1.72 | 82.24 | | | |
| 15 | 0.50 | 1.51 | 83.75 | | | |
| 16 | 0.49 | 1.48 | 85.22 | | | |
| 17 | 0.48 | 1.46 | 86.68 | | | |
| 18 | 0.42 | 1.26 | 87.95 | | | |
| 19 | 0.41 | 1.24 | 89.18 | | | |
| 20 | 0.39 | 1.17 | 90.36 | | | |
| 21 | 0.36 | 1.09 | 91.45 | | | |
| 22 | 0.35 | 1.05 | 92.50 | | | |
| 23 | 0.33 | 1.01 | 93.51 | | | |
| 24 | 0.30 | 0.92 | 94.43 | | | |
| 25 | 0.28 | 0.86 | 95.29 | | | |
| 26 | 0.27 | 0.83 | 96.12 | | | |
| 27 | 0.25 | 0.76 | 96.87 | | | |
| 28 | 0.23 | 0.69 | 97.57 | | | |
| 29 | 0.21 | 0.64 | 98.20 | | | |
| 30 | 0.19 | 0.56 | 98.77 | | | |
| 31 | 0.17 | 0.51 | 99.28 | | | |
| 32 | 0.13 | 0.40 | 99.67 | | | |
| 33 | 0.11 | 0.33 | 100.00 | | | |

There is a second method used to define the number of factors to be extracted from the final solution is the scree plot. The point at which the curve changes direction and becomes horizontal is observed. The scree plot suggests retaining only factors or (components) above this point (point at which the curve changes direction). The point at which the curve changes direction and becomes horizontal suggests the number of factors extracted. By looking at the scree plot in Figure 7.1, at point four, the curve clearly starts to change its direction to the horizontal; therefore, the scree plot suggests retaining at least factors or (components) 1 to 4. Accordingly, referring to both the eigenvalues and the scree plot, the factor analysis has a range from 1 to 4 (using the scree plot), and 1 to 6 (using the eigenvalue) factors that can be considered for further investigation. The Kaiser's criterion was followed, by looking at the eigenvalues greater than one, in Table 7.5 above. Thus, these six factors will be retained because they are considered meaningful as they keep most of the information from the data, because having eigenvalues greater than one is enough to explain the variance of the factors (Field, 2013).

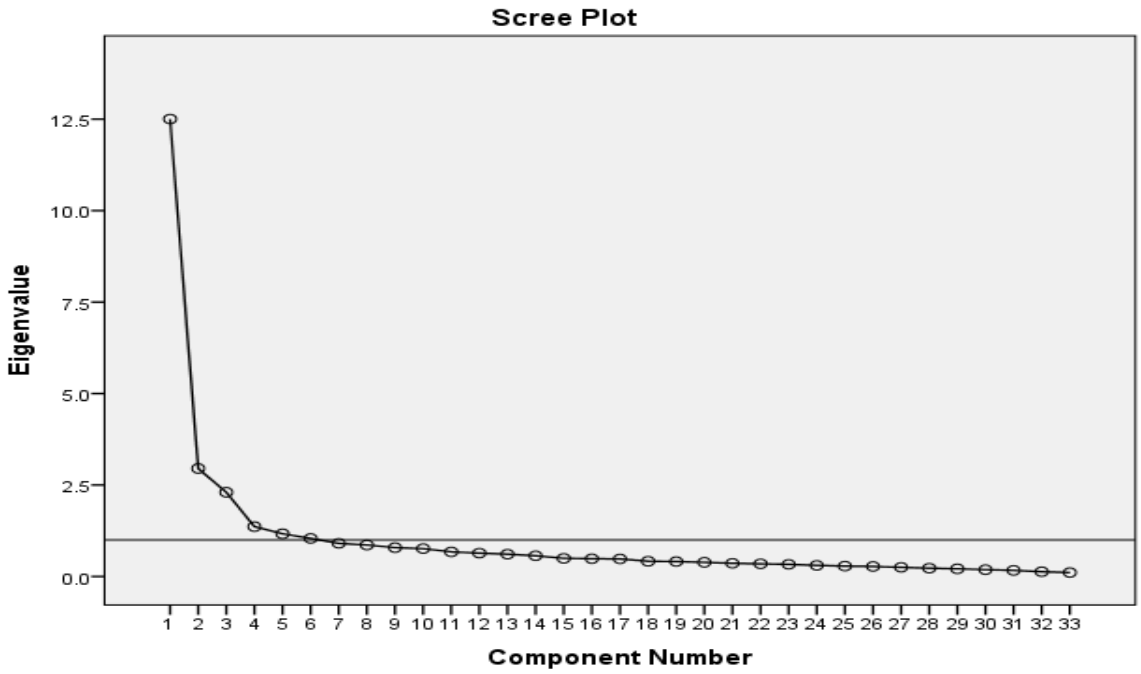


*Figure 7.1 Factor analysis scree plot*

### 7.2.4 Factor Rotation

After deciding the number of factors to be retained, the next step is to interpret the Items that are loaded in those factors (or components) by applying factor rotation. For this purpose, the factors are "rotated". Rotation provides a method for interpretation and, from here, the interpretability of the factors can be improved. The "loading" represents the value of correlation of that item to the related factor. After the rotation, the loadings of the items are maximised onto one factor and minimised on the remaining factor. This process allows clear identification of the items' clustering and their associated factors. As mentioned in Section 4.3.4, there are two techniques used for rotating factors, orthogonal (varimax) and oblique (oblimin). To see which rotation technique was most appropriate for the data, both techniques were initially performed (Pallant, 2013). This work assumes a correlation between the factors and attitude, but orthogonal rotation assumes that the factors are uncorrelated and unrelated, so it was not applied here. From the factor rotation, correlation of the factors (or components) was obtained, as shown in the correlation matrix Table 7.6 (minimum $r = 0.26$ and maximum $r = 0.49$). Although the correlations are considered medium, as presented in Section 4.3.2, this result provided information that the factors (or components) cannot be assumed to be independent, since the correlation matrix indicated that the factors were partially related.

*Table 7.6 Correlation Matrix*

| Component/ Factor | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **1** | 1 | 0.32 | 0.49 | 0.39 | 0.27 | 0.45 |
| **2** | | 1 | 0.26 | 0.27 | 0.44 | 0.23 |
| **3** | | | 1 | 0.34 | 0.31 | 0.37 |
| **4** | | | | 1 | 0.27 | 0.32 |
| **5** | | | | | 1 | 0.26 |
| **6** | | | | | | 1 |
| Extraction Method: Principal Component Analysis.<br>Rotation Method: Oblimin with Kaiser Normalisation. | | | | | | |

In oblique rotation, the pattern matrix contains the factor loadings after the rotation in Table 7.7. Table 7.7 presents the factor loadings using oblique rotation for the six factors (or components) and their related items. For a sample size of 200 and above, a loading 0.30 or above is rated as acceptable (Tabachnick & Fidell, 2007). All the factors had loadings values of 0.30 and above. However, the SPSS was programmed to display only loadings greater than 0.30 in order to make interpretation simpler (Tabachnick & Fidell, 2007). Some loadings are left blank in the pattern matrix as they are below 0.30.

*Table 7.7 Pattern Matrix*

| | Component/ Factor | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **PU1** | | | | | | 0.66 |
| **PU2** | | | | | | 0.71 |
| **PU3** | | | | | | 0.74 |
| **PU4** | | | | | | 0.54 |
| **PEU1** | | | 0.75 | | | |
| **PEU2** | | | 0.83 | | | |
| **PEU3** | | | 0.59 | | | |
| **PEU4** | | | 0.55 | | | |
| **SE1** | | | 0.80 | | | |
| **SE2** | | | 0.79 | | | |
| **SE3** | | | 0.78 | | | |
| **SE4** | | | 0.77 | | | |
| **SI1** | | 0.49 | | | | |
| **SI2** | | 0.77 | | | | |
| **SI3** | | 0.65 | | | | |
| **SI4** | | 0.44 | | | | |
| **FEI** | | 0.71 | | | | |
| **FE2** | | 0.77 | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **FE5** | | 0.31 | | | | |
| **FE6** | | 0.33 | | | | |
| **CO1** | | | | 0.34 | | |
| **CO3** | | | | 0.46 | | |
| **CO4** | | | | 0.81 | | |
| **CO5** | | | | 0.64 | | |
| **CO6** | | | | 0.58 | | |
| **AC1** | | | | | 0.63 | |
| **AC2** | | | | | 0.59 | |
| **AC3** | | | | | 0.68 | |
| **AC4** | | | | | 0.44 | |
| **AT1** | 0.80 | | | | | |
| **AT2** | 0.83 | | | | | |
| **AT3** | 0.86 | | | | | |
| **AT4** | 0.76 | | | | | |
| Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalisation. | | | | | | |

While the structure matrix describes the relationship between the items and the factors as presented in Table 7.8.

*Table 7.8 Structure Matrix*

| | Component/ Factor | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **PU1** | 0.47 | | 0.48 | | | 0.77 |
| **PU2** | 0.49 | | 0.38 | | | 0.74 |
| **PU3** | 0.35 | | 0.38 | 0.34 | | 0.78 |
| **PU4** | 0.47 | | 0.39 | | | 0.62 |
| **PEU1** | 0.32 | | 0.83 | | | 0.48 |
| **PEU2** | 0.39 | | 0.87 | | | 0.33 |
| **PEU3** | 0.35 | | 0.62 | | | 0.34 |
| **PEU4** | 0.34 | 0.35 | 0.64 | | | |
| **SE1** | 0.32 | | 0.85 | 0.34 | | 0.31 |
| **SE2** | 0.32 | | 0.82 | | | |
| **SE3** | 0.48 | | 0.87 | 0.31 | | |
| **SE4** | | | 0.84 | | | |
| **SI1** | 0.48 | 0.45 | | | | |
| **SI2** | | 0.70 | | | 0.44 | |
| **SI3** | | 0.57 | | | 0.39 | 0.31 |
| **SI4** | | 0.33 | | 0.36 | 0.35 | 0.43 |
| **FEI** | | 0.67 | | | 0.32 | |
| **FE2** | | 0.67 | | | 0.42 | |
| **FE5** | | | | | 0.34 | |
| **FE6** | | | | | 0.30 | |

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **CO1** | 0.33 | | 0.39 | | | 0.33 |
| **CO3** | 0.41 | | 0.41 | | | 0.43 |
| **CO4** | | | | 0.42 | | |
| **CO5** | | | | 0.41 | | 0.48 |
| **CO6** | 0.41 | 0.34 | 0.33 | 0.40 | | 0.39 |
| **AC1** | 0.32 | | 0.41 | 0.35 | | |
| **AC2** | 0.34 | | 0.39 | 0.31 | | |
| **AC3** | | 0.46 | | | 0.40 | |
| **AC4** | | | 0.42 | 0.41 | | |
| **AT1** | 0.84 | | 0.50 | 0.50 | | 0.43 |
| **AT2** | 0.86 | | 0.40 | 0.43 | | 0.43 |
| **AT3** | 0.88 | | 0.43 | | | 0.32 |
| **AT4** | 0.80 | | 0.33 | 0.44 | | 0.39 |
| Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalisation. | | | | | | |

### 7.2.5 Interpretation of Factors and the Related Items

Rotation helped provide ways to understand and interpret the factors. The pattern matrix (Table 7.7) contains the factor loadings after rotation. The items that load onto the factors (from the pattern matrix) were checked for their common themes to interpret the items relating to that factor. The factors were clustered according to the questionnaire responses. The analysis of 33 items was clustered into six factors (or components), when developing a scale to weight the characteristics being combined. Each component represented a scale based on the empirical relationships among the characteristics. As additional findings, the factor analysis gave the weights to be employed for each characteristic when combining them into scales. The factor score results are actually such scales, developed by summing characteristics times these weights. SPSS does not insert the labelling or meaning for each factor; it only shows the grouping or clustering of the items. It is up to the researcher to understand the content of the loadings and their themes based on the research objectives. Although the items are initially grouped accordingly in the questionnaire, when they are clustered in the factor analysis there is still a need to interpret the meaning. Pattern matrix is the preferred matrix used by most researchers when interpreting an oblique solution, while the structure matrix provides relationship for the items; however, the study will interpret and discuss the meaning of the factors from the pattern matrix because it contains information about the unique contribution of an item to a factor (Field, 2013). In Table 7.7, six factors have been extracted; four factors retained the same items as before, which were Perceived Usefulness, Content,

Accessibility and Attitude. However, two factors combined different items, but shared similar meanings. The meanings of the components loaded on the factors are discussed below.

**Factor 1:** It contained loadings related to the attitude towards summative e-assessment. It was based on four items (see Table 7.9). This factor looked into how students thought about the decision of using/implementing e-assessment in their course and replacing paper-based exams. This factor remains with the same name and code as before, Attitude (AT).

*Table 7.9 Items measuring Attitude factor and their loading*

| Item | Label | Loadings |
|---|---|---|
| I consider the decision to use e-assessment is a positive one | AT1 | 0.80 |
| I would like to see e-assessment implemented further in departmental modules | AT2 | 0.83 |
| I would like e-assessment to replace paper-based exams at my university | AT3 | 0.86 |
| In general, I was a positive towards using the e-assessment system | AT3 | 0.76 |

**Factor 2:** It showed the importance of university environment on students' attitude towards using summative e-assessment. It was loaded with eight items (see Table 7.10). This component also included all Social Influence factors, SI1, SI2, SI3, SI4, which looked for the importance of social enviroment, such as friends' opinion, IT support, teachers and university support. And the items, FE1, FE2, FE5 and FE6, belonged to Facilitating of the Examination which looked for the importance of university enviroment such as training befor exam, support during exam and university infrastructure including hardware, software and network. These loadings are best described as University Environment (UEN).

*Table 7.10 Items measuring University Environment factor and their loadings*

| Item | Label | Loadings |
|---|---|---|
| The opinion of my friends about e-assessment is important to me | SI1 | 0.49 |
| The IT support at my university is helpful in the use of e-assessment | SI2 | 0.77 |
| My teacher is very supportive of the use of e-assessment at my university | SI3 | 0.65 |
| In general, my university supports the use of e-assessment | SI4 | 0.44 |
| When I need help during the e-assessment exam, someone is there to help me | FE1 | 0.71 |
| Support staff are available to help me at any time I use e-assessment | FE2 | 0.77 |
| I usually need assistance when using e-assessment for the first time | FE5 | 0.31 |
| Overall, the e-assessment environment infrastructure at my university is efficient | FE6 | 0.33 |

**Factor 3:** This component was loaded with eight items. It included all the items of Perceived Ease of Use factor, PEU1, PEU2, PEU3, PEU4, and all the items of Self-Efficacy factor, SE1, SE2, SE3, SE4 (see Table 7.11). All these items are used to indicate how easy it is to use the e-assessment system and the capability of using a computer in exam influences students' attitude towards summative e-assessment. It is best described as Perceived Ability of Use (PAU).

*Table 7.11 Items measuring Perceived Ability of Use factor and their loadings*

| Item | Label | Loadings |
|---|---|---|
| Learning to use the e-assessment system would be easy for me | PEU1 | 0.75 |
| The e-assessment system is easy to use | PEU2 | 0.83 |
| I find taking e-assessment is easier than a paper-based exam | PEU3 | 0.59 |
| Interacting with the e-assessment system does not require a lot of mental effort from me | PEU4 | 0.55 |
| I am able to use the e-assessment system | SE1 | 0.80 |
| I could use the e-assessment system even if I had no prior experience on similar systems | SE2 | 0.79 |
| I do not need advanced skills when I use the e-assessment system | SE3 | 0.78 |
| I can use the e-assessment system without any assistance | SE4 | 0.77 |

**Factor 4:** It had five loadings representing the importance of the content of the course, question and feedback on influencing students' attitude towards summative e-assessment. This factor was loaded with eight items, CO1, CO3, CO4, CO5, and CO6 (see Table 7.12). This factor remains with the same name and code as before, Content (CO).

*Table 7.12 Items measuring Content factor and their loadings*

| Item | Label | Loadings |
|---|---|---|
| I think e-assessment is appropriate for all subjects | CO1 | 0.34 |
| I find the feedback I have received from e-assessment is sufficient | CO3 | 0.46 |
| E-assessment needs to include a variety of question types in order to test my knowledge fully | CO4 | 0.81 |
| I find e-assessment questions are useful for my course | CO5 | 0.64 |
| The content of feedback during e-assessment would improve my learning | CO6 | 0.58 |

**Factor 5:** It had four loadings representing the importance of Accessibility in students' attitude towards summative e-assessment (see Table 7.13). All these items, AC1, AC2, AC3, AC4, are used to indicate the importance of Accessibility of e-assessment. This factor remains with the same name and code as before, Accessibility (AC).

*Table 7.13 Items measuring Accessibility factor and their loadings*

| Item | Label | Loadings |
|---|---|---|
| I think e-assessment is appropriate for all students | AC1 | 0.63 |
| I believe e-assessment is more accessible than a paper-based exam | AC2 | 0.59 |
| My university provides assistive technology such as screen readers for students with special needs to help them take e-assessment | AC3 | 0.68 |
| Text-sizing and contrast controls within assessments are important to aid participants with low/partial vision | AC4 | 0.44 |

**Factor 6:** In the last component, the four loadings described the importance of Perceived Usefulness on students' attitude towards summative e-assessment (see Table 7.14). This factor looked into how students thought about the usefulness of e-assessment on their course, if it helped improve

their learning, the benefit of feedback in the e-assessment system, and how e-assessment was more useful than paper and pencil testing. This factor remains with the same name and code as before, Perceived Usefulness (PU).

*Table 7.14 Items measuring Perceived Usefulness factor and their loadings*

| Item | Label | Loadings |
|---|---|---|
| I find using e-assessment is useful on my course | PU1 | 0.66 |
| I believe e-assessment helps improve my learning | PU2 | 0.71 |
| I find e-assessment gives me quick feedback, which helps me in my course | PU3 | 0.74 |
| I think e-assessment is more useful than paper and pencil testing | PU4 | 0.54 |

Table 7.15 summarises the updated factors' names and codes from the factor analysis.

*Table 7.15 The updated factors' names and codes*

| Factor | Code | Description |
|---|---|---|
| Attitude | AT | Includes 4 Items: AT1, AT2, AT3 and AT4. |
| University Environment | UEN | Includes 8 items: SI1, SI2, SI3, SI4, FE1, FE2, FE5 and FE6. |
| Perceived Ability of Use | PAU | Includes 8 items: PEU1, PEU2, PEU3, PEU4, SE1, SE2, SE3 and SE4. |
| Content | CO | Includes 5 items: CO1, CO3, CO4, CO5 and CO6. |
| Accessibility | AC | Includes 4 items: AC1, AC2, AC3 and AC4. |
| Perceived Usefulness | PU | Includes 4 items: PU1, PU2, PU3 and PU4. |

## 7.3 Result of Multiple Linear Regression

As presented in Section 4.3.5, MLR approach was used to investigate factors will strongly affect students' attitude towards summative e-assessment in Saudi Arabian universities. This approach also made it possible to build the model and to evaluate how good a fit it was. Six factors (components) obtained from factor analysis were used in multiple linear regression. The Attitude was the dependent variable, and the independent variables were Perceived Usefulness, Perceived Ability of Use, Content, Accessibility and University Environment. This work uses regression to investigate the effect of the independent variables on dependent variable (attitude). The first step is to determine the line of best fit, which goes through or near as many data points as possible. this is achieved through the method of least squares, which finds the line that produces the least "sum of squared differences" (SS) (Field, 2013). The second stage is assessing how well this line fits the actual data, using a value called $R^2$. This value is calculated by taking the model sum of squares ($SS_M$), which is the difference between the sum of squared differences from the mean and the sum of squared differences from the predicted model line, and dividing it by the sum of squared differences from the mean ($SS_T$), as follows (Field, 2013).

$$R^2 = SS_M/SS_T$$

The value of R obtained indicates the correlation between the two variables, while $R^2$ identifies how much variance the independent variables can account for in the dependent variable (Field, 2013). The last step is calculating the *F*-ratio of the model, which measures how much the model improves the prediction of the dependent variable, when compared to the model's inaccuracy; a more representative model will have a greater value (at least 1, if not more) (Field, 2013). The SPSS output gives the values of Pearson correlation (*r*), multiple coefficient of determination ($R^2$), multiple correlation coefficient (R) and adjusted multiple coefficient of determination (adjusted $R^2$). Table 7.16 to 7.19 present the SPSS output of the regression model process.

*Table 7.16 Pearson correlation between variables*

| | AT | PU | CO | AC | UEN | PAU |
|---|---|---|---|---|---|---|
| **AT** | 1.00 | 0.77** | 0.78** | 0.70** | 0.40** | 0.62** |
| **PU** | | 1.00 | 0.70** | 0.60** | 0.37** | 0.60** |
| **CO** | | | 1.00 | 0.68** | 0.50** | 0.58** |
| **AC** | | | | 1.00 | 0.58** | 0.57** |
| **UEN** | | | | | 1.00 | 0.41** |
| **PAU** | | | | | | 1.00 |
| ** Correlation is significant at the 0.01 level (2-tailed) | | | | | | |

Table 7.16 shows the Pearson correlation matrix. The variables have a significant positive relationship at $p < 0.01$ level. Correlations matrix is determined by using the value of the correlation coefficient (*r*) where value is between number -1 to 1, as discussed in Section 4.3.2. Value of 0 indicates no relationship at all, correlation of value 1 presents the perfect positive relationship and value -1 presents the perfect negative relationship. Attitude factor (AT) is significantly correlated to Perceived Usefulness (PU) $r = 0.77$, Content (CO) $r = 0.78$, Accessibility (AC) $r = 0.70$, Perceived Ability of Use (PAU) $r = 0.64$, and University Environment (UEN) $r = 0.40$. It is calculated by the sum of the item score divided by the number of items. Table 7.17 summarises how the variables relate to Attitude. Comparing all the models, Model 5 is the best fit, because the higher value of $R^2$, the better the model fits the data. The value of $R^2$ for Model 5 is 0.75, which suggests the model is a relatively good variable of the dependent (Attitude). This shows that a 75% change in the response dependent variable (Attitude) occurred because of changes in a combination of the five independent variables CO, PU, AC, PAU, and UEN.

*Table 7.17 Regression model summary*

| Model | R | $R^2$ | Adjusted $R^2$ |
|---|---|---|---|
| 1 | 0.78[1] | 0.60 | 0.60 |
| 2 | 0.84[2] | 0.70 | 0.70 |
| 3 | 0.85[3] | 0.73 | 0.73 |
| 4 | 0.86[4] | 0.74 | 0.73 |
| 5 | 0.86[5] | 0.75 | 0.74 |

| Model | R | $R^2$ | Adjusted $R^2$ |
|---|---|---|---|
| 1. Variables: (Constant), CO<br>2. Variables: (Constant), CO, PU<br>3. Variables: (Constant), CO, PU, AC<br>4. Variables: (Constant), CO, PU, AC, PAU<br>5. Variables: (Constant), CO, PU, AC, PAU, UEN | | | |

Table 7.18 shows the regression ANOVA result. The *F*-test determines whether the model is a good fit for the data. According to the *p*-value result, all five independent variables have a significant effect on the dependent variable (Attitude). This result indicates that Model 5 is a good fit for the data.

*Table 7.18 Regression ANOVA (F-Ratio and Significance Values)*

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | | **Sum of Squares** | **df** | **Mean Square** | ***F*** | ***p*** |
| 1 | Regression | 275.87 | 1 | 275.87 | 616.61 | < 0.001[1] |
| | Residual | 181.65 | 41 | 0.45 | | |
| | Total | 457.52 | 41 | | | |
| 2 | Regression | 320.95 | 2 | 160.47 | 475.88 | < 0.001[2] |
| | Residual | 136.57 | 41 | 0.34 | | |
| | Total | 457.52 | 41 | | | |
| 3 | Regression | 333.99 | 3 | 111.33 | 364.10 | < 0.001[3] |
| | Residual | 123.53 | 40 | 0.31 | | |
| | Total | 457.52 | 41 | | | |
| 4 | Regression | 336.75 | 4 | 84.19 | 280.91 | < 0.001[4] |
| | Residual | 120.77 | 40 | 0.30 | | |
| | Total | 457.52 | 41 | | | |
| 5 | Regression | 339.33 | 5 | 67.87 | 230.83 | < 0.001[5] |
| | Residual | 118.19 | 40 | 0.30 | | |
| | Total | 457.52 | 41 | | | |
| a. Dependent Variable: AT<br>1. Independent variables: (Constant), CO<br>2. Independent variables: (Constant), CO, PU<br>3. Independent variables: (Constant), CO, PU, AC<br>4. Independent variables: (Constant), CO, PU, AC, PAU<br>5. Independent variables: (Constant), CO, PU, AC, PAU, UEN | | | | | | |

Based on Table 7.19, the beta coefficients for each independent variable, CO, PU, AC, PAU and UEN, had a positive effect on dependent variable Attitude. In other words, students' attitude would be expected to increase when CO, PU, AC, PAU and UEN increase. The standardised coefficients for the five independent variables are significant ($p < 0.001$). This means that five independent variables are effect of Attitude, which results in Model 5 being the best model to fit the data.

*Table 7.19 Estimates of coefficients for AT*

| Model | Unstandardised Coefficients | | Standardised Coefficients | *t* | *p* |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | –0.48 | 0.10 | | –4.81 | < 0.001 |
| CO | 0.46 | 0.05 | 0.35 | 8.61 | < 0.001 |
| PU | 0.39 | 0.04 | 0.34 | 8.78 | < 0.001 |
| AC | 0.34 | 0.05 | 0.25 | 6.42 | < 0.001 |
| PAU | 0.18 | 0.05 | 0.11 | 3.32 | < 0.001 |
| UEN | –0.13 | 0.04 | –0.09 | –2.96 | < 0.001 |
| a. Dependent Variable: AT | | | | | |

## 7.4 How Different Perspectives Affected Responses

The demographic data were presented in Section 7.1.2. These were tested by repeated measures of one-way multivariate analysis of variance (MANOVA), as shown in Section 5.2.3. The results are shown in the following tables. Table 7.20 shows how the university affected the responses: King Abdulaziz University (N = 125), Imam Abdurrahman Bin Faisal University (N = 99), and Saudi Electronic University (N = 104). It suggests that there were no statistically significant effects of the university on participants' responses; Wilks' Lambda = 0.94, $F$ (66,29) = 0.59, $p$ = 0.970.

*Table 7.20 How the university affected the responses*

| Multivariate Tests | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| University | Pillai's Trace | 0.06 | 0.59 | 66 | 29 | 0.970 |
| | Wilks' Lambda | 0.94 | 0.59 | 66 | 29 | 0.970 |
| | Hotelling's Trace | 0.06 | 0.59 | 66 | 29 | 0.970 |
| | Roy's Largest Root | 0.06 | 0.59 | 33 | 29 | 0.970 |

Table 7.21 shows how the discipline affected the responses: Natural Science (N = 173) and Social Science (N = 155). It suggests that there was no statistically significant effect of the discipline on the participants' responses; Wilks' Lambda = 0.94, $F$ (33,29) = 0.55, $p$ = 0.980.

*Table 7.21 How the discipline affected the responses*

| Multivariate Tests | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Discipline | Pillai's Trace | 0.06 | 0.55 | 33 | 29 | 0.980 |
| | Wilks' Lambda | 0.94 | 0.55 | 33 | 29 | 0.980 |
| | Hotelling's Trace | 0.06 | 0.55 | 33 | 29 | 0.980 |
| | Roy's Largest Root | 0.06 | 0.55 | 33 | 29 | 0.980 |

Table 7.22 shows how gender affected the responses: male (N = 160) and female (N = 168). It suggests that there was no statistically significant effect of the gender on the participants' responses; Wilks' Lambda = 0.94, $F$ (33,29) = 0.56, $p$ = 0.978.

*Table 7.22 How the gender affected the responses*

| **Multivariate Tests** | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Gender | Pillai's Trace | 0.06 | 0.56 | 33 | 29 | 0.978 |
| | Wilks' Lambda | 0.94 | 0.56 | 33 | 29 | 0.978 |
| | Hotelling's Trace | 0.06 | 0.56 | 33 | 29 | 0.978 |
| | Roy's Largest Root | 0.06 | 0.56 | 33 | 29 | 0.978 |

A full description of the statistical analysis can be found in Appendix C.4.

## 7.5 Result of Qualitative Open-ended Questions

The final part of the questionnaire was optional and asked students for additional comments about the use of summative e-assessment at their universities. It is individual opinions, which intend to hear about their sound of the strength, and weakness of applying E-assessment in their course. Thirty-two participants left comments in Arabic about their experiences. In presenting the findings below, alphabetical and numeral codes are used instead of participants. The letter (P) refers to the participant where the number represents the participant's ID when answering the questionnaire (1 to 328). A manual thematic analysis approach was applied to analyse the open question, as shown in Section 4.3.1. The English transcripts were later encoded and analysed to produce the findings on the five themes.

**Attitude theme.** Students preferred to use a computer in their exam. One stated that *'I would prefer to take the exam on computer*' (P.28) and '*I found the e-exam is reducing the exam anxiety'* (P.129). Another wrote **'***I like e-exams more than paper-based testing'* (P.33). Some commented about their interest in this research; they preferred using e-exams, especially for typing (P.154, 188, 210, 306, 322). In general, students showed a positive attitude towards summative e-assessment (P.43, 87, 91, 92, 185, 204, 316, 333).

**Perceived Usefulness theme.** Students said that they would like to use a computer in the examination if that had benefits for their learning outcomes. Students would like e-assessment if this would be useful for their course (P.74, 87, 301, 307, 324). They mentioned that they would like e-assessment if they found it would add value to their learning. '*The teacher should apply an e-exam if that would support the overall purpose of the study'* (P.70). '*I think an e-exam would help improve the learning outcome in some courses'* (P.13). '*e-assessment improves the quality of learning at my university'* (P.50).

**Perceived Ability of Use theme**. Students believed that they were able to use e-assessment, as some mentioned that they feel confident in using a computer. This was expressed in the following

ways: '*I found e-assessment helps improve the IT skills for students'* (P.118), '*As we are using computers every day, I would not find any problem in using a computer in the exam'* (P.30), '*e-assessment does not need advanced IT skill'* (P.76).

**University Environment theme.** Students commented about the importance of having support from teachers. P.4, 60, 95 mentioned that some teachers are not available in of the event technical issues happen during e-assessment, which affects the overall result. Others mentioned that they would like an e-exam more than paper-based testing, if IT staff were available (P.44, 122, 167). P.54 said that '*There should be enough awareness from universities before applying e-assessment.'* Students found some issues could have inhibited the acceptance of e-assessment. They mentioned that problems in the network made them worried, and expressed their feelings: '*It is very important to make sure the network is running correctly before the exam'* (P.6), '*Sometimes, when the pages in the e-exam system are heavy and do not open fast, the teachers should give us extra time'* (P.97). In addition, students felt worried about sudden shut downs and slowing of the network. '*Electronic tests are good at improving the level of study, but in the event of computer failure or lack of a strong network performance, we face difficulty, and some teachers do not understand the situation'* (P.65). Some students found the technical issues made them less comfortable in the examination: '*I like taking exams by computer; however, I do not really like the slowness of the network'* (P.112). '*My experience in electronic testing was negative, due to problems with the network'* (P.11). '*I found the e-exam is good idea, if there are no technical issues*.'

**Content theme.** E-assessment should be compatible with subjects. Some students commented that some courses are not suitable for e-assessment, maths for example. They would prefer it to be applied in some courses than others. '*I think e-assessment can be applied in all courses except for some courses that involve writing formally. In these courses, paper-based exams would be much more useful*' (P.62), '*I would say the e-assessment in much more suitable in some courses that others'* (P.40). '*It is much better with a theoretical course'* (P.3), and '*I don't like to take* e-*assessment in the course that needs equations and calculations; I would prefer paper testing'* (P.98). Students also preferred a specific way to deliver e-assessment, '*I found e-assessment is suitable for quizzes'* (P.120) and '*I would prefer the e-assessment in the form of multiple choice'* (P.25). Students were also concerned about the feedback in e-assessment, '*I hope we can get the result at the end of an e-exam'* (P.87, 94, 166). P.130 wrote **'***It would be useful for the course if we could receive immediate feedback*' *and* P.310 stated that '*A feedback feature would make e-assessment worth applying*.' (P.120)

## 7.6 Discussion of the Findings

Factor analysis on 33 items has been conducted. Following the eigenvalue rules, six factors have been extracted (Section 7.2). Four of the factors retained the same items as before (17 in total), which were Perceived Usefulness(PU), Content(CO), Accessibility(AC) and Attitude(AT). 16 items remained. Eight of the items were loaded in one factor which covers the importance of university and social environment on students' attitude towards using summative e-assessment, this factor was name as University Environment (UEN). The remaining eight items indicate the ease of use of the e-assessment system and the capability of students to use a computer in an exam situation, this factor was named as Perceived Ability of Use (PAU). A multiple linear regression was carried out to investigate whether the five factors (UEN, PAU, CO, AC and PU) could statistically significantly influence the Attitude (AT) (section 7.3). Five models were built, and a comparison of the models showed that Model 5 was a better fit to the data than the others with a value of R-squared = 0.75 (Table 7.17). Model 5 showed that all five variables obtained from the factor analysis were selected. It showed that 75% of the change in the response-dependent variable (Attitude) was due to changes in the combination of the five independent variables, CO, PU, AC, PAU and UEN. This confirms that CO, PU, AC, PAU and UEN influence students' attitude towards e-assessment, respectively.

Content (CO) is the major variable influencing students' attitude with a beta weight value of 0.35. This variable focuses on the importance of the compatibility of e-assessment with the subjects. The Content is concerned with whether the system provides sufficient, useful content and fits a learner's needs (Sun, Tsai, Finger, Chen, & Yeh, 2008; Wang, 2003). This result supported the findings of the confirmatory study (see chapter 5) where both experts and students agreed that Content was important for students' attitude. It was also expected based on the findings of the open questions (see section 7.5), some students observed that there are some courses not suitable for e-assessment. They would prefer e-assessment to be applied in some courses but not all. The result is aligned to the reviewed empirical studies (Davies, 2001; Nicol, 2007; Terzis & Economides, 2011) who argue that content is an important factor that impacts students' behavioural intention to use e-assessment. Further, (Howard, 1987; Iahad, Dafoulas, Kalaitzakis, & Macaulay, 2004; Ypsilandis, 2002) argue that the content of the feedback should be clear, fair, balanced and relevant to the assessment to be accepted by learners. The findings have significant implications for universities in Saudi Arabia. A university should think about how far applying e-assessment would be suitable for the type of course and students.

The second important variable from the regression analysis affecting students is Perceived Usefulness (PU) with a beta weight value 0.34. This variable looks at how students perceive the usefulness of e-assessment to their course, how it helps improve their learning, the benefit of

feedback in the e-assessment system, and how e-assessment is more useful than paper and pencil testing. This finding is in alignment with the findings of some of the earlier studies reviewed. It has been agreed that there is a strong effect by perceived usefulness on behavioural intentions to accept an e-assessment system in (Alkiş, 2010; Imtiaz & Maarop, 2014; Schneberger et al., 2007; Terzis & Economides, 2011). This finding is in alignment with the findings of the confirmatory study (see chapter 5) where was no doubt among any of the experts that the Perceive Usefulness of an e-assessment is an important factor which affects students' attitude towards e-assessment. In the discussion in open questions (see section 7.5), some students observed that they would like summative e-assessment if they found it would add value to their learning and have benefits for their learning outcomes. They found the feedback feature would make e-assessment worth applying. Accordingly, students are more likely to accept e-assessment that meet their expectations. This finding has significant implications for universities in Saudi Arabia. The result implores universities to think about how applying e-assessment to a course would help students in their learning. This information can be used to inform educators to apply e-assessment in a way that supports students' learning.

The third important variable affecting students is Accessibility (AC) with a beta weight value of 0.25. It indicates the importance of Accessibility in students' attitudes towards e-assessment. It was clear that from the findings of the confirmatory study (see chapter 5) the experts confirmed the importance of considering Accessibility in students' attitude towards summative e-assessment. This conclusion emphasizes the guidance of (Ball, 2006) which reiterated that e-assessment must be fair for all users through accessibility measures. The question type in multiple forms (e.g. written, graphics, video) should be presented in different methods of access, such as alternative text and sound (Ball, 2006). The e-assessment system features should be designed in a way that supports students with special needs. This information can be used to inform the design of the e-assessment system to be introduced into universities. By doing so, the chances of students accepting the system will be higher than otherwise. Such a process would as well call for the adoption of assistive technologies labs by the Saudi Universities where students with special needs have more space to be able to use computers before exams.

The fourth important variable from the regression analysis affecting students is Perceived Ability of Use (PAU) with a beta weight value of 0.11. It indicates how easy it is to use the e-assessment system and the capability of using a computer in the exam. This variable looks at eight items covering various aspects of students' self-perceived ability to use a computer. The current finding builds on earlier evidence by (Imtiaz & Maarop, 2014; Maqableh, Taisir, Ra'ed, & Mohammed,

2015). They found that students with high self-efficacy are more likely to believe that they can deal with the computer efficiently, so they might perform better in exams. Other studies which validated the significant, positive effect of perceived ease of use on the attitude towards e-assessment (Alkiş, 2010; Schneberger et al., 2007; Terzis & Economides, 2011). This result supported the findings of the confirmatory study (see chapter 5) which emphasize that students who perceive themselves as having more experience in computer skills are more likely to accept e-assessment. In the discussion in open questions (see section 7.5), some students observed that they would not find any problem in using a computer in the exam. The findings are significant for Saudi universities. They should invest in enabling their students to become fairly skilled in computers and IT. This would inform any strategy to fill the skills gap, as a precondition towards creating self-motivated students with less resistance to adopting new technologies.

The final variable is University Environment (UEN) with beta weight value 0.09, which looked at eight items covering various aspects of the importance of the support during e-exams and the university's preparation for the e-exam. It also the importance of social environments, such as friends' opinions, teachers, university support and the environment. It has been arguing that culture is a critical factor in the successful implementation of e-assessment (McCann, 2010; Warburton, 2009). Other scholars stressed that the university should provide an expert during e-exams to overcome students' queries about the use of the system or even about the content of the question (Maqableh et al., 2015; Terzis & Economides, 2011). From the findings of the confirmatory study (see chapter 5) both experts and students had confirmed the importance of considering the preparation of the university environment for e-exam. Also, the result from the open questions (see section 7.5) supported these findings. Students found some issues could affect their attitude towards e-assessment, such as network faults and technical issues. The findings are significant to the way universities plan to adopt e-assessment. This evidence requires universities to invest in the examination facilities by providing a reliable network and equipment, along with appropriate assistive technology. This means that a university should give more support to students when applying e-assessment. The key message is that the staff need to take care to improve the university culture for accepting the new technology. Managerial implications were provided in the following chapter for e-assessment developers, policymakers, and practitioners based on this research's results. Such implications can guide universities to take appropriate means and actions to successful implement e-assessment.

The findings of the open ended questions have been reflected the discussion on quantitative result. The findings indicate that students preferred to use a computer in their exam. Students would prefer e-assessment is applied in some courses such as theoretical courses. Students would like e-assessment if it would be useful for their course. Students believed that they were able to use e-

assessment, as some mentioned that they feel confident in using a computer. However, students commented about the importance of having support from teachers in the event technical issues happen during the e-assessment sessions, which affects the overall result.

While this work has developed some interesting findings and result, there are some areas of critiques. This work focused on the attitudes of students towards e-assessment in principle, generally, which might be quite different from the attitude of students towards e-assessment using a specific computer system. This work proposed five diverse factors affecting the attitude of students. The work did not explore exogenous factors which may contribute to an increase in the explained variance in the students' attitude towards summative e-assessment, such as a focus on feedback features. This work focused on summative e-assessment. Other types, such as formative or diagnostic e-assessment, were not addressed. Students might have different attitudes toward different types of e-assessment. The effects of moderating factors on the relationships between the factors were not examined which would enhance the explanatory power of the framework. For example, the impact of moderators such as early adopters, risk-taking and the subject matter (e.g. mathematics, computer science, religion) (Sun & Zhang, 2006). This work focused on the positive factors that influence the attitude of students towards e-assessment. It did not take into consideration the negative factors which might affect their attitude, for example, negative factors, such as Anxiety (Standing & Standing, 2008).

## 7.7 Summary

This chapter presented the results of the research questionnaire. The questionnaire was distributed to students in Saudi Arabian universities, from whom 328 usable responses were obtained. The questionnaire was analysed using factor analysis and multiple linear regression. Cronbach's alpha was applied to test the reliability of the questionnaire, which showed that the questionnaire items were reliable. During factor analysis, factors were regrouped to consist of six factors (components) containing 33 items. The meanings of these factors were discussed. Four factors retained the same name, while two factors were renamed based on the new combination of items. From this, multiple linear regression was run to identify which factors strongly affect students' attitudes. The result of the MLR indicated that all five independent variables have a significant effect on students' attitude towards summative e-assessment. The five independent variables, CO, PU, AC, PAU and UEN is confirm to influence students' attitude towards summative e-assessment respectively. The results of the open-ended questionnaire were discussed and found to reflect the result of the multiple linear regression.

# Chapter 8 Conclusion and Future Work

The aim of this chapter is to summarise this work's objectives and findings, the implications of the research findings, and its limitations and future research possibilities.

## 8.1 Summary

The main goal of this thesis was to address the gaps in the literature related to the investigation students' attitude towards summative e-assessment in Saudi Arabia universities by developing a conceptual framework. A review of relevant literature was conducted, as reported in Chapter 2. This was the first step to understanding learning, assessment and feedback in higher education. Then followed reviewing the e-assessment concept, its benefits, dis-benefits and challenges faced in adopting it, and the gathering of evidence that supported the design of a framework to investigate students' attitude towards summative e-assessment in Saudi Arabian universities. The literature demonstrated the importance of assessment in the learning process, which must be designed to address the educational goals. It is crucial for the educator to ensure that e-assessment will benefit students, by improving their learning outcomes and by providing education techniques that engender greater success. Students need to have a positive attitude e-assessment in order for it to be successfully *adopted*. The literature produced only limited research for investigation of students' attitude towards using summative e-assessment, and nothing about students' attitude in Saudi Arabian universities.

A framework was proposed by considering the limitations found in the field studies. The framework was based on previous studies, as shown in Section 2.5, where SRQ 1 was answered. The initial framework consisted of eight factors: Perceived Usefulness, Perceived Ease of Use, Self-Efficacy, Perceived Playfulness, Social Influence, Facilitating of Examination, Content and Accessibility. This framework was confirmed by both e-assessment experts and university students, and the results reported in Chapter 5. The experts agreed with all the factors in the proposed framework, except for one: Perceived Playfulness, this was discussed in Section 5.1. The experts addressed the importance to investigate the influence of university infrastructure on students' attitude towards using summative e-assessment. Then, students agreed all factors are important except Anxiety.

The confirmed framework was deployed by developing a questionnaire to investigate students' attitude towards using summative e-assessment presented in detail in Chapter 6. Finally, investigation study was performed, and the results were described in Chapter 7. The main results were that five variables had a significant and positive influence on students' attitude of using

summative e-assessment. In order of significance they are: Perceived Usefulness, Perceived Ability of Use, University Environment, Content and Accessibility. This resulted in SRQ2 being answered.

## 8.2 Contributions

The present study is important for both theoretical and practical reasons. The research provides important contributions to a pool of literature on summative e-assessment as well as practical contribution.

### 8.2.1 Theoretical and Contextual Contributions

As far as the theoretical aspects are concerned, the present study is one of the first investigation into the factors that influence students' attitude towards summative e-assessment in Saudi Arabian universities. This work has built a framework for a new context. The novel contribution concerns the framework that offers detail in understanding the influences on students' attitude towards e-assessment in Saudi Arabian universities. The framework developed here can be tested in different contexts. The study proposed methodological contributions by adopting a mixed methods approach in order to increase the validity of this research. The review of previous study indicates that there was no study which investigated the attitude of students towards using e-assessment by adopting mixed methods. The reviewed studies applied a quantitative approach. Interviews were used in this study to explore the opinions of experts in e-assessment regarding the proposed factors that affect the attitude of students towards using summative e-assessment.

This study developed and validated the questionnaire's measurement items, some of which were self-developed to suit this research context. The questionnaire can also be used as an instance of the framework whose future use might be to help stakeholders evaluate summative e-assessment systems. This work is expected to serve as a useful guide for future studies in the e-assessment field. It will serve as a base for scholars to lead further studies on summative e-assessment adoption in the future by taking into account the cultural differences.

### 8.2.2 Contribution to Practice

The results of this research offer valuable recommendations for the developers and stakeholders of summative e-assessment through the following:

- The research data and findings obtained will provide input to universities and researchers. Applying summative e-assessment stills need a better representation of the educational needs

with which to approach educational policy makers. The findings could possibly assist policy makers with the establishment and modification of university assessment, as they endeavour to make relevant decisions.

- The research makes recommendations that can be brought to the attention of policy makers in Saudi Arabian universities. In addition to investigating factors that influence the students' attitude towards using summative e-assessment, this study also sheds light on the factors that may attract new users.

## 8.3 Applying the Framework

The proposed framework can be used in various situations and at different levels: from designing and development of e-assessment systems to ex-post evaluation of the system. The framework can apply by the practitioners to assess students' attitude towards using e-assessment before adopt it in their course. Based on the results obtained in this study, some insights and recommendations are put forward to e-assessment providers and instructors to inform their instructional design and pedagogical approaches, which may be considered in the future. The findings suggest the following as the areas of critical concern for the higher education practitioners:

- Perceived Usefulness of the e-assessment is a key incentive for students to accept e-assessment. This finding points to the need for e-assessment developers and teachers to increase students' awareness of the reasons for taking the exam on a computer in some courses. Students are increasingly confused about the benefits and usefulness of e-assessment, and this could be one of the reasons for the decreased positive attitude of students towards e-assessment.
- Accessibility significantly influences a student's attitude towards summative e-assessment. Therefore, developers should take this into account. Different approaches can address Accessibility, such as screen readers, screen magnifiers and speech recognition software. It is recommended that questions are presented in multiple forms, e.g. written, graphics, sound. It has also been suggested in the literature that Saudi Arabian universities should focus more on improving accessibility (Al-Khalifa, 2014).
- The development of a positive attitude by students towards summative e-assessment significantly depends on Perceived Ability of Use. Accordingly, developers should devise a method by which the system used is both simple and understandable. Designers of e-assessments should invest in providing a successful e-assessment tool. The e-assessment system should be easy to use, have clear instructions and be user-friendly. This can lead to an improvement in a student's experience and an increased positive attitude towards e-assessment. The contents of the system should be organised for easy and quick access. A

users' guide must be provided, which explains how to use the system, especially for new and inexperienced students. From the findings, students who viewed themselves having good computer skills were more likely to accept e-assessment. This is evidence to require universities to invest in ensuring that their students and staff master computer skills before the introduction of e-assessment systems. This would inform any strategy to fill the skills gaps as a precondition towards creating self-efficacious student with less resistance to adopting new technologies.

- The University Environment significantly influences students' attitude towards summative e-assessment, it is important for teachers to train students in general technology use as a means of developing students' skills before implementing e-assessment. Universities also need to ensure training is provided to teachers on how to use summative e-assessment effectively in learning. The system requires a good wireless network and computers to work well. A university focused on providing a high-quality network will enhance the student experience. From the results, it was found that the adoption of new technologies is a function of peer and social pressures. This implies that individual attitude towards e-assessment systems is mainly based on the perceptions and the general cultures of peer groups towards e-assessment. To this end, higher education practitioners particularly university faculty must ensure that they understand the popular norms of the students' community in order to understand their impact on the adoption of new technologies. Also, plans should be in place to manage the norms to favour the adoption of e-assessment systems.

## 8.4 Limitations and Future Research

This work has some limitations, but these can lead to significant suggestions for areas of future research.

- The first limitation is related to sample size. This research applied the volunteer sampling method for collecting questionnaire responses. Therefore, a self-selection bias affects the possibility of the results being generalised. Future research should apply probability sampling methods.
- A manual approach was chosen for qualitative data analysis. Initially, the software was unable to identify the codes and pseudonyms, since the interview transcripts were not in standard Arabic. Therefore, manual coding was eventually employed, which was less prone to these problems.

- Another limitation is associated with the generalisation of the results, since the number of participants was limited to 328.
- Investigation questionnaire responses were received from only three universities. Future studies could be conducted more widely, which would provide rich data from each university and which could be used to investigate and to support pedagogical development.
- This work focused on the positive factors that influence the attitude of students towards e-assessment. It did not take into consideration the negative factors which might affect their attitude. In future, it might be possible to investigate negative factors, such as Anxiety, etc. (Standing & Standing, 2008).
- The effects of moderating factors on the relationships between the factors were not examined. Future research could study the impact of moderators such as age, gender and the discipline (e.g. mathematics, computer science, religion) on the relationships between the factors. Including these moderating factors might enhance the explanatory power of the framework (Sun & Zhang, 2006).
- This work focused on summative e-assessment. Other types, such as formative or diagnostic e-assessment, were not addressed. Students might have different attitudes to different types of e-assessment. Further research could investigate the factors affecting the attitudes of students in different types of e-assessment. The framework can be expanded to focus deeply on feedback for formative assessment.
- This work proposed five diverse factors affecting the attitude of students. There is still abundant room for exploring other factors which may contribute to an increase in the explained variance in the students' attitude towards summative e-assessment, such as focus on feedback features.
- Future studies could focus on university readiness and awareness, and investigate the right pedagogy for e-assessment use in the university context. University readiness to use, and awareness of, e-assessment could usefully be investigated before integrating an e-assessment system.
- This work focused on attitudes of students towards e-assessment in principle, which might be quite different from the attitude of students towards e-assessment using a specific computer system. Further research could be undertaken to investigate the factors affecting the retention of users using a specific computer system.

## 8.5 Concluding Remarks

The researcher found that, although the empirical research was challenging, it was very interesting and, most importantly, when applied correctly, valuable results were obtained. Finally, it was found that applying statistical analyses was highly useful in empirical e-assessment research. However,

finding a suitable statistical analysis for the collected data required good understanding of the data, the goals of the research and the statistical tests available to fulfil the specified goal. The results presented here are useful for accelerating the progress of summative e-assessment forward within Saudi Arabian universities. Finally, testing the framework developed in this study in different cultural contexts and settings would be useful for generalising the results obtained.

# Appendix A Confirmatory Study

## A.1 Interview Guide

The main aim of this research is to construct a framework for investigation of the attitude of students towards summative e-assessment in a Saudi Arabian universities context. You have been chosen because you are an expert in e-assessment and this research wishes to obtain your opinion about which factors affect students' attitude towards using e-assessment. This research is under the auspices of the School of Electronics and Computer Science, University of Southampton. I would appreciate your response to the following questions. Your information will be used for research purposes only. Thank you very much for your time.

الهدف الرئيسي من هذا البحث هو بناء إطار للتحقيق في موقف الطلاب من التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية. لقد تم اختيارك لأنك خبير في التقييم الإلكتروني ويرغب هذا البحث في الحصول على رأيك حول العوامل التي تؤثر على موقف الطلاب من استخدام التقييم الإلكتروني. هذا البحث تحت رعاية كلية الإلكترونيات وعلوم الكمبيوتر ، جامعة ساوثهامبتون. سأكون ممتناً لردكم على الأسئلة التالية. سيتم استخدام معلوماتك لأغراض البحث فقط. شكرا جزيلا على وقتك.

| **To what extent do you agree the following factors are important for investigation of the attitude of students towards summative e-assessment in a Saudi Arabian universities context.**<br>إلى أي مدى توافق على أن العوامل التالية مهمة للتحقيق في موقف الطلاب من التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية. | **Important**<br>مهم | **Not important**<br>غير مهم | **Any Comment**<br>أي تعليق |
|---|---|---|---|
| 1- Perceived Usefulness | | | |
| 2- Perceived Ease of Use | | | |
| 3- Self-Efficacy | | | |
| 4- Perceived Playfulness | | | |
| 5- Social Influence | | | |
| 6- Facilitating Examination | | | |
| 7- Content | | | |
| 8- Accessibility | | | |
| *Open question:<br>Are there any factors (you think) could influence students' attitude towards using summative e-assessment?<br>هل هناك أي عوامل (في اعتقادك) يمكن أن تؤثر على موقف الطلاب من استخدام التقييم الإلكتروني (في التقييم النهائي) ؟ | | | |

## A.2 The codes and sub-codes derived from the current study Step2.

| Number of words | Codes | Sub-codes | Main Theme |
|---|---|---|---|
| 127 | This specific code describes the important of Perceived Usefulness on students' attitude towards e-assessment. | Achieve educational goals.<br>Advantages of learning.<br>Increasing marks.<br>Understanding the information in different ways. | **Perceived Usefulness** |
| 129 | This specific code describes the important of Perceived Ease of Use on students' attitude towards e-assessment. | Ease of use is important factor.<br>Ease of use is important for certain classes of students.<br>Ease of use is important for those who are not familiar with the technology.<br>Navigation features. | **Perceived Ease of Use** |
| 75 | This specific code describes the important of Self-Efficacy on students' attitude towards e-assessment. | Able to use computer.<br>Confidence to use computer.<br>Familiar with technologies.<br>Does not require effort. | **Self-Efficacy** |
| 73 | This specific code describes the important of Perceived Playfulness on students' attitude towards e-assessment. | The usability is more important than playfulness.<br>Interface of the system.<br>Design of system should be easy to use. | **Perceived Playfulness** |
| 147 | This specific code describes the important of Social Influence on students' attitude towards e-assessment. | Lecturers can affect the students positively and also negatively.<br>Lecturers' support.<br>Influence of friends.<br>University culture.<br>University which uses more technologies. | **Social Influence** |
| 126 | This specific code describes the important of Facilitating of Examination on students' attitude towards e-assessment. | IT staff support during exam.<br>Training before first e-exam.<br>Providing an e-exam training session for students.<br>The availability of IT staff. | **Facilitating of Examination** |

| | | | |
|---|---|---|---|
| 184 | This specific code describes the important of Content on students' attitude towards e-assessment. | The type of course.<br>Preferred multiple-choice questions.<br>Receive the result quickly.<br>Feedback. | **Content** |
| 138 | This specific code describes the important of Accessibility on students' attitude towards e-assessment. | Students with special needs and e-exam.<br>Assistive Technology.<br>Labs include assistive technology.<br>Present the questions in different formats. | **Accessibility** |

## A.3 The codes and sub-codes derived from the current study Step3.

| **Number of words** | **Codes** | **Sub-codes** | **Additional Theme** |
|---|---|---|---|
| 162 | This specific code describes the influence of university infrastructure on students' attitude towards e-assessment. | Reliability of the network.<br>Technical issues.<br>Worried about the network.<br>Slowing down of the computer.<br>Sudden shutdown. | **University Infrastructure** |
| 55 | This specific code describes the students' feeling towards using computer in exam. | Anxious due to technical issues. | **Anxiety** |

## A.4 The codes and sub-codes derived from the current study Final result.

| Number of words | Codes | Sub-codes | Main Theme |
|---|---|---|---|
| 127 | This specific code describes the important of Perceived Usefulness on students' attitude towards e-assessment. | Achieve educational goals.<br>Advantages of learning.<br>Increasing marks.<br>Understanding the information in different ways. | **Perceived Usefulness** |
| 129 | This specific code describes the important of Perceived Ease of Use on students' attitude towards e-assessment. | Ease of use is important factor.<br>Ease of use is important for certain classes of students.<br>Ease of use is important for those who are not familiar with the technology.<br>Navigation features. | **Perceived Ease of Use** |
| 75 | This specific code describes the important of Self-Efficacy on students' attitude towards e-assessment. | Able to use computer.<br>Confidence to use computer.<br>Familiar with technologies.<br>Does not require effort. | **Self-Efficacy** |
| 73 | This specific code describes the important of Perceived Playfulness on students' attitude towards e-assessment. | The usability is more important than playfulness.<br>Interface of the system.<br>Design of system should be easy to use. | **Perceived Playfulness** |
| 147 | This specific code describes the important of Social Influence on students' attitude towards e-assessment. | Lecturers can affect the students positively and also negatively.<br>Lecturers' support.<br>Influence of friends.<br>University culture.<br>University which uses more technologies. | **Social Influence** |
| 126 | This specific code describes the important of Facilitating of Examination on students' attitude towards e-assessment. | IT staff support during exam.<br>Training before first e-exam.<br>Providing an e-exam training session for students.<br>The availability of IT staff. | **Facilitating of Examination** |

| | | | |
|---|---|---|---|
| 184 | This specific code describes the important of Content on students' attitude towards e-assessment. | The type of course.<br>Preferred multiple-choice questions.<br>Receive the result quickly.<br>Feedback. | **Content** |
| 138 | This specific code describes the important of Accessibility on students' attitude towards e-assessment. | Students with special needs and e-exam.<br>Assistive Technology.<br>Labs include assistive technology.<br>Present the questions in different formats. | **Accessibility** |
| 162 | This specific code describes the influence of university infrastructure on students' attitude towards e-assessment. | Reliability of the network.<br>Technical issues.<br>Worried about the network.<br>Slowing down of the computer.<br>Sudden shutdown. | **University Infrastructure** |
| 55 | This specific code describes the students' feeling towards using computer in exam. | Anxious due to technical issues. | **Anxiety** |

## A.5 Participant Information Sheet

UNIVERSITY OF Southampton

**ورقة معلومات المشاركين**

**Study Title:** An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context.

**عنوان الدراسة:** دراسة العوامل المؤثرة في اتجاه الطلاب من التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.

**Researcher name:** Someah Alangari **الباحث:** سمية العنقري

**Ethics reference:** 21170 **رقم الأخلاقيات:** 21170

**Please read this information carefully before deciding to take part in this research. If you are happy to participate, you will be asked to sign a consent form.**

**يرجى قراءة هذه المعلومات بعناية قبل اتخاذ القرار بالمشاركة في هذا البحث. إذا كنت سعيداً بالمشاركة سوف يطلب منك التوقيع على استماره الموافقة.**

**What is the research about?**

This research is examining students' attitude towards summative e-assessment in Saudi Arabian universities. The aim of this study is to investigate the factors that influence students' attitude towards using summative e-assessment in Saudi Arabian universities. This research is under the auspices of the School of Electronics and Computer Science, University of Southampton, UK.

**ماذا عن هذا البحث؟**

يهدف هذا البحث إلى استكشاف العوامل المؤثره على اتجاهات الطلبة نحو الإختبارات الإلكترونية في الجامعات السعودية. تحديد هذه العوامل تساعد الجامعات في على تعزيز طرق التقييم ونجاح تطبيق الإختبارات الإلكترونية ورضا الطلبة. هذا البحث تحت إشراف كليه علوم الحاسوب بجامعه ساوثهامبتون ، المملكه المتحدة ، ويتم تمويلة بالكامل من قبل الملحقية الثقافية السعودية.

**Why have I been chosen?**

I invite you to participate in this because your opinion will help in confirming the constructed framework for investigation of the attitude of students towards summative e-assessment in a Saudi Arabian universities context.

**لماذا تم اختياري؟**

تم اختيارك للمشاركة في هذه الدراسة لأن رأيك سوف يساعد في هذه الدراسة التي تهدف إلى تحديد اتجاهات الطلبة تجاه الإختبارات الإلكترونية في الجامعات السعودية.

**What will happen to me if I take part?**

I will send you the link to the questionnaire, and then the study will begin. The questionnaire will take about 10 minutes to complete.

**ماذا سيحث لي إذا شاركت؟**

سوف اقوم بإرسال رابط للاستبيان ، الاستبيان يستغرق 10 دقائق.

**Are there any benefits in my taking part?**

This research is not designed to help you personally, but your feedback will help me gather educationalist opinions on the development efforts.

**هل هناك أي فوائد عند مشاركتي؟**

هذه الدراسة لم تصمم لمساعدتك شخصياً ، ولكن رأيك سيسهم في تطوير الدراسة لهدف دعم الجامعات السعودية بنتيجة هذه الدراسة.

**Are there any risks involved?**

No.

**هل هناك أي مخاطر؟**

لا

**Will my participation be confidential?**

Yes. Your information will be stored and used on secure systems and will be used for this study purposes only, and your responses are voluntary and will be confidential. Individual responses will not be identified. All responses will be compiled together and analysed as a group.

**هل ستكون مشاركتي سرية؟**

نعم. سيتم الإحتفاظ بالمعلومات التي تقدمها للبحث في سرية تامة مجهولة. سيتم تخزين المعلومات الخاصة بك على أنظمة امنة وسوف تستخدم لأغراض الرسالة فقط.

**What happens if I change my mind?**

You have the right to terminate your participation in the research at any stage, without giving any reasons, and without your legal rights being affected. Your data will be deleted directly if you decide to withdraw at any time.

**ماذا سيحدث إذا قمت بتغيير رأيي؟**

لديك الحق في الإنسحاب في أي مرحلة دون الحاجة إلى إعطاء أسباب وبدون أي عقوبة و سيتم حذف معلوماتك التي قدمتها.

**ماذا يحدث إذا حدث خطأ ما؟**

في حالة القلق يرجى الإتصال بمدير إدارة البحوث.

**What happens if something goes wrong?**

In the unlikely case of concern or complaint, please contact Research Governance Manager (02380 595058, rgoinfo@soton.ac.uk).

Where can I get more information?

**أين يمكنني الحصول على مزيد من المعلومات؟**

لمزيد من المعلومات يرجى الاتصال بي أو بالمشرفين على دراستي:

For further details, please contact either myself or my study Supervisors, Dr. Gary Wills and Prof. Mike Wald
Researcher: sssa1e13@ecs. soton.ac.uk

Gary Wills: gbw@ecs.soton.ac.uk Mike Wald: mw@ecs.soton.ac.uk

## A.6 Consent Form

UNIVERSITY OF Southampton

**نموذج الموافقة**

**Study title:** An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context

**عنوان الدراسة:** دراسة العوامل المؤثرة في اتجاه الطلاب من التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.

**Researcher name:** Someah Alangari **الباحث:** سمية العنقري

**Ethics reference:** 21170 **رقم الأخلاقيات:** 21170

**Please initial the boxes if you agree with the statements.**

**يرجى التأشير في المربع أدناه إذا كنت توافق على العبارة:**

| | |
|---|---|
| I have read and understood the information sheet (*2016/6/20/version 1*) and have had the opportunity to ask questions about the study.<br>لقد قرأت ورقة المعلومات( النسخة رقم 1، تاريخ: 20 جون 2016) وأتيحت لي الفرصة لطرح أسأله حول الدراسة. | |
| I agree to take part in this research project and agree for my data to be used for the purpose of this study.<br>أوافق على المشاركة في هذا المشروع البحثي وأوافق على استخدام البيانات الخاصة بي للغرض من هذه الدراسة. | |
| I understand my participation is voluntary and I may withdraw at any time for any reason without my rights being affected.<br>أنا أفهم أن مشاركتي تطوعيه وأنني أستطيع الإنسحاب في أي وقت دون أن تتأثر حقوقي القانونية. | |

**Print Name of participant ..... إسم المشارك**

**Signature of participant ..... توقيع المشارك**

**Date ..... التاريخ**

## A.7 Students' Questionnaire

**دراسة العوامل المؤثرة في اتجاه الطلاب نحو التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.**

**مرحباً!**

شكراً جزيلاً على اهتمامك بالمشاركة في هذه الإستبانة وأقدر لك وقتك ومشاركتك القيمة. يستغرق الإستبيان حوالي 5 دقائق.

يهدف هذا البحث إلى دراسة العوامل المؤثرة في سلوك الطلاب والطالبات لتقبل الإختبارات الالكترونية والمقصود بـ الإختبارات الالكترونية:هي الإختبارات التي تُجرى باستخدام الكمبيوتر سواء عن طريق نظام بلاك بورد أو أي نظام آخر مستخدم في جامعتك. هذا البحث يشمل دراسة أربعة نواحي وهي الفردية، الإجتماعية، المصادر الخارجية وأخيرا محتويات النظام. مشاركتك سوف تفيد الجامعات في تحديد الإتجاهات المستقبلية للإختبارات الإلكترونية وسوف تساعد في تطوير هذا المجال.

يمكنك الإطلاع على معلومات البحث والباحثة لهذة الدراسة من خلال هذا الرابط:

https://www.dropbox.com/s/quzk9c4z0r20o96/Participant%20Information%20Sheet.pdf?

شاكرة لكم تعاونكم ووقتكم..

سمية العنقري

An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context

**Welcome!**

Thank you very much for your interest in taking this questionnaire. I appreciate your time and valuable participation. It should take about five minutes. The main aim of this research is to construct a framework for investigation of the attitude of students towards using summative e-assessment in a Saudi Arabian universities context. You have been chosen for your opinion about which factors affect students' attitude towards using summative e-assessment systems in Saudi Arabian universities.

This research is under the auspices of the School of Electronic and Computer Science, University of Southampton. I would appreciate your response to the following questions. Your information will be used for the research purpose only. A Participant Information Sheet is available from this link:

https://www.dropbox.com/s/quzk9c4z0r20o96/Participant%20Information%20Sheet.pdf?

Thank you very much for completing this questionnaire.

Someah Alangari

**Questions: Part 1: General information** **الجزء الأول: معلومات عامة**

| |
|---|
| الرجاء ادخال اسم الجامعة التي تدرس فيها<br>Please enter the university where you are studying. |
| تحت أي قسم يندرج تخصصك الجامعي<br>Please choose your department/major.<br>o Natural Science التخصصات العلمية<br>o Social Science التخصصات الأدبية |
| الرجاء اختيار الجنس (ذكر / أنثى)<br>Please select your gender (male/female).<br>o Male<br>o Female |
| هل سبق أن أجري لك اختبار الكتروني ؟ (نعم / لا)<br>Have you ever used e-assessment systems before? (Yes/No) |

**Part 2: Factors affecting the attitude of students towards summative e-assessment in Saudi Arabian universities.**

**الجزء الثاني: العوامل المؤثرة على اتجاهات الطلبة تجاة استخدام الإختبارات الإلكترونية (التقييم النهائي) في الجامعات السعودية.**

من فضلك يرجى الإشارة إلى درجتك في الإتفاق أو عدم الإتفاق على العبارات التالية أنها تؤثر على اتجاهك نحو التقييم الإلكتروني. الرجاء الإجابة على كل عبارة عن طريق إختيار إجابة واحدة فقط لكل عبارة.

Read the following statement about factors influencing students' attitude towards summative e-assessment and then please tick (✓) one per item, how much you agree or disagree with each of the statement is an important factor effect students' attitude towards summative e-assessment.

| **Statement** | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| أنا على استعداد لقبول الإختبارات الإلكترونية إذا كان استخدامها له فائده لتعليمي<br>I will accept e-assessment if it's useful for my education | | | | | |
| أنا على استعداد لقبول الإختبارات الإلكترونية إذا كان النظام سهل الاستخدام<br>I will accept e-assessment if the system is easy to use | | | | | |
| عدم الإلمام باستخدام الكمبيوتريحد من تقبلي للإختبارات الإلكترونيه<br>Lack of familiarity with using technology tools inhibits me from using e-assessment | | | | | |
| أنا على استعداد لاستخدام الإختبارات الإلكترونية إذا كان النظام لا يتطلب المزيد من الجهد مقارنه مع الإختبار الورقي<br>I am happy to use e-assessment if the system does not require more effort compared to paper-based assessment | | | | | |
| أشعر بالتوتر من إجراء الإختبار بإستخدام الكمبيوتر.<br>I feel anxious about taking exams on computer | | | | | |
| الأساتذة في الجامعة يشجعون الطلاب على استخدام الإختبار الإلكتروني<br>University lecturers are a factor that influence me for acceptance of e-assessment | | | | | |
| وجهه نظر زملائي تجاه الإختبارات الإلكترونية هو عامل مؤثر في تقبي لها<br>The attitude of my friends towards e-assessment is a factor that influences my use of e-assessment | | | | | |
| ثقافة الجامعة تؤثر على تقبلي واستخدامي للإختبارات الإلكترونيه<br>The university culture will affect my use of e-assessment | | | | | |
| التدريب على استخدام نظام التقييم الإلكتروني ضروري لمساعدتي على أن أكون على درايه بالنظام قبل الإختبار<br>Training to use the e-assessment systems is very important to help me to become familiar with the systems before exams | | | | | |
| سوف اتقبل الإختبار الإلكتروني إذا كان موظف الدعم الفني موجود أثناء الإختبار<br>I will accept e-assessment if IT Staff are available during exams | | | | | |

Appendix A

| | | | | | |
|---|---|---|---|---|---|
| استعدادات الجامعة (أجهزه, برامج, شبكات)عامل مهم بالنسبه لي لقبول الإختبارات الالكترونية<br>University environment, such as computer hardware, software and communication network, is important to me to accept the e-exam | | | | | |
| محتوى المادة هو عامل مهم يؤثرعلى رغبتي لإستخدام الإختبارات الإلكترونية<br>Course content is a factor that influences my attitude towards use of e-assessment | | | | | |
| من المهم أن تكون نوعيه الأسئلة في الإختبارات الإلكترونية في مستوى مناسب لطبيعه المادة التي أدرسها<br>It is important that the questions of the course are of the right level for the course I am taking | | | | | |
| تنوع الأسئلة مهم بالنسبه لي لتقبل الإختبار الإلكتروني<br>Making a variety of questions available would be very important to me to accept e-assessment | | | | | |
| سوف اقبل الإختبارات الإلكترونية إذا كانت النتيجه تظهر لي بعد الإختبار مباشرة<br>I will accept e-assessment if I receive immediate feedback | | | | | |
| سوف أقبل الإختبارات الإلكترونية إذا كان هناك شرح كافي لتفاصيل الدرجة<br>I will accept e-assessment if I receive sufficient feedback | | | | | |
| من المهم عرض الأسئله بصيغ مختلفه (صوت - رسوم- فيديو) للطلاب من ذوي الإحتياجات الخاصه<br>It is important to present questions in different formats, e.g. sounds and graphs, for students with special needs | | | | | |
| من المهم توفير معامل خاصه بذوي الإحتياجات الخاصه في جامعتي لتمكينهم من إجراء الإختبارات الإلكترونية<br>Assistive Technology is important to make e-assessment accessible for students with special needs. | | | | | |
| أرى أن استخدام الإختبارات الإلكترونية في جامعتي فكرة جيدة<br>I like the idea of using e-assessment at my university | | | | | |

# A.8 Descriptive Statistics for the Confirmatory Questionnaire

### A.8.1 Repeated Measures One-way ANOVA on 19 Items

| Within-Subjects Factors | |
|---|---|
| **Item** | **Dependent Variable** |
| 1 | PU |
| 2 | PEU |
| 3 | SE1 |
| 4 | SE2 |
| 5 | ANX |
| 6 | SI1 |
| 7 | SI2 |
| 8 | SI3 |
| 9 | FE1 |
| 10 | FE2 |
| 11 | FE3 |
| 12 | CO1 |
| 13 | CO2 |
| 14 | CO3 |
| 15 | CO4 |
| 16 | CO5 |
| 17 | AC1 |
| 18 | AC2 |
| 19 | AT |

Appendix A

| Descriptive Statistics | Mean | Std. Deviation | N |
|---|---|---|---|
| Perceived Usefulness | 4.20 | 0.75 | 102 |
| Perceived Ease of Use | 4.50 | 0.56 | 102 |
| Self-Efficacy (1) | 3.32 | 0.89 | 102 |
| Self-Efficacy (2) | 4.35 | 0.80 | 102 |
| Anxiety | 2.70 | 1.20 | 102 |
| Social Influence (Lecturer) | 3.34 | 0.96 | 102 |
| Social Influence (Friends) | 3.40 | 1.12 | 102 |
| Social Influence (University culture) | 3.84 | 1.01 | 102 |
| Facilitating Examination (Training) | 4.23 | 0.80 | 102 |
| Facilitating Examination (Support during exam) | 4.06 | 0.89 | 102 |
| Facilitating Examination (University environment) | 4.65 | 0.57 | 102 |
| Content (Course) | 4.02 | 0.89 | 102 |
| Content (Questions type 1) | 4.49 | 0.61 | 102 |
| Content (Questions type 2) | 4.26 | 0.73 | 102 |
| Content (Immediate feedback) | 4.10 | 0.99 | 102 |
| Content (Sufficient feedback) | 4.32 | 0.75 | 102 |
| Accessibility (1) | 4.52 | 0.69 | 102 |
| Accessibility (2) | 4.56 | 0.59 | 102 |
| Attitude | 4.26 | 1.00 | 102 |

| Mauchly's Test of Sphericity[a] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Within Subjects Effect | Mauchly's W | Approx. Chi-Square | df | *p* | Epsilon[b] | | |
| | | | | | Greenhouse-Geisser | Huynh-Feldt | Lower-bound |
| Items | 0.01 | 485.80 | 17 | < 0.001 | 0.65 | 0.74 | 0.06 |
| Tests the null hypothesis that the error covariance matrix of the orthonormalised transformed dependent variables is proportional to an identity matrix. | | | | | | | |
| a. Design: Intercept; Within Subjects Design: Items<br>b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table. | | | | | | | |

| Tests of Within-Subjects Effects | | | | | | |
|---|---|---|---|---|---|---|
| Source | | Type III Sum of Squares | df | Mean Square | *F* | *p* |
| Items | Sphericity Assumed | 496.54 | 18.00 | 27.59 | 42.61 | < 0.001 |
| | Greenhouse-Geisser | 496.54 | 11.73 | 42.32 | 42.61 | < 0.001 |
| | Huynh-Feldt | 496.54 | 13.39 | 37.10 | 42.61 | < 0.001 |
| | Lower-bound | 496.54 | 1.00 | 496.54 | 42.61 | < 0.001 |
| Error (Items) | Sphericity Assumed | 1177.04 | 182.00 | 0.65 | | |
| | Greenhouse-Geisser | 1177.04 | 1185.12 | 0.10 | | |
| | Huynh-Feldt | 1177.04 | 1351.91 | 0.90 | | |
| | Lower-bound | 1177.04 | 101.00 | 11.65 | | |

| Tests of Within-Subjects Contrasts | | | | | | |
|---|---|---|---|---|---|---|
| Source | Items | Type III Sum of Squares | df | Mean Square | *F* | *p* |
| Items | Level 1 vs. Level 2 | 9.42 | 1 | 9.42 | 20.00 | < 0.001 |
| | Level 2 vs. Level 3 | 141.18 | 1 | 141.18 | 156.10 | < 0.001 |
| | Level 3 vs. Level 4 | 108.09 | 1 | 108.09 | 77.47 | < 0.001 |
| | Level 4 vs. Level 5 | 280.01 | 1 | 280.01 | 131.51 | < 0.001 |
| | Level 5 vs. Level 6 | 42.71 | 1 | 42.71 | 16.51 | < 0.001 |
| | Level 6 vs. Level 7 | 0.35 | 1 | 0.35 | 0.19 | 0.660 |
| | Level 7 vs. Level 8 | 19.85 | 1 | 19.85 | 9.68 | 0.002 |
| | Level 8 vs. Level 9 | 14.91 | 1 | 14.91 | 9.53 | 0.003 |
| | Level 9 vs. Level 10 | 2.83 | 1 | 2.83 | 2.80 | 0.097 |
| | Level 10 vs. Level 11 | 35.29 | 1 | 35.29 | 41.11 | < 0.001 |
| | Level 11 vs. Level 12 | 40.16 | 1 | 40.16 | 42.32 | < 0.001 |
| | Level 12 vs. Level 13 | 22.59 | 1 | 22.59 | 22.95 | < 0.001 |
| | Level 13 vs. Level 14 | 5.19 | 1 | 5.19 | 6.56 | 0.012 |
| | Level 14 vs. Level 15 | 2.83 | 1 | 2.83 | 2.04 | 0.156 |
| | Level 15 vs. Level 16 | 5.19 | 1 | 5.19 | 5.58 | 0.020 |
| | Level 16 vs. Level 17 | 3.92 | 1 | 3.92 | 5.21 | 0.025 |
| | Level 17 vs. Level 18 | 0.16 | 1 | 0.16 | 0.40 | 0.530 |
| | Level 18 vs. Level 19 | 8.82 | 1 | 8.82 | 8.32 | 0.005 |
| Error (Items) | Level 1 vs. Level 2 | 47.58 | 101 | 0.47 | | |
| | Level 2 vs. Level 3 | 90.82 | 101 | 0.90 | | |
| | Level 3 vs. Level 4 | 140.91 | 101 | 1.40 | | |
| | Level 4 vs. Level 5 | 214.99 | 101 | 2.20 | | |
| | Level 5 vs. Level 6 | 261.29 | 101 | 2.59 | | |

| | | | | | |
|---|---|---|---|---|---|
| | Level 6 vs. Level 7 | 183.65 | 101 | 1.82 | |
| | Level 7 vs. Level 8 | 207.15 | 101 | 2.05 | |
| | Level 8 vs. Level 9 | 158.09 | 101 | 1.57 | |
| | Level 9 vs. Level 10 | 102.17 | 101 | 1.01 | |
| | Level 10 vs. Level 11 | 86.71 | 101 | 0.86 | |
| | Level 11 vs. Level 12 | 95.84 | 101 | 0.95 | |
| | Level 12 vs. Level 13 | 99.41 | 101 | 0.98 | |
| | Level 13 vs. Level 14 | 79.81 | 101 | 0.79 | |
| | Level 14 vs. Level 15 | 140.17 | 101 | 1.39 | |
| | Level 15 vs. Level 16 | 93.81 | 101 | 0.93 | |
| | Level 16 vs. Level 17 | 76.08 | 101 | 0.75 | |
| | Level 17 vs. Level 18 | 39.84 | 101 | 0.39 | |
| | Level 18 vs. Level 19 | 107.18 | 101 | 1.06 | |

### A.8.2 MANOVA: How Different Perspectives Affected Participants' Responses

- **How university affected the responses**

| **Between-Subjects Factors** | | |
|---|---|---|
| | **University** | **N** |
| 1 | King Saud University | 24 |
| 2 | Princess Nora bint Abdul Rahman University | 38 |
| 3 | King Abdulaziz University | 40 |

| **Descriptive Statistics** | | | | |
|---|---|---|---|---|
| | **University** | **Mean** | **Std. Deviation** | **N** |
| Perceived Usefulness | King Saud University | 4.38 | 0.71 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.08 | 0.59 | 38 |
| | King Abdulaziz University | 4.30 | 0.61 | 40 |
| | Total | 4.24 | 0.63 | 102 |
| Perceived Ease of Use | King Saud University | 4.67 | 0.57 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.47 | 0.57 | 38 |
| | King Abdulaziz University | 4.43 | 0.59 | 40 |
| | Total | 4.50 | 0.56 | 102 |
| Computer Self-Efficacy (1) | King Saud University | 3.67 | 0.48 | 24 |
| | Princess Nora bint Abdul Rahman University | 3.61 | 0.60 | 38 |
| | King Abdulaziz University | 3.45 | 0.60 | 40 |
| | Total | 3.56 | 0.57 | 102 |
| Computer Self-Efficacy (2) | King Saud University | 4.54 | 0.60 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.21 | 0.66 | 38 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **University** | **Mean** | **Std. Deviation** | **N** |
| | King Abdulaziz University | 4.37 | 0.77 | 40 |
| | Total | 4.35 | 0.70 | 102 |
| Social and Cultural Influence (Lecturer) | King Saud University | 3.75 | 0.68 | 24 |
| | Princess Nora bint Abdul Rahman University | 3.45 | 0.69 | 38 |
| | King Abdulaziz University | 3.55 | 0.64 | 40 |
| | Total | 3.56 | 0.67 | 102 |
| Social and Cultural Influence (Friends) | King Saud University | 3.96 | 0.55 | 24 |
| | Princess Nora bint Abdul Rahman University | 3.87 | 0.62 | 38 |
| | King Abdulaziz University | 4.00 | 0.39 | 40 |
| | Total | 3.94 | 0.52 | 102 |

Appendix A

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | University | Mean | Std. Deviation | N |
| Social and Cultural Influence (University culture) | King Saud University | 4.08 | 0.65 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.03 | 0.72 | 38 |
| | King Abdulaziz University | 4.03 | 0.77 | 40 |
| | Total | 4.04 | 0.72 | 102 |
| Facilitating Examination (Training) | King Saud University | 4.29 | 0.62 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.16 | 0.68 | 38 |
| | King Abdulaziz University | 4.33 | 0.83 | 40 |
| | Total | 4.25 | 0.73 | 102 |
| Facilitating Examination (Support during exam) | King Saud University | 4.21 | 0.72 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.16 | 0.75 | 38 |
| | King Abdulaziz University | 4.05 | 0.71 | 40 |
| | Total | 4.13 | 0.73 | 102 |
| Facilitating Examination (University environment) | King Saud University | 4.54 | 0.66 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.63 | 0.59 | 38 |
| | King Abdulaziz University | 4.73 | 0.51 | 40 |
| | Total | 4.65 | 0.57 | 102 |
| Content (Course) | King Saud University | 4.25 | 0.53 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.11 | 0.73 | 38 |
| | King Abdulaziz University | 4.00 | 0.78 | 40 |
| | Total | 4.10 | 0.71 | 102 |
| Content (Questions type 1) | King Saud University | 4.50 | 0.51 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.42 | 0.50 | 38 |
| | King Abdulaziz University | 4.60 | 0.59 | 40 |
| | Total | 4.51 | 0.54 | 102 |
| Content (Questions type 2) | King Saud University | 4.25 | 0.74 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.24 | 0.71 | 38 |
| | King Abdulaziz University | 4.35 | 0.62 | 40 |
| | Total | 4.28 | 0.68 | 102 |
| Content (Immediate feedback) | King Saud University | 4.38 | 0.65 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.11 | 0.89 | 38 |
| | King Abdulaziz University | 4.10 | 0.90 | 40 |
| | Total | 4.17 | 0.85 | 102 |
| Content (Sufficient feedback) | King Saud University | 4.54 | 0.51 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.58 | 0.50 | 38 |
| | King Abdulaziz University | 4.48 | 0.51 | 40 |
| | Total | 4.53 | 0.50 | 102 |
| Accessibility (1) | King Saud University | 4.63 | 0.50 | 24 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **University** | **Mean** | **Std. Deviation** | **N** |
| | Princess Nora bint Abdul Rahman University | 4.39 | 0.64 | 38 |
| | King Abdulaziz University | 4.58 | 0.68 | 40 |
| | Total | 4.52 | 0.63 | 102 |
| Accessibility (2) | King Saud University | 4.75 | 0.44 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.53 | 0.52 | 38 |
| | King Abdulaziz University | 4.58 | 0.55 | 40 |
| | Total | 4.60 | 0.51 | 102 |
| Attitude | King Saud University | 4.42 | 0.78 | 24 |
| | Princess Nora bint Abdul Rahman University | 4.37 | 0.71 | 38 |
| | King Abdulaziz University | 4.32 | 0.83 | 40 |
| | Total | 4.36 | 0.77 | 102 |

| Multivariate Tests[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Intercept | Pillai's Trace | 0.10 | 2123.19[b] | 18 | 82 | < 0.001 |
| | Wilks' Lambda | 0.00 | 2123.19[b] | 18 | 82 | < 0.001 |
| | Hotelling's Trace | 466.07 | 2123.19[b] | 18 | 82 | < 0.001 |
| | Roy's Largest Root | 466.07 | 2123.19[b] | 18 | 82 | < 0.001 |
| University | Pillai's Trace | 0.35 | 0.99 | 36 | 166 | 0.492 |
| | Wilks' Lambda | 0.68 | 0.98[b] | 36 | 164 | 0.508 |
| | Hotelling's Trace | 0.43 | 0.97 | 36 | 162 | 0.524 |
| | Roy's Largest Root | 0.25 | 1.13[c] | 18 | 83 | 0.338 |

a. Design: Intercept + University
b. Exact statistic
c. The statistic is an upper bound on F that yields a lower bound on the significance level.

- **How discipline affected the responses**

| Between-Subjects Factors | | |
|---|---|---|
| | **Discipline** | **N** |
| 1 | Social Science (SS) | 38 |
| 2 | Natural Science (NS) | 64 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Discipline** | **Mean** | **Std. Deviation** | **N** |
| Perceived Usefulness | SS | 4.21 | 0.70 | 38 |
| | NS | 4.25 | 0.59 | 64 |
| | Total | 4.24 | 0.63 | 102 |
| Perceived Ease of Use | SS | 4.53 | 0.56 | 38 |
| | NS | 4.48 | 0.56 | 64 |
| | Total | 4.50 | 0.56 | 102 |
| Computer Self-Efficacy (1) | SS | 3.63 | 0.49 | 38 |
| | NS | 3.52 | 0.62 | 64 |
| | Total | 3.56 | 0.57 | 102 |
| Computer Self-Efficacy (2) | SS | 4.42 | 0.64 | 38 |
| | NS | 4.31 | 0.73 | 64 |
| | Total | 4.35 | 0.70 | 102 |
| Social and Cultural Influence (Lecturer) | SS | 3.63 | 0.63 | 38 |
| | NS | 3.52 | 0.69 | 64 |
| | Total | 3.56 | 0.70 | 102 |
| Social and Cultural Influence (Friends) | SS | 3.87 | 0.53 | 38 |
| | NS | 3.98 | 0.52 | 64 |
| | Total | 3.94 | 0.52 | 102 |
| Social and Cultural Influence (University culture) | SS | 4.00 | 0.70 | 38 |
| | NS | 4.06 | 0.73 | 64 |
| | Total | 4.04 | 0.72 | 102 |
| Facilitating Examination (Training) | SS | 4.21 | 0.78 | 38 |
| | NS | 4.28 | 0.70 | 64 |
| | Total | 4.25 | 0.73 | 102 |
| Facilitating Examination (Support during exam) | SS | 4.21 | 0.70 | 38 |
| | NS | 4.08 | 0.74 | 64 |
| | Total | 4.13 | 0.73 | 102 |
| Facilitating Examination (University environment) | SS | 4.61 | 0.60 | 38 |
| | NS | 4.67 | 0.57 | 64 |
| | Total | 4.65 | 0.57 | 102 |
| Content (Course) | SS | 4.16 | 0.59 | 38 |
| | NS | 4.06 | 0.77 | 64 |
| | Total | 4.10 | 0.71 | 102 |
| Content (Questions type 1) | SS | 4.53 | 0.51 | 38 |
| | NS | 4.39 | 0.66 | 64 |
| | Total | 4.44 | 0.61 | 102 |
| Content (Questions type 2) | SS | 4.24 | 0.71 | 38 |
| | NS | 4.31 | 0.66 | 64 |
| | Total | 4.28 | 0.68 | 102 |
| Content (Immediate feedback) | SS | 4.29 | 0.80 | 38 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Discipline** | **Mean** | **Std. Deviation** | **N** |
| | NS | 4.09 | 0.87 | 64 |
| | Total | 4.17 | 0.85 | 102 |
| Content (Sufficient feedback) | SS | 4.61 | 0.50 | 38 |
| | NS | 4.48 | 0.50 | 64 |
| | Total | 4.53 | 0.50 | 102 |
| Accessibility (1) | SS | 4.50 | 0.60 | 38 |
| | NS | 4.47 | 0.73 | 64 |
| | Total | 4.48 | 0.69 | 102 |
| Accessibility (2) | SS | 4.61 | 0.60 | 38 |
| | NS | 4.53 | 0.59 | 64 |
| | Total | 4.56 | 0.59 | 102 |
| Attitude | SS | 4.32 | 0.81 | 38 |
| | NS | 4.39 | 0.75 | 64 |
| | Total | 4.36 | 0.77 | 102 |

| Multivariate Tests[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Intercept | Pillai‘s Trace | 0.10 | 1801.03[b] | 18 | 83 | < 0.001 |
| | Wilks‘ Lambda | 0.00 | 1801.03[b] | 18 | 83 | < 0.001 |
| | Hotelling‘s Trace | 390.59 | 1801.03[b] | 18 | 83 | < 0.001 |
| | Roy‘s Largest Root | 390.59 | 1801.03[b] | 18 | 83 | < 0.001 |
| Discipline | Pillai‘s Trace | 0.12 | 0.60[b] | 18 | 83 | 0.889 |
| | Wilks‘ Lambda | 0.89 | 0.06[b] | 18 | 83 | 0.889 |
| | Hotelling‘s Trace | 0.13 | 0.60[b] | 18 | 83 | 0.889 |
| | Roy‘s Largest Root | 0.13 | 0.60[b] | 18 | 83 | 0.889 |

a. Design: Intercept + Discipline
b. Exact statistic

- **How gender affected the responses**

| Between-Subjects Factors | | |
|---|---|---|
| | **Gender** | **N** |
| 1 | Male | 16 |
| 2 | Female | 86 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Gender** | **Mean** | **Std. Deviation** | **N** |
| Perceived Usefulness | Male | 4.31 | 0.70 | 16 |
| | Female | 4.22 | 0.62 | 86 |
| | Total | 4.24 | 0.63 | 102 |
| Perceived Ease of Use | Male | 4.69 | 0.60 | 16 |
| | Female | 4.47 | 0.55 | 86 |
| | Total | 4.50 | 0.56 | 102 |
| Computer Self-Efficacy (1) | Male | 3.69 | 0.48 | 16 |
| | Female | 3.53 | 0.59 | 86 |
| | Total | 3.56 | 0.57 | 102 |
| Computer Self-Efficacy (2) | Male | 4.50 | 0.63 | 16 |
| | Female | 4.33 | 0.71 | 86 |
| | Total | 4.35 | 0.70 | 102 |
| Social and Cultural Influence (Lecturer) | Male | 3.56 | 0.63 | 16 |
| | Female | 3.56 | 0.68 | 86 |
| | Total | 3.56 | 0.67 | 102 |
| Social and Cultural Influence (Friends) | Male | 3.81 | 0.40 | 16 |
| | Female | 3.73 | 0.64 | 86 |
| | Total | 3.75 | 0.61 | 102 |
| Social and Cultural Influence (University culture) | Male | 4.00 | 0.63 | 16 |
| | Female | 4.05 | 0.73 | 86 |
| | Total | 4.04 | 0.72 | 102 |
| Facilitating Examination (Training) | Male | 4.50 | 0.52 | 16 |
| | Female | 4.21 | 0.75 | 86 |
| | Total | 4.25 | 0.73 | 102 |
| Facilitating Examination (Support during exam) | Male | 4.19 | 0.75 | 16 |
| | Female | 4.12 | 0.73 | 86 |
| | Total | 4.13 | 0.73 | 102 |
| Facilitating Examination (University environment) | Male | 4.50 | 0.73 | 16 |
| | Female | 4.67 | 0.54 | 86 |
| | Total | 4.65 | 0.57 | 102 |
| Content (Course) | Male | 4.31 | 0.48 | 16 |
| | Female | 4.06 | 0.74 | 86 |
| | Total | 4.10 | 0.71 | 102 |
| Content (Questions type 1) | Male | 4.56 | 0.51 | 16 |
| | Female | 4.42 | 0.62 | 86 |
| | Total | 4.44 | 0.61 | 102 |
| Content (Questions type 2) | Male | 4.13 | 0.81 | 16 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Gender** | **Mean** | **Std. Deviation** | **N** |
| | Female | 4.31 | 0.66 | 86 |
| | Total | 4.28 | 0.68 | 102 |
| Content (Immediate feedback) | Male | 4.31 | 0.70 | 16 |
| | Female | 4.14 | 0.87 | 86 |
| | Total | 4.17 | 0.85 | 102 |
| Content (Sufficient feedback) | Male | 4.50 | 0.52 | 16 |
| | Female | 4.34 | 0.64 | 86 |
| | Total | 4.36 | 0.63 | 102 |
| Accessibility (1) | Male | 4.69 | 0.48 | 16 |
| | Female | 4.44 | 0.71 | 86 |
| | Total | 4.48 | 0.69 | 102 |
| Accessibility (2) | Male | 4.75 | 0.45 | 16 |
| | Female | 4.52 | 0.61 | 86 |
| | Total | 4.56 | 0.59 | 102 |
| Attitude | Male | 4.38 | 0.81 | 16 |
| | Female | 4.36 | 0.77 | 86 |
| | Total | 4.36 | 0.77 | 102 |

| Multivariate Tests[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Intercept | Pillai's Trace | 0.99 | 700.11[b] | 18 | 83 | < 0.001 |
| | Wilks' Lambda | 0.06 | 700.11[b] | 18 | 83 | < 0.001 |
| | Hotelling's Trace | 151.83 | 700.11[b] | 18 | 83 | < 0.001 |
| | Roy's Largest Root | 151.83 | 700.11[b] | 18 | 83 | < 0.001 |
| Gender | Pillai's Trace | 0.16 | 0.86[b] | 18 | 83 | 0.622 |
| | Wilks' Lambda | 0.84 | 0.86[b] | 18 | 83 | 0.622 |
| | Hotelling's Trace | 0.19 | 0.86[b] | 18 | 83 | 0.622 |
| | Roy's Largest Root | 0.19 | 0.86[b] | 18 | 83 | 0.622 |

a. Design: Intercept + Gender
b. Exact statistic

- **How experience affected the responses**

| Between-Subjects Factors | | |
|---|---|---|
| | **Experience** | **N** |
| 1 | Used e-assessment before | 48 |
| 2 | Not used e-assessment before | 54 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Experience** | **Mean** | **Std. Deviation** | **N** |
| Perceived Usefulness | Used | 4.27 | 0.71 | 48 |
| | Not used | 4.20 | 0.56 | 54 |
| | Total | 4.24 | 0.63 | 102 |
| Perceived Ease of Use | Used | 4.54 | 0.54 | 48 |
| | Not used | 4.46 | 0.57 | 54 |
| | Total | 4.50 | 0.56 | 102 |
| Computer Self-Efficacy (1) | Used | 3.62 | 0.49 | 48 |
| | Not used | 3.50 | 0.64 | 54 |
| | Total | 3.56 | 0.57 | 102 |
| Computer Self-Efficacy (2) | Used | 4.33 | 0.66 | 48 |
| | Not used | 4.37 | 0.73 | 54 |
| | Total | 4.35 | 0.70 | 102 |
| Social and Cultural Influence (Lecturer) | Used | 3.62 | 0.67 | 48 |
| | Not used | 3.50 | 0.67 | 54 |
| | Total | 3.56 | 0.67 | 102 |
| Social and Cultural Influence (Friends) | Used | 3.88 | 0.57 | 48 |
| | Not used | 4.00 | 0.48 | 54 |
| | Total | 3.94 | 0.52 | 102 |
| Social and Cultural Influence (University culture) | Used | 4.06 | 0.67 | 48 |
| | Not used | 4.02 | 0.77 | 54 |
| | Total | 4.04 | 0.72 | 102 |
| Facilitating Examination (Training) | Used | 4.27 | 0.64 | 48 |
| | Not used | 4.24 | 0.80 | 54 |
| | Total | 4.25 | 0.73 | 102 |
| Facilitating Examination (Support during exam) | Used | 4.21 | 0.71 | 48 |
| | Not used | 4.06 | 0.74 | 54 |
| | Total | 4.13 | 0.73 | 102 |
| Facilitating Examination (University environment) | Used | 4.60 | 0.61 | 48 |
| | Not used | 4.69 | 0.54 | 54 |
| | Total | 4.65 | 0.57 | 102 |
| Content (Course) | Used | 4.21 | 0.62 | 48 |
| | Not used | 4.00 | 0.78 | 54 |
| | Total | 4.10 | 0.71 | 102 |

| | | | | |
|---|---|---|---|---|
| Content (Questions type 1) | Used | 4.40 | 0.61 | 48 |
| | Not used | 4.48 | 0.61 | 54 |
| | Total | 4.44 | 0.61 | 102 |
| Content (Questions type 2) | Used | 4.27 | 0.71 | 48 |
| | Not used | 4.30 | 0.66 | 54 |
| | Total | 4.28 | 0.68 | 102 |
| Content (Immediate feedback) | Used | 4.29 | 0.77 | 48 |
| | Not used | 4.06 | 0.90 | 54 |
| | Total | 4.17 | 0.85 | 102 |
| Content (Sufficient feedback) | Used | 4.54 | 0.50 | 48 |
| | Not used | 4.44 | 0.50 | 54 |
| | Total | 4.49 | 0.50 | 102 |
| Accessibility (1) | Used | 4.50 | 0.62 | 48 |
| | Not used | 4.46 | 0.75 | 54 |
| | Total | 4.48 | 0.69 | 102 |
| Accessibility (2) | Used | 4.56 | 0.62 | 48 |
| | Not used | 4.56 | 0.57 | 54 |
| | Total | 4.56 | 0.59 | 102 |
| Attitude | Used | 4.44 | 0.71 | 48 |
| | Not used | 4.30 | 0.82 | 54 |
| | Total | 4.36 | 0.77 | 102 |

**Multivariate Tests**[a]

| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
|---|---|---|---|---|---|---|
| Intercept | Pillai‘s Trace | 0.10 | 1781.87[b] | 18 | 83 | <0.001 |
| | Wilks‘ Lambda | 0.00 | 1781.87[b] | 18 | 83 | <0.001 |
| | Hotelling‘s Trace | 386.43 | 1781.87[b] | 18 | 83 | <0.001 |
| | Roy‘s Largest Root | 386.43 | 1781.87[b] | 18 | 83 | <0.001 |
| Experience | Pillai‘s Trace | 0.12 | 0.65[b] | 18 | 83 | 0.851 |
| | Wilks‘ Lambda | 0.88 | 0.65[b] | 18 | 83 | 0.851 |
| | Hotelling‘s Trace | 0.14 | 0.65[b] | 18 | 83 | 0.851 |
| | Roy‘s Largest Root | 0.14 | 0.65[b] | 18 | 83 | 0.851 |

a. Design: Intercept + Experience
b. Exact statistic

# Appendix B Questionnaire Development

## B.1 Participant Information Sheet

UNIVERSITY OF Southampton

**ورقة معلومات المشاركين**

**Study Title:** An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context.

**عنوان الدراسة:** دراسة العوامل المؤثرة في اتجاه الطلاب نحو التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.

**Researcher name:** Someah Alangari **الباحث:** سمية العنقري

**Ethics reference:** 30943 **رقم الأخلاقيات:** 30943

**Please read this information carefully before deciding to take part in this research. If you are happy to participate, you will be asked to sign a consent form.**

**يرجى قراءة هذه المعلومات بعناية قبل اتخاذ القرار بالمشاركة في هذا البحث. إذا كنت سعيداً بالمشاركة سوف يطلب منك التوقيع على استماره الموافقة.**

**What is the research about?**

The aim of this study is to investigate the factors that influence students' attitude towards summative e-assessment in Saudi Arabian universities. This research is under the auspices of the School of Electronics and Computer Science, University of Southampton, UK.

**ماذا عن هذا البحث؟**

يهدف هذا البحث إلى استكشاف العوامل المؤثره على اتجاهات الطلبة نحو الإختبارات اللإلكترونية في الجامعات السعودية. تحديد هذه العوامل تساعد الجامعات في على تعزيز طرق التقييم ونجاح تطبيق الإختبارات الإلكترونية ورضا الطلبة. هذا البحث تحت إشراف كليه علوم الحاسوب بجامعه ساوثهامبتون ، المملكه المتحدة ، ويتم تمويلة بالكامل من قبل الملحقية الثقافية السعودية.

**Why have I been chosen?**

I invite you to participate in this study focused on students' attitude towards summative e-assessment. Your opinion will help in reviewing a questionnaire for investigation of the attitude of students towards summative e-assessment in a Saudi Arabian universities context.

**لماذا تم اختياري؟**

تم اختيارك للمشاركة في هذه الدراسة لأن رأيك سوف يساعد في هذه الدراسة التي تهدف إلى تحديد اتجاهات الطلبة تجاه الإختبارات الإلكترونية في الجامعات السعودية.

**What will happen to me if I take part?**

I will send you the link to the questionnaire, and then the study will begin. The questionnaire will take about 10 minutes to complete.

**ماذا سيحث لي إذا شاركت؟**

سوف اقوم بإرسال رابط للاستبيان ، الاستبيان يستغرق 10 دقائق.

**Are there any benefits in my taking part?**

This research is not designed to help you personally, but your feedback will help me gather educationalist opinions on the development efforts.

**هل هناك أي فوائد عند مشاركتي؟**

هذه الدراسة لم تصمم لمساعدتك شخصياً ، ولكن رأيك سيسهم في تطوير الدراسة لهدف دعم الجامعات السعودية بنتيجة هذه الدراسة.

**Are there any risks involved?**

No.

**هل هناك أي مخاطر؟**

لا

**Will my participation be confidential?**

Yes. Your information will be stored and used on secure systems and will be used for this study purposes only, and your responses are voluntary and will be confidential. Individual responses will not be identified. All responses will be compiled together and analysed as a group.

**هل ستكون مشاركتي سرية؟**

نعم. سيتم الإحتفاظ بالمعلومات التي تقدمها للبحث في سرية تامة مجهولة. سيتم تخزين المعلومات الخاصة بك على أنظمة امنة وسوف تستخدم لأغراض الرسالة فقط.

**What happens if I change my mind?**

You have the right to terminate your participation in the research at any stage, without giving any reasons, and without your legal rights being affected. Your data will be deleted directly if you decide to withdraw at any time.

**ماذا سيحدث إذا قمت بتغيير رأيي؟**

لديك الحق في الإنسحاب في أي مرحلة دون الحاجة إلى إعطاء أسباب وبدون أي عقوبة و سيتم حذف معلوماتك التي قدمتها.

**ماذا يحدث إذا حدث خطأ ما؟**

في حالة القلق يرجى الإتصال بمدير إدارة البحوث.

**What happens if something goes wrong?**

In the unlikely case of concern or complaint, please contact Research Governance Manager (02380 595058, rgoinfo@soton.ac.uk).

**Where can I get more information?**

**أين يمكنني الحصول على مزيد من المعلومات؟**

لمزيد من المعلومات يرجى الاتصال بي أو بالمشرفين على دراستي:

For further details, please contact either myself or my study Supervisors, Dr. Gary Wills and Prof. Mike Wald
Researcher: sssa1e13@ecs. soton.ac.uk

Gary Wills: gbw@ecs.soton.ac.uk Mike Wald: mw@ecs.soton.ac.uk

## B.2 Consent Form

UNIVERSITY OF Southampton

**نموذج الموافقة**

**Study title**: An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context.

**عنوان الدراسة:** دراسة العوامل المؤثرة في اتجاه الطلاب نحو التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.

**Researcher name:** Someah Alangari **الباحث:** سمية العنقري

**Ethics reference:** 30943 **رقم الأخلاقيات:** 30943

**Please initial the boxes if you agree with the statements.**

**يرجى التأشير في المربع أدناه إذا كنت توافق على العبارة:**

| | |
|---|---|
| I have read and understood the information sheet (*2017/10/25/version 1*) and have had the opportunity to ask questions about the study.<br>لقد قرأت ورقة المعلومات( النسخة رقم 1، تاريخ: 25 اكتوبر 2017) وأتيحت لي الفرصة لطرح أسأله حول الدراسة. | |
| I agree to take part in this research project and agree for my data to be used for the purpose of this study.<br>أوافق على المشاركة في هذا المشروع البحثي وأوافق على استخدام البيانات الخاصة بي للغرض من هذه الدراسة. | |
| I understand my participation is voluntary and I may withdraw at any time for any reason without my rights being affected.<br>أنا أفهم أن مشاركتي تطوعيه وأنني أستطيع الإنسحاب في أي وقت دون أن تتأثر حقوقي القانونية. | |

**Print Name of participant ..... إسم المشارك**

**Signature of participant ..... توقيع المشارك**

**Date ..... التاريخ**

## B.3 Questionnaire for Experts

شكرًا على موافقتك على المشاركة في مراجعة هذا الاستبيان حول العوامل التي تؤثر على موقف الطلاب من استخدام التقييم الإلكتروني (في التقييم النهائي) في سياق الجامعات السعودية التي أقوم بتطويرها. تتضمن الجداول المرفقة وصفًا لمشروع البحث وتعريفات هذه العوامل، ثم قائمة أسئلة حول كل عنصر من العناصر في الاستطلاع. يرجى البدء بتوقيع نموذج الموافقة والتعريف بمعلومات البحث هذه وتعريفات العوامل، ثم مراجعة العناصر لاستكمال التحقق من المحتوى. يرجى وضع نفسك في موقف الطلاب للإجابة على الأسئلة التالية.

Thanks for agreeing to participate in reviewing this questionnaire on the factors affecting the attitude of students towards using summative e-assessment in a Saudi Arabian universities context that I am developing. The tables attached comprise a description of the research project, the factor definitions, and then a list of questions about each of the items in the survey. Please begin by signing the consent form, familiarising yourself with this background information and the factors definitions, and then review the items for completing the content validation.

| No | **To what extent do you agree the following items are essential to investigation of the attitude of students towards summative e-assessment. Please put yourself in the students' position to answer the following questions.** | **Essential** | **Useful but Not Essential** | **Not Necessary** |
|---|---|---|---|---|
| **Perceived Usefulness** | | | | |
| **1** | أجد أن استخدام الإختبارات الإلكترونية مفيدة في تخصصي الجامعي.<br>Using e-assessment is useful on my course. | ☐<br>Comment: | ☐ | ☐ |
| **2** | أعتقد ان الإختبارات الإلكترونية تساعد في تحسين دراستي.<br>E-assessment helps improve my learning | ☐<br>Comment: | ☐ | ☐ |
| **3** | التقييم الإلكتروني يعزز جودة التعلم.<br>E-assessment enhances the quality of learning. | ☐<br>Comment: | ☐ | ☐ |
| **4** | أجد أن الإختبارات الإلكترونية تزودني بالتغذية الراجعة السريعة التي تساعدني كثيرا في دراستي.<br>E-assessment gives me quick feedback, which helps me in my course. | ☐<br>Comment: | ☐ | ☐ |
| **5** | يسمح لي التقييم الإلكتروني بإثبات معرفتي بطرق أكثر من الامتحانات الورقية.<br>E-assessment allows me to demonstrate my knowledge in more ways than paper-based exams. | ☐<br>Comment: | ☐ | ☐ |
| **6** | يمكن للتقييم الإلكتروني أن يفعل أشياء لا تستطيع الاختبارات الورقية القيام بها.<br>E-assessment can do things paper-based exams cannot. | ☐<br>Comment: | ☐ | ☐ |
| **7** | أعتقد أن الإختبارات الإلكترونية هي أكثر فائدة لي من الإختبار الورقي.<br>E-assessment is more useful than paper and pencil testing. | ☐<br>Comment: | ☐ | ☐ |
| **Perceived Ease of Use** | | | | |
| **8** | اجد أن تعلم استخدام نظام الإختبار الإلكتروني سهلاً بالنسبة لي.<br>Taking e-assessment is easier than a paper-based exam. | ☐<br>Comment: | ☐ | ☐ |

| | | | | |
|---|---|---|---|---|
| **9** | أنظمه الإختبارات الإلكترونية سهله الإستخدام.<br>The e-assessment systems are easy to use. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **10** | التفاعل مع أنظمة الإختبارات الإلكترونية لا يتطلب مني الكثير من الجهد الذهني.<br>Interacting with the e-assessment systems does not require a lot of mental effort. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **11** | التعليمات الخاصة بأنظمة التقييم الإلكتروني واضحة.<br>The instructions for the e-assessment systems are clear. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **12** | اجد أن تعلم استخدام نظام الإختبار الإلكتروني سهلاً بالنسبة لي.<br>Learning to use the e-assessment systems is easy for me. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **13** | من السهل التنقل في نظام التقييم الإلكتروني.<br>It is easy to navigate the e-assessment system. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Self-Efficacy** | | | | |
| **14** | أنظمه الإختبارات الإلكترونية لاتتطلب مني مهارات عاليه لإستخدامها.<br>I do not need advanced skills when I use the e-assessment system. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **15** | أستطيع استخدام أنظمه الإختبارات الإلكترونية حتى إن لم يكن لدي خبره سابقة بأنظمة مشابهة.<br>I could use the e-assessment systems even if I had no prior experience on similar system. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **16** | أنا قادر على استخدام نظام الإختبار الإلكتروني.<br>I am able to use e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **17** | يمكنني إكمال وظيفة أو مهمة باستخدام الكمبيوتر إذا أظهر أحدهم كيفية القيام بذلك أولاً.<br>I could complete a job or task using the computer if someone showed how to do it first. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **18** | كنت قادرًا تمامًا على استخدام الكمبيوتر قبل استخدام التقييم الإلكتروني.<br>I was fully able to use the computer before I used e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **19** | بإمكاني أن استخدم نظام الإختبارات الإلكترونية بدون أي مساعده.<br>I can use the e-assessment system without any assistance. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Social Influence** | | | | |
| **20** | وجهه نظر أصدقائي تجاه الإختبارات الإلكترونية مهمه بالنسبه لي.<br>The opinion of my friends about e-assessment is important to me. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **21** | موظفي الدعم الفني في الجامعه يساعدون في استخدام الإختبارات الإلكترونية.<br>The IT support at my university is helpful in the use of e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **22** | الأساتذه في جامعتي يدعمون الطلاب عند إجراء الإختبارات الإلكترونية.<br>My teacher is very supportive of the use of e-assessment in my university. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **23** | الإدارة في الجامعة تساعد في استخدام نظام التقييم الإلكتروني. | ☐ | ☐ | ☐ |
| | | Comment: | | |

| | | | | |
|---|---|---|---|---|
| | The senior management in the university is helpful in the use of the e-assessment system. | | | |
| **24** | بشكل عام أرى أن جامعتي تؤيد استخدام الإختبارات الإلكترونية.<br>In general, my university has supported the use of e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Facilitating of Examination** | | | | |
| **25** | عندما أحتاج إلى مساعدة أثناء إجراء الإختبار الإلكتروني، أجد شخص ما لمساعدتي.<br>When I need help during the e-assessment exam, someone is there to help me. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **26** | فريق الدعم الفني متواجدين في أي وقت لمساعدتي في استخدام نظام الإختبارات الإلكترونية.<br>Support staff are available to help me at any time I use e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **27** | التدريب على التقييم الإلكتروني متاحة لي قبل الاختبار.<br>An e-assessment training course is available to me before an exam. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **28** | دليل إرشادات عبر الإنترنت لاستخدام التقييم الإلكتروني متاح لي في أي وقت.<br>An online instruction guideline for using e-assessment is available to me any time. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **29** | التدريب على التقييم الإلكتروني واضحة.<br>The e-assessment training course is clear. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **30** | استعدادات الجامعة (أجهزه, برامج, شبكات)عامل مهم بالنسبه لي لقبول الإختبارات الالكترونية<br>University preparation, such as computer hardware and communications network, was sufficient for the e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **31** | بشكل عام أرى أن البنيه التحتية للجامعة كافية لإجراء الإختبارات الإلكترونية.<br>Overall, the e-assessment environment infrastructure at my university is efficient. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **32** | أتلقى مساعدة من الدعم الفني لتكنولوجيا المعلومات أثناء إجراء التقييم الإلكتروني.<br>I receive help from IT technical support while doing e- assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **33** | أتلقى مساعدة من المدرس أثناء قيامي بالتقييم الإلكتروني.<br>I receive help from my instructor while doing e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **34** | عادة، أحتاج إلى مساعدة عند استخدام نظام الإختبار الإلكتروني للمرة الأولى.<br>Usually, I need assistance when using e-assessment for the first time. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Content** | | | | |
| **35** | أعتقد أن الإختبارات الإلكتروني مناسب لجميع المواد الدراسية.<br>E-assessment is appropriate for all subjects. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **36** | الإختبار الإلكتروني مفيد لبعض االمواد الدراسية عن غيرها.<br>E-assessment is more useful for some courses than others. | ☐ | ☐ | ☐ |
| | | Comment: | | |

| | | | | |
|---|---|---|---|---|
| **37** | مجال موضوعي معقد للغاية بحيث لا يمكن التعامل معه عن طريق أسئلة متعددة الخيارات عبر الإنترنت.<br>My subject area is too complex to be dealt with by online multiple-choice questions. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **38** | التقييم الإلكتروني يساعد على استخراج النتائج بسرعة.<br>E-assessment helps extract results quickly. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **39** | أجد أن التغذية الراجعة في الإختبار الإلكتروني كافية.<br>The feedback I have received from e-assessment is sufficient. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **40** | سأكون قادرًا على كتابة الإجابات في التقييم الإلكتروني.<br>I would like to be able to type answers in e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **41** | يجب أن يتضمن الإختبار الإلكتروني مجموعة متنوعة من الأسئلة من أجل اختبار معرفتي بشكل كامل.<br>E-assessment needs to include a variety of question types in order to test my knowledge fully. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **42** | أسئلة التقييم الإلكتروني مفيدة لتخصصي.<br>E-assessment questions are useful for my course. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **43** | تؤثر سرعة الكتابة الخاصة بي بشكل كبير على وقت الانتهاء.<br>My typing speed significantly influences my completion time. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **44** | محتوى التغذية الراجعة في الاختبار الإلكتروني يساهم في تحسين مستواي الدراسي.<br>The content of feedback in e-assessment improves my learning. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Accessibility** | | | | |
| **45** | أعتقد أن الإختبار الإلكتروني مناسب لجميع الطلاب.<br>E-assessment is appropriate for all students. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **46** | الإختبارات الإلكترونية هي أكثر ملائمة لجميع الطلاب من الاختبارات الورقية.<br>E-assessment is more accessible than paper-based exams. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **47** | توفر جامعتي تقنيات مساعدة مثل قراء الشاشة للطلاب ذوي الاحتياجات الخاصة لمساعدتهم على إجراء الإختبار الإلكتروني.<br>My university provides an assistive technology, such as screen readers, for students with special needs to help them take e-assessment. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **48** | من المهم تقديم أسئلة بتنسيقات مختلفة ، على سبيل المثال الصور والصوت والفيديو للطلاب ذوي الاحتياجات الخاصة.<br>It is important to present questions in different formats, e.g. images, audio and video, for students with special needs. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **49** | الإختبارات الإلكترونية هي أكثر ملائمة لجميع الطلاب من الاختبارات الورقية.<br>E-assessment favours some students more than others. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **50** | التقييم الإلكتروني سهل القراءة على الشاشة.<br>E-assessment is easy to read on the screen. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **51** | | ☐ | ☐ | ☐ |

| | | | | |
|---|---|---|---|---|
| | من المهم أن تكون عمليات ضبط حجم النص والتباين متوفرة في أنظمة الأختبارات الإلكترونيه لمساعدة المشاركين ذوي الرؤية المنخفضة / الجزئية.<br>Text-sizing and contrast controls within assessments are important to aid participants with low/partial vision. | Comment: | | |
| **52** | يعد التنقل بين التقييمات عبر لوحة المفاتيح و / أو الأجهزة البديلة ، لاستيعاب المشاركين الذين لا يستطيعون استخدام الماوس ، مهمًا لتلبية احتياجات المشاركين ذوي الإعاقة.<br>Navigation of assessments via keyboard and/or alternate devices, to accommodate participants who are unable to use a mouse, is important to meet the needs of participants with disabilities. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **Attitude** | | | | |
| **53** | أرى أن قرار استخدام الإختبارات الإلكترونية قرار إيجابي.<br>I consider the decision to use e-assessment is a positive one. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **54** | أحب فكرة استخدام التقييم الإلكتروني في جامعتي.<br>I like the idea of using e-assessment at my university. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **55** | أود أن أرى الإختبار الإلكتروني ينفذ في المواد الدراسية الأخرى.<br>I would like to see e-assessment implemented further in departmental modules. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **56** | بشكل عام ، يعد استخدام التقييم الإلكتروني في دراستي قرارًا حكيمًا.<br>Overall, using e-assessment in my course is a wise decision. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **57** | أفضل استخدام الكيبورد بدلاً من الكتابه باليد.<br>I prefer typing rather than handwriting answers. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **58** | بشكل عام، لدي إيجابية تجاه استخدام الإختبارات الإلكترونية.<br>In general, I was a positive towards using the e-assessment system. | ☐ | ☐ | ☐ |
| | | Comment: | | |
| **59** | أود أن يتم استبدال جميع الإختبارات الورقية في جامعتي بالإختبارات الإلكترونية.<br>I would like e-assessment to replace paper-based exam at university. | ☐ | ☐ | ☐ |
| | | Comment: | | |

## B.4 Experts Review Result

### B.4.1 Correlation Between Experts

| Descriptive Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| Expert 1 | 2.86 | 0.35 | 36 |
| Expert 2 | 2.86 | 0.35 | 36 |
| Expert 3 | 2.69 | 0.47 | 36 |
| Expert 4 | 2.78 | 0.42 | 36 |
| Expert 5 | 2.78 | 0.42 | 36 |
| Expert 6 | 2.75 | 0.44 | 36 |
| Expert 7 | 2.81 | 0.40 | 36 |

| Correlations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Expert 1** | **Expert 2** | **Expert 3** | **Expert 4** | **Expert 5** | **Expert 6** | **Expert 7** |
| **Expert 1** | Pearson Correlation | 1 | 0.54** | 0.43** | 0.56** | 0.75** | 0.33 | 0.61** |
| **Expert 2** | Pearson Correlation | | 1 | 0.43** | 0.17 | 0.37* | 0.51** | 0.41* |
| **Expert 3** | Pearson Correlation | | | 1 | 0.23 | 0.37* | 0.45** | 0.59** |
| **Expert 4** | Pearson Correlation | | | | 1 | 0.52** | 0.31 | 0.41* |
| **Expert 5** | Pearson Correlation | | | | | 1 | 0.31 | 0.58** |
| **Expert 6** | Pearson Correlation | | | | | | 1 | 0.37* |
| **Expert 7** | Pearson Correlation | | | | | | | 1 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | |

### B.4.2 Overall Expert Correlation

| One-Sample Statistics | | | | |
|---|---|---|---|---|
| | N | Mean | Std. Deviation | Std. Error Mean |
| Overall Expert Correlation | 21 | 0.44 | 0.14 | 0.03 |

| One-Sample Test | | | | | | |
|---|---|---|---|---|---|---|
| | Test Value = 0 | | | | | |
| | t | df | *p.* (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Overall Expert Correlation | 14.51 | 20 | <0.001 | 0.44 | 0.38 | 0.50 |

### B.4.3 Differences in Expert Means

| Expert | Dependent Variable |
|---|---|
| 1 | Expert 1 |
| 2 | Expert 2 |
| 3 | Expert 3 |
| 4 | Expert 4 |
| 5 | Expert 5 |
| 6 | Expert 6 |
| 7 | Expert 7 |

| Multivariate Tests[a] | | | | | | |
|---|---|---|---|---|---|---|
| Effect | | Value | *F* | Hypothesis df | Error df | *p* |
| Expert | Pillai's Trace | 0.21 | 1.35[b] | 6 | 30 | 0.266 |
| | Wilks' Lambda | 0.79 | 1.35[b] | 6 | 30 | 0.266 |
| | Hotelling's Trace | 0.27 | 1.35[b] | 6 | 30 | 0.266 |
| | Roy's Largest Root | 0.27 | 1.35[b] | 6 | 30 | 0.266 |
| a. Design: Intercept<br>Within Subjects Design: Expert | | | | | | |
| b. Exact statistic | | | | | | |

| Mauchly's Test of Sphericity[a] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Within Subjects Effect** | **Mauchly's W** | **Approx. Chi-Square** | **df** | ***p*** | **Epsilon[b]** | | |
| | | | | | **Greenhouse-Geisser** | **Huynh-Feldt** | **Lower-bound** |
| Expert | 0.33 | 35.99 | 20 | 0.016 | 0.76 | 0.89 | 0.17 |
| Tests the null hypothesis that the error covariance matrix of the orthonormalised transformed dependent variables is proportional to an identity matrix. | | | | | | | |
| a. Design: Intercept<br>Within Subjects Design: Expert | | | | | | | |
| b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table. | | | | | | | |

| Tests of Within-Subjects Effects | | | | | | |
|---|---|---|---|---|---|---|
| **Source** | | **Type III Sum of Squares** | **df** | **Mean Square** | ***F*** | ***p*** |
| Expert | Sphericity Assumed | 0.77 | 6 | 0.13 | 1.34 | 0.240 |
| | Greenhouse-Geisser | 0.77 | 4.56 | 0.17 | 1.34 | 0.253 |
| | Huynh-Feldt | 0.77 | 5.33 | 0.14 | 1.34 | 0.246 |
| | Lower-bound | 0.77 | 1.00 | 0.77 | 1.34 | 0.255 |
| Error (Expert) | Sphericity Assumed | 20.09 | 210 | 0.10 | | |
| | Greenhouse-Geisser | 20.09 | 159.63 | 0.13 | | |
| | Huynh-Feldt | 20.09 | 186.50 | 0.11 | | |
| | Lower-bound | 20.09 | 35.00 | 0.57 | | |

| Tests of Within-Subjects Contrasts | | | | | | |
|---|---|---|---|---|---|---|
| **Source** | **Expert** | **Type III Sum of Squares** | **df** | **Mean Square** | ***F*** | ***p*** |
| Expert | Level 1 vs. Level 2 | 0.00 | 1 | 0.00 | 0.00 | 1.000 |
| | Level 2 vs. Level 3 | 1.00 | 1 | 1.00 | 5.00 | 0.032 |
| | Level 3 vs. Level 4 | 0.25 | 1 | 0.25 | 0.81 | 0.373 |
| | Level 4 vs. Level 5 | 0.00 | 1 | 0.00 | 0.00 | 1.000 |
| | Level 5 vs. Level 6 | 0.03 | 1 | 0.03 | 0.11 | 0.744 |
| | Level 6 vs. Level 7 | 0.11 | 1 | 0.11 | 0.49 | 0.487 |
| Error (Expert) | Level 1 vs. Level 2 | 4.00 | 35 | 0.11 | | |
| | Level 2 vs. Level 3 | 7.00 | 35 | 0.20 | | |
| | Level 3 vs. Level 4 | 10.75 | 35 | 0.31 | | |
| | Level 4 vs. Level 5 | 6.00 | 35 | 0.17 | | |
| | Level 5 vs. Level 6 | 8.97 | 35 | 0.26 | | |
| | Level 6 vs. Level 7 | 7.89 | 35 | 0.23 | | |

| Tests of Between-Subjects Effects | | | | | |
|---|---|---|---|---|---|
| **Source** | **Type III Sum of Squares** | **df** | **Mean Square** | ***F*** | ***p*** |
| Intercept | 280.16 | 1 | 280.16 | 3269.20 | <0.001 |
| Error | 2.10 | 35 | 0.09 | | |

| Expert | | | | |
|---|---|---|---|---|
| **Expert** | **Mean** | **Std. Error** | **95% Confidence Interval** | |
| | | | **Lower Bound** | **Upper Bound** |
| 1 | 2.86 | 0.06 | 2.74 | 2.98 |
| 2 | 2.86 | 0.06 | 2.74 | 2.98 |
| 3 | 2.69 | 0.08 | 2.54 | 2.85 |
| 4 | 2.78 | 0.07 | 2.64 | 2.92 |
| 5 | 2.78 | 0.07 | 2.64 | 2.92 |
| 6 | 2.75 | 0.07 | 2.60 | 2.90 |
| 7 | 2.81 | 0.07 | 2.67 | 2.94 |

## B.5 Students Questionnaire Final Version

**دراسة العوامل المؤثرة في اتجاه الطلاب نحو التقييم الإلكتروني (التقييم النهائي) في سياق الجامعات السعودية.**

**مرحباً!**

شكراً جزيلاً على اهتمامك بالمشاركة في هذه الإستبانة وأقدر لك وقتك ومشاركتك القيمة. يستغرق الإستبيان حوالي 5 دقائق.

يهدف هذا البحث إلى دراسة العوامل المؤثرة في سلوك الطلاب والطالبات لتقبل الإختبارات الالكترونية والمقصود بـ الإختبارات الالكترونية:هي الإختبارات التي تُجرى باستخدام الكمبيوتر سواء عن طريق نظام بلاك بورد أو أي نظام آخر مستخدم في جامعتك. هذا البحث يشمل دراسة أربعة نواحي وهي الفردية، الإجتماعية، المصادر الخارجية وأخيرا محتويات النظام. مشاركتك سوف تفيد الجامعات في تحديد الإتجاهات المستقبلية للإختبارات الإلكترونية وسوف تساعد في تطوير هذا المجال.

لمزيد من المعلومات وللإطلاع على ملخص النتائج يمكنك مراسلتي على العنوان التالي sssa1e13@soton.ac.uk

بالضغط على زر الموافقة بالأسفل يدل على أنك قرأت التعليمات وأنت موافق على المشاركة تطوعياً في هذا الاستبيان.

شاكرة لكم تعاونكم ووقتكم..

سمية العنقري

An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context.

Thank you very much for your interest in taking this questionnaire, I appreciate your time and valuable participation, it should take about 10 minutes. The main aim of this research is to construct the framework for investigation of the attitude of students towards summative e-assessment in a Saudi Arabian universities context.

You have been chosen to obtain your opinion about which factors affect students' attitude towards using summative e-assessment in Saudi universities. This research is under the direction of the School of Electronics and Computer Science, University of Southampton. I would appreciate your response to the following questions. Your information will be used for the research purpose only. For more information and if you would like to see the summary of the results, please contact me on sssa1e13@soton.ac.uk.

Clicking on the "agree" button below indicates that you have read the above information and you voluntarily agree to participate.

☐ Agree موافق

Thank you very much for completing this questionnaire.

Someah Alangari

**Questions: Part 1: General information** **الجزء الأول: معلومات عامة**

| |
|---|
| الرجاء ادخال اسم الجامعة التي تدرس فيها<br>Please enter the university where you are studying. |
| تحت أي قسم يندرج تخصصك الجامعي<br>Please choose your department/major.<br><br>o Natural Science التخصصات العلمية<br>o Social Science التخصصات الأدبية |
| الرجاء اختيار الجنس (ذكر / أنثى)<br>Please select your gender (male/female).<br><br>o Male<br>o Female |
| هل سبق أن أجري لك اختبار الكتروني ؟ (نعم / لا)<br>Have you ever used e-assessment systems before? (Yes/No) |

**Part 2: Factors affecting the attitude of students towards summative e-assessment in Saudi Arabian universities.**

**الجزء الثاني: العوامل المؤثرة على اتجاهات الطلبة تجاة استخدام الإختبارات الإلكترونية (التقييم النهائي) في الجامعات السعودية.**

من فضلك يرجى الإشارة إلى درجتك في الإتفاق أو عدم الإتفاق على العبارات التالية أنها تؤثر على اتجاهك نحو التقييم الإلكتروني. الرجاء الإجابة على كل عبارة عن طريق إختيار إجابة واحدة فقط لكل عبارة.

Read the following statement about factors influencing students' attitude towards summative e-assessment and then please tick (✓) one per item, how much you agree or disagree with each of the statement is an important factor effect students' attitude towards summative e-assessment.

| no | Statement | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| PU1 | أجد أن استخدام الإختبارات الإلكترونية مفيدة في تخصصي الجامعي.<br>I find using e-assessment is useful on my course. | | | | | |
| PU2 | أعتقد ان الإختبارات الإلكترونية تساعد في تحسين دراستي.<br>I believe e-assessment helps improve my learning. | | | | | |
| PU3 | أجد أن الإختبارات الإلكترونية تزودني بالتغذية الراجعة السريعة التي تساعدني كثيرا في دراستي.<br>I find e-assessment give me a quick feedback, which helps me in my course. | | | | | |
| PU4 | أعتقد أن الإختبارات الإلكترونية هي أكثر فائدة لي من الإختبار الورقي.<br>I think e-assessment is more useful than paper and pencil testing. | | | | | |
| PEU1 | اجد أن تعلم استخدام نظام الإختبار الإلكتروني سهلاً بالنسبة لي.<br>Learning to use e-assessment system would be easy to me. | | | | | |
| PEU2 | أنظمه الإختبارات الإلكترونية سهله الإستخدام.<br>The e-assessment system is easy to use. | | | | | |
| PEU3 | أجد ان الإختبارات الإلكترونية هي أسهل في الآداء من الإختبار الورقي.<br>I find taking e-assessment is easier than a paper-based exam. | | | | | |
| PEU4 | التفاعل مع أنظمة الإختبارات الإلكترونية لا يتطلب مني الكثير من الجهد الذهني.<br>Interacting with e-assessment systems does not require a lot of mental effort from me. | | | | | |
| SE1 | أنا قادر على استخدام نظام الإختبار الإلكتروني.<br>I am able to use the e-assessment system. | | | | | |
| SE2 | أستطيع استخدام أنظمه الإختبارات الإلكترونية حتى إن لم يكن لدي خبره سابقة بأنظمة مشابهة.<br>I could use the e-assessment system even if I had no prior experience on similar systems. | | | | | |
| SE3 | أنظمه الإختبارات الإلكترونية لاتتطلب مني مهارات عاليه لإستخدامها.<br>I do not need advanced skills when I use an e-assessment system. | | | | | |
| SE4 | بإمكاني أن استخدم نظام الإختبارات الإلكترونية بدون أي مساعده.<br>I can use e-assessment systems without any assistance. | | | | | |
| SI1 | وجهه نظر أصدقائي تجاه الإختبارات الإلكترونية مهمه بالنسبه لي.<br>The opinion of my friends about e-assessment is important to me. | | | | | |
| SI2 | موظفي الدعم الفني في الجامعه يساعدون في استخدام الإختبارات الإلكترونية. | | | | | |

Appendix B

| | | | | | | |
|---|---|---|---|---|---|---|
| | The IT support in my university is helpful in the use of e-assessment. | | | | | |
| SI3 | الأساتذه في جامعتي يدعمون الطلاب عند إجراء الإختبارات الإلكترونية.<br>My teacher is very supportive of the use of e-assessment at my university. | | | | | |
| SI4 | بشكل عام أرى أن جامعتي تؤيد استخدام الإختبارات الإلكترونية.<br>In general, my university supports the use of e-assessment. | | | | | |
| FE1 | عندما أحتاج إلى مساعدة أثناء إجراء الإختبار الإلكتروني، أجد شخص ما لمساعدتي.<br>When I need help during the e-assessment exam, someone is there to help me. | | | | | |
| FE2 | فريق الدعم الفني متواجدين في أي وقت لمساعدتي في استخدام نظام الإختبارات الإلكترونية.<br>Support staff are available to help me at any time I use e-assessment. | | | | | |
| FE3 | عادة، أحتاج إلى مساعدة عند استخدام نظام الإختبار الإلكتروني للمرة الأولى.<br>I usually need assistance when using e-assessment for the first time. | | | | | |
| FE4 | الدورات التدريبة على استخدام نظام الإختبارات الإلكترونيه متوفره في جامعتي قبل الإختبار.<br>E-assessment training course are available to me before the e-assessment. | | | | | |
| FE5 | البنية التحتية للجامعة مثل الكمبيوترات و الشبكة هي كافية لإجراء اختبار الكتروني بسلاسه.<br>University preparation such as computer hardware and communication network was sufficient for the e-assessment. | | | | | |
| FE6 | بشكل عام أرى أن البنيه التحتية للجامعة كافية لإجراء الإختبارات الإلكترونية.<br>Overall, the e-assessment environment infrastructure at my university is efficient. | | | | | |
| CO1 | أعتقد أن الإختبارات الإلكتروني مناسب لجميع المواد الدراسية.<br>I think e-assessment is appropriate for all subjects. | | | | | |
| CO2 | الإختبار الإلكتروني مفيد لبعض االمواد الدراسية عن غيرها.<br>E-assessment is more useful for some courses than others. | | | | | |
| CO3 | أجد أن أسئلة الإختبار الإلكتروني مناسبه لدراستي.<br>I find e-assessment questions are useful for my course. | | | | | |
| CO4 | يجب أن يتضمن الإختبار الإلكتروني مجموعة متنوعة من الأسئلة من أجل اختبار معرفتي بشكل كامل.<br>E-assessment needs to include a variety of question types in order to test my knowledge fully. | | | | | |
| CO5 | محتوى التغذية الراجعة في الاختبار الإلكتروني يساهم في تحسين مستواي الدراسي.<br>The content of feedback in e-assessment would improve my learning. | | | | | |
| CO6 | أجد أن التغذية الراجعة في الإختبار الإلكتروني كافية.<br>I find the feedback I have received from e-assessment is sufficient. | | | | | |
| AC1 | أعتقد أن الإختبار الإلكتروني مناسب لجميع الطلاب.<br>I think e-assessment is appropriate for all students. | | | | | |
| AC2 | الإختبارات الإلكترونية هي أكثر ملائمة لجميع الطلاب من الاختبارات الورقية.<br>I believe e-assessment is more accessible than a paper-based exam. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| AC3 | توفر جامعتي تقنيات مساعدة مثل قراء الشاشة للطلاب ذوي الاحتياجات الخاصة لمساعدتهم على إجراء الإختبار الإلكتروني.<br>My university provides assistive technology, such as screen readers, for students with special needs to help them take e-assessment. | | | | | |
| AC4 | من المهم أن تكون عمليات ضبط حجم النص والتباين متوفرة في أنظمة الأختبارات الإلكترونيه لمساعدة المشاركين ذوي الرؤية المنخفضة / الجزئية.<br>Text-sizing and contrast controls within assessments are important to aid participants with low/partial vision. | | | | | |
| AT1 | أرى أن قرار استخدام الإختبارات الإلكترونية قرار إيجابي.<br>I consider the decision of using e-assessment is a positive one. | | | | | |
| AT2 | أود أن أرى الإختبار الإلكتروني ينفذ في المواد الدراسية الأخرى.<br>I would like to see e-assessment implemented further in departmental modules. | | | | | |
| AT3 | أود أن يتم استبدال جميع الإختبارات الورقية في جامعتي بالإختبارات الإلكترونية.<br>I would like e-assessment to replace paper-based exams at my university. | | | | | |
| AT4 | بشكل عام، لدي إيجابية تجاه استخدام الإختبارات الإلكترونية.<br>In general, I was a positive towards using an e-assessment system. | | | | | |

Thank you very much for completing this questionnaire. Your response will be very useful to the research. If you have any questions related to the research study, please contact the researcher Someah Alangari sssa1e13@soton.ac.uk.

# Appendix C Investigation Study

## C.1 Participant Information Sheet

UNIVERSITY OF Southampton

**ورقة معلومات المشاركين**

**Study Title:** An Investigation of the Factors Influence the Attitude of Students towards Summative e-assessment in a Saudi Arabian Universities Context.

**عنوان الدراسة:** دراسة العوامل المؤثرة في اتجاه الطلاب نحوالإختبارات الإلكترونية (التقييم النهائي) في سياق الجامعات السعودية.

**Researcher name:** Someah Alangari

**الباحث:** سمية العنقري

**Ethics reference:** 30836

**رقم الأخلاقيات:** 30836

**Please read this information carefully before deciding to take part in this research. If you are happy to participate, you will be asked to sign a consent form.**

**يرجى قراءة هذه المعلومات بعناية قبل اتخاذ القرار بالمشاركة في هذا البحث. إذا كنت سعيداً بالمشاركة سوف يطلب منك التوقيع على استماره الموافقة.**

**What is the research about?**

This research is investigating students' attitude towards summative e-assessment in Saudi Arabian universities. This research is under the auspices of the School of Electronics and Computer Science, University of Southampton, UK.

**ماذا عن هذا البحث؟**

يهدف هذا البحث إلى استكشاف العوامل المؤثره على اتجاهات الطلبة نحو الإختبارات اللإلكترونية في الجامعات السعودية. تحديد هذه العوامل تساعد الجامعات في على تعزيز طرق التقييم ونجاح تطبيق الإختبارات الإلكترونية ورضا الطلبة. هذا البحث تحت إشراف كليه علوم الحاسوب بجامعه ساوثهامبتون ، المملكه المتحدة ، ويتم تمويلة بالكامل من قبل الملحقية الثقافية السعودية.

**Why have I been chosen?**

I invite you to participate in this study focused on students' attitude towards using summative e-assessment. Your opinion will help in investigating the attitude of students towards using summative e-assessment in a Saudi Arabian universities context.

**لماذا تم اختياري؟**

تم اختيارك للمشاركة في هذه الدراسة لأن رأيك سوف يساعد في هذه الدراسة التي تهدف إلى تحديد اتجاهات الطلبة تجاه الإختبارات الإلكترونية في الجامعات السعودية.

**What will happen to me if I take part?**

I will send you the link to the questionnaire, and then the study will begin. The questionnaire will take about 10 minutes to complete.

**ماذا سيحث لي إذا شاركت؟**

سوف اقوم بإرسال رابط للاستبيان ، الاستبيان يستغرق 10 دقائق.

**Are there any benefits in my taking part?**

This research is not designed to help you personally, but your feedback will help me gather educationalist opinions on the development efforts.

**هل هناك أي فوائد عند مشاركتي؟**

هذه الدراسة لم تصمم لمساعدتك شخصياً ، ولكن رأيك سيسهم في تطوير الدراسة لهدف دعم الجامعات السعودية بنتيجة هذه الدراسة.

**Are there any risks involved?**

No.

**هل هناك أي مخاطر؟**

لا

**Will my participation be confidential?**

Yes. Your information will be stored and used on secure systems and will be used for this study purposes only, and your responses are voluntary and will be confidential. Individual responses will not be identified. All responses will be compiled together and analysed as a group.

**هل ستكون مشاركتي سرية؟**

نعم. سيتم الإحتفاظ بالمعلومات التي تقدمها للبحث في سرية تامة مجهولة. سيتم تخزين المعلومات الخاصة بك على أنظمة امنة وسوف تستخدم لأغراص الرسالة فقط.

**What happens if I change my mind?**

You have the right to terminate your participation in the research at any stage, without giving any reasons, and without your legal rights being affected. Your data will be deleted directly if you decide to withdraw at any time.

**ماذا سيحدث إذا قمت بتغيير رأيي؟**

لديك الحق في الإنسحاب في أي مرحلة دون الحاجة إلى إعطاء أسباب وبدون أي عقوبة و سيتم حذف معلوماتك التي قدمتها.

**What happens if something goes wrong?** **ماذا يحدث إذا حدث خطأ ما؟**

في حالة القلق يرجى الإتصال بمدير إدارة البحوث.

In the unlikely case of concern or complaint, please contact Research Governance Manager (02380 595058, rgoinfo@soton.ac.uk).

**Where can I get more information?** **أين يمكنني الحصول على مزيد من المعلومات؟**

لمزيد من المعلومات يرجى الاتصال بي أو بالمشرفين على دراستي:

For further details, please contact either myself or my study Supervisors, Dr. Gary Wills and Prof. Mike Wald
Researcher: sssa1e13@ecs. soton.ac.uk

Gary Wills: gbw@ecs.soton.ac.uk Mike Wald: mw@ecs.soton.ac.uk

## C.2 Descriptive Statistics of the Factors (First run on 36 items)

- **Perceived Usefulness (PU)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.88 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| PU1 | 1.86 | 0.95 | 328 |
| PU2 | 2.09 | 1.04 | 328 |
| PU3 | 2.06 | 1.03 | 328 |
| PU4 | 2.12 | 1.19 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| PU1 | 6.27 | 8.18 | 0.75 | 0.85 |
| PU2 | 6.04 | 7.56 | 0.79 | 0.83 |
| PU3 | 6.07 | 7.97 | 0.71 | 0.86 |
| PU4 | 6.02 | 7.11 | 0.73 | 0.86 |

- **Perceived Ease of Use (PEU)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.80 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| PEU1 | 1.58 | 0.78 | 328 |
| PEU2 | 1.55 | 0.77 | 328 |
| PEU3 | 1.83 | 1.09 | 328 |
| PEU4 | 2.29 | 1.12 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Cronbach's alpha if item deleted |
| PEU1 | 5.67 | 6.00 | 0.63 | 0.74 |
| PEU2 | 5.70 | 5.83 | 0.70 | 0.72 |
| PEU3 | 5.42 | 4.80 | 0.64 | 0.73 |
| PEU4 | 4.96 | 5.08 | 0.54 | 0.79 |

- **Self-Efficacy (SE)**

| Reliability statistics | |
|---|---|
| Cronbach's alpha | N of items |
| 0.85 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | Mean | Std. deviation | N |
| SE1 | 1.46 | 0.74 | 328 |
| SE2 | 1.86 | 0.93 | 328 |
| SE3 | 1.73 | 0.87 | 328 |
| SE4 | 1.84 | 0.95 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Cronbach's alpha if item deleted |
| SE1 | 5.43 | 5.64 | 0.67 | 0.83 |
| SE2 | 5.02 | 4.80 | 0.71 | 0.81 |
| SE3 | 5.16 | 5.00 | 0.71 | 0.81 |
| SE4 | 5.04 | 4.66 | 0.72 | 0.81 |

- **Social Influence (SI)**

| Reliability statistics | |
|---|---|
| Cronbach's alpha | N of items |
| 0.64 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| SI1 | 2.66 | 1.28 | 328 |
| SI2 | 2.53 | 1.13 | 328 |
| SI3 | 2.47 | 1.06 | 328 |
| SI4 | 2.20 | 1.04 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| SI1 | 7.20 | 6.33 | 0.29 | 0.62 |
| SI2 | 7.34 | 6.03 | 0.46 | 0.55 |
| SI3 | 7.39 | 5.95 | 0.54 | 0.50 |
| SI4 | 7.66 | 6.51 | 0.43 | 0.57 |

- **Facilitating of Examination (FE)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.73 | 6 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| FEI | 2.45 | 1.15 | 328 |
| FE2 | 2.72 | 1.21 | 328 |
| FE3 | 2.68 | 1.25 | 328 |
| FE4 | 3.20 | 1.16 | 328 |
| FE5 | 2.61 | 1.30 | 328 |
| FE6 | 2.50 | 1.25 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| FEI | 13.71 | 17.05 | 0.48 | 0.69 |
| FE2 | 13.45 | 16.02 | 0.57 | 0.67 |
| FE3 | 13.48 | 20.48 | 0.08 | 0.80 |
| FE4 | 12.96 | 17.24 | 0.46 | 0.70 |
| FE5 | 13.55 | 14.81 | 0.65 | 0.64 |
| FE6 | 13.66 | 15.20 | 0.64 | 0.64 |

- **Content (CO)**

| Reliability statistics | |
|---|---|
| **Cronbach's Alpha** | **N of Items** |
| 0.75 | 6 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| CO1 | 2.42 | 1.38 | 328 |
| CO2 | 2.06 | 1.06 | 328 |
| CO3 | 2.05 | 1.06 | 328 |
| CO4 | 2.07 | 1.08 | 328 |
| CO5 | 2.14 | 0.99 | 328 |
| CO6 | 2.34 | 1.01 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| CO1 | 10.66 | 13.03 | 0.43 | 0.73 |
| CO2 | 11.03 | 16.04 | 0.09 | 0.77 |
| CO3 | 11.03 | 13.03 | 0.67 | 0.66 |
| CO4 | 11.02 | 14.73 | 0.41 | 0.73 |
| CO5 | 10.95 | 14.02 | 0.58 | 0.69 |
| CO6 | 10.75 | 13.41 | 0.65 | 0.67 |

- **Accessibility (AC)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.67 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| AC1 | 2.26 | 1.14 | 328 |
| AC2 | 2.24 | 1.21 | 328 |
| AC3 | 2.92 | 1.18 | 328 |
| AC4 | 1.65 | 0.88 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| AC1 | 6.81 | 5.43 | 0.59 | 0.50 |
| AC2 | 6.83 | 4.92 | 0.65 | 0.44 |
| AC3 | 6.16 | 6.59 | 0.31 | 0.65 |
| AC4 | 7.42 | 7.74 | 0.28 | 0.66 |

- **Attitude (AT)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.92 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| AT1 | 1.90 | 1.06 | 328 |
| AT2 | 2.05 | 1.21 | 328 |
| AT3 | 2.37 | 1.40 | 328 |
| AT4 | 1.82 | 0.10 | 328 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| AT1 | 6.24 | 10.68 | 0.85 | 0.88 |
| AT2 | 6.09 | 9.84 | 0.84 | 0.88 |
| AT3 | 5.76 | 9.15 | 0.78 | 0.91 |
| AT4 | 6.31 | 11.24 | 0.81 | 0.90 |

## C.3 Descriptive Statistics of the Factors (Second run on 33 items)

- **The overall reliability**

| Reliability statistics | | |
|---|---|---|
| **Cronbach's alpha** | **Cronbach's Alpha Based on Standardised Items** | **N of items** |
| 0.94 | 0.95 | 33 |

- **Perceived Usefulness (PU)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.88 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| PU1 | 1.87 | 0.99 | 408 |
| PU2 | 2.10 | 1.06 | 408 |
| PU3 | 2.07 | 1.05 | 408 |
| PU4 | 2.18 | 1.24 | 408 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| PU1 | 6.35 | 8.51 | 0.74 | 0.84 |
| PU2 | 6.13 | 7.99 | 0.78 | 0.82 |
| PU3 | 6.15 | 8.36 | 0.71 | 0.85 |
| PU4 | 6.04 | 7.43 | 0.72 | 0.85 |

- **Perceived Ease of Use (PEU)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.79 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| PEU1 | 1.58 | 0.79 | 408 |
| PEU2 | 1.54 | 0.76 | 408 |
| PEU3 | 1.84 | 1.10 | 408 |
| PEU4 | 2.27 | 1.12 | 408 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| PEU1 | 5.66 | 5.91 | 0.64 | 0.73 |
| PEU2 | 5.69 | 5.90 | 0.69 | 0.72 |
| PEU3 | 5.39 | 4.74 | 0.63 | 0.73 |
| PEU4 | 4.96 | 5.08 | 0.53 | 0.78 |

- **Self-Efficacy (SE)**

| Reliability Statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.84 | 4 |

| Item Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| SE1 | 1.46 | 0.72 | 408 |
| SE2 | 1.85 | 0.91 | 408 |
| SE3 | 1.73 | 0.86 | 408 |
| SE4 | 1.83 | 0.93 | 408 |

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| SE1 | 5.42 | 5.31 | 0.66 | 0.81 |
| SE2 | 5.02 | 4.51 | 0.70 | 0.79 |
| SE3 | 5.14 | 4.74 | 0.67 | 0.80 |
| SE4 | 5.04 | 4.38 | 0.71 | 0.79 |

- **Social Influence (SI)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.66 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| SI1 | 2.69 | 1.29 | 408 |
| SI2 | 2.53 | 1.12 | 408 |
| SI3 | 2.50 | 1.09 | 408 |
| SI4 | 2.22 | 1.03 | 408 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| SI1 | 7.25 | 6.47 | 0.31 | 0.65 |
| SI2 | 7.40 | 6.27 | 0.48 | 0.56 |
| SI3 | 7.44 | 6.10 | 0.55 | 0.51 |
| SI4 | 7.71 | 6.79 | 0.44 | 0.59 |

- **Facilitating of Examination (FE)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.80 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| FEI | 2.49 | 1.17 | 408 |
| FE2 | 2.72 | 1.20 | 408 |
| FE5 | 2.62 | 1.31 | 408 |
| FE6 | 2.50 | 1.24 | 408 |

| Item-total statistics | | | | |
|---|---|---|---|---|
| | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Cronbach's alpha if item deleted |
| FEI | 7.84 | 10.23 | 0.46 | 0.80 |
| FE2 | 7.61 | 9.30 | 0.59 | 0.75 |
| FE5 | 7.72 | 8.20 | 0.69 | 0.70 |
| FE6 | 7.83 | 8.46 | 0.70 | 0.70 |

- **Content (CO)**

| Reliability statistics | |
|---|---|
| Cronbach's alpha | N of items |
| 0.78 | 5 |

| Item Statistics | | | |
|---|---|---|---|
| | Mean | Std. deviation | N |
| CO1 | 2.50 | 1.40 | 408 |
| CO3 | 2.10 | 1.04 | 408 |
| CO4 | 2.07 | 1.10 | 408 |
| CO5 | 2.17 | 0.99 | 408 |
| CO6 | 2.39 | 1.01 | 408 |

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| | Scale mean if item deleted | Scale variance if item deleted | Corrected item-total correlation | Cronbach's alpha if item deleted |
| CO1 | 8.73 | 10.11 | 0.52 | 0.76 |
| CO3 | 9.13 | 11.01 | 0.66 | 0.71 |
| CO4 | 9.16 | 12.52 | 0.38 | 0.77 |
| CO5 | 9.06 | 11.56 | 0.62 | 0.72 |
| CO6 | 8.84 | 11.13 | 0.70 | 0.70 |

- **Accessibility (AC)**

| Reliability statistics | |
|---|---|
| Cronbach's alpha | N of items |
| 0.68 | 4 |

Appendix C

| Item Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| AC1 | 2.29 | 1.17 | 408 |
| AC2 | 2.28 | 1.22 | 408 |
| AC3 | 2.93 | 1.18 | 408 |
| AC4 | 1.66 | 0.89 | 408 |

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| AC1 | 6.87 | 5.50 | 0.61 | 0.50 |
| AC2 | 6.88 | 5.14 | 0.64 | 0.47 |
| AC3 | 6.23 | 6.87 | 0.31 | 0.66 |
| AC4 | 7.50 | 7.87 | 0.30 | 0.67 |

- **Attitude (AT)**

| Reliability statistics | |
|---|---|
| **Cronbach's alpha** | **N of items** |
| 0.91 | 4 |

| Item statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. deviation** | **N** |
| AT1 | 1.93 | 1.06 | 408 |
| AT2 | 2.12 | 1.22 | 408 |
| AT3 | 2.46 | 1.42 | 408 |
| AT4 | 1.86 | 1.02 | 408 |

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| | **Scale mean if item deleted** | **Scale variance if item deleted** | **Corrected item-total correlation** | **Cronbach's alpha if item deleted** |
| AT1 | 6.44 | 10.98 | 0.84 | 0.88 |
| AT2 | 6.25 | 9.97 | 0.85 | 0.87 |
| AT3 | 5.90 | 9.23 | 0.78 | 0.90 |
| AT4 | 6.51 | 11.47 | 0.80 | 0.89 |

## C.4 MANOVA: How Different Perspectives Affected Participants' Responses

- **How university affected the responses**

| Between-Subjects Factors | | | |
|---|---|---|---|
| | | **Value label** | **N** |
| **University** | 1 | Imam Abdurrahman Bin Faisal University | 99 |
| | 2 | Saudi Electronic University | 104 |
| | 3 | King Abdulaziz University | 125 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **University** | **Mean** | **Std. deviation** | **N** |
| PU1 | Imam Abdurrahman Bin Faisal University | 2.05 | 0.92 | 99 |
| | Saudi Electronic University | 1.90 | 1.02 | 104 |
| | King Abdulaziz University | 1.96 | 0.95 | 125 |
| | Total | 1.97 | 0.96 | 328 |
| PU2 | Imam Abdurrahman Bin Faisal University | 2.33 | 0.83 | 99 |
| | Saudi Electronic University | 2.35 | 1.17 | 104 |
| | King Abdulaziz University | 2.24 | 0.87 | 125 |
| | Total | 2.30 | 0.96 | 328 |
| PU3 | Imam Abdurrahman Bin Faisal University | 2.22 | 0.95 | 99 |
| | Saudi Electronic University | 2.29 | 1.15 | 104 |
| | King Abdulaziz University | 2.09 | 0.94 | 125 |
| | Total | 2.19 | 1.02 | 328 |
| PU4 | Imam Abdurrahman Bin Faisal University | 2.31 | 1.09 | 99 |
| | Saudi Electronic University | 2.09 | 1.23 | 104 |
| | King Abdulaziz University | 2.20 | 1.21 | 125 |
| | Total | 2.20 | 1.18 | 328 |
| PEU1 | Imam Abdurrahman Bin Faisal University | 1.97 | 0.89 | 99 |
| | Saudi Electronic University | 1.96 | 0.93 | 104 |
| | King Abdulaziz University | 1.82 | 0.84 | 125 |
| | Total | 1.91 | 0.88 | 328 |
| PEU2 | Imam Abdurrahman Bin Faisal University | 2.23 | 0.92 | 99 |
| | Saudi Electronic University | 2.14 | 0.67 | 104 |
| | King Abdulaziz University | 2.32 | 0.79 | 125 |
| | Total | 2.24 | 0.80 | 328 |
| PEU3 | Imam Abdurrahman Bin Faisal University | 1.99 | 0.96 | 99 |
| | Saudi Electronic University | 1.79 | 1.20 | 104 |
| | King Abdulaziz University | 1.96 | 1.09 | 125 |
| | Total | 1.91 | 1.09 | 328 |
| PEU4 | Imam Abdurrahman Bin Faisal University | 2.83 | 0.87 | 99 |
| | Saudi Electronic University | 2.67 | 0.85 | 104 |
| | King Abdulaziz University | 2.58 | 1.03 | 125 |
| | Total | 2.68 | 0.93 | 328 |
| SE1 | Imam Abdurrahman Bin Faisal University | 1.47 | 0.73 | 99 |

| | | | | |
|---|---|---|---|---|
| | Saudi Electronic University | 1.42 | 0.82 | 104 |
| | King Abdulaziz University | 1.47 | 0.67 | 125 |
| | Total | 1.46 | 0.74 | 328 |
| SE2 | Imam Abdurrahman Bin Faisal University | 2.27 | 0.81 | 99 |
| | Saudi Electronic University | 2.09 | 0.96 | 104 |
| | King Abdulaziz University | 2.10 | 0.90 | 125 |
| | Total | 2.15 | 0.89 | 328 |
| SE3 | Imam Abdurrahman Bin Faisal University | 1.81 | 0.97 | 99 |
| | Saudi Electronic University | 1.63 | 0.84 | 104 |
| | King Abdulaziz University | 1.74 | 0.82 | 125 |
| | Total | 1.73 | 0.87 | 328 |
| SE4 | Imam Abdurrahman Bin Faisal University | 1.78 | 0.10 | 99 |
| | Saudi Electronic University | 1.93 | 1.05 | 104 |
| | King Abdulaziz University | 1.82 | 0.83 | 125 |
| | Total | 1.84 | 0.95 | 328 |
| SI1 | Imam Abdurrahman Bin Faisal University | 2.65 | 1.00 | 99 |
| | Saudi Electronic University | 2.74 | 1.19 | 104 |
| | King Abdulaziz University | 2.88 | 1.39 | 125 |
| | Total | 2.77 | 1.22 | 328 |
| SI2 | Imam Abdurrahman Bin Faisal University | 2.74 | 1.09 | 99 |
| | Saudi Electronic University | 2.63 | 0.90 | 104 |
| | King Abdulaziz University | 2.66 | 1.12 | 125 |
| | Total | 2.67 | 1.05 | 328 |
| SI3 | Imam Abdurrahman Bin Faisal University | 2.34 | 1.02 | 99 |
| | Saudi Electronic University | 2.52 | 1.09 | 104 |
| | King Abdulaziz University | 2.53 | 1.08 | 125 |
| | Total | 2.47 | 1.06 | 328 |
| SI4 | Imam Abdurrahman Bin Faisal University | 2.08 | 0.92 | 99 |
| | Saudi Electronic University | 2.34 | 1.14 | 104 |
| | King Abdulaziz University | 2.18 | 1.04 | 125 |
| | Total | 2.20 | 1.04 | 328 |
| FEI | Imam Abdurrahman Bin Faisal University | 2.72 | 1.03 | 99 |
| | Saudi Electronic University | 2.65 | 0.89 | 104 |
| | King Abdulaziz University | 2.74 | 1.02 | 125 |
| | Total | 2.71 | 0.98 | 328 |
| FE2 | Imam Abdurrahman Bin Faisal University | 3.19 | 0.91 | 99 |
| | Saudi Electronic University | 2.99 | 0.78 | 104 |
| | King Abdulaziz University | 3.06 | 0.95 | 125 |
| | Total | 3.08 | 0.89 | 328 |
| FE5 | Imam Abdurrahman Bin Faisal University | 3.04 | 1.14 | 99 |
| | Saudi Electronic University | 2.88 | 0.87 | 104 |
| | King Abdulaziz University | 2.73 | 1.32 | 125 |
| | Total | 2.87 | 1.14 | 328 |
| FE6 | Imam Abdurrahman Bin Faisal University | 2.78 | 1.18 | 99 |
| | Saudi Electronic University | 2.77 | 0.86 | 104 |
| | King Abdulaziz University | 2.65 | 1.28 | 125 |
| | Total | 2.73 | 1.13 | 328 |
| CO1 | Imam Abdurrahman Bin Faisal University | 2.59 | 1.13 | 99 |
| | Saudi Electronic University | 2.55 | 1.28 | 104 |
| | King Abdulaziz University | 2.70 | 1.42 | 125 |

| | | | | |
|---|---|---|---|---|
| | Total | 2.62 | 1.29 | 328 |
| CO3 | Imam Abdurrahman Bin Faisal University | 1.87 | 0.90 | 99 |
| | Saudi Electronic University | 2.14 | 1.23 | 104 |
| | King Abdulaziz University | 2.13 | 1.01 | 125 |
| | Total | 2.05 | 1.06 | 328 |
| CO4 | Imam Abdurrahman Bin Faisal University | 1.99 | 1.07 | 99 |
| | Saudi Electronic University | 2.22 | 1.11 | 104 |
| | King Abdulaziz University | 2.01 | 1.05 | 125 |
| | Total | 2.07 | 1.08 | 328 |
| CO5 | Imam Abdurrahman Bin Faisal University | 2.31 | 0.84 | 99 |
| | Saudi Electronic University | 2.44 | 0.92 | 104 |
| | King Abdulaziz University | 2.30 | 0.92 | 125 |
| | Total | 2.35 | 0.90 | 328 |
| CO6 | Imam Abdurrahman Bin Faisal University | 2.27 | 1.05 | 99 |
| | Saudi Electronic University | 2.48 | 0.90 | 104 |
| | King Abdulaziz University | 2.43 | 1.01 | 125 |
| | Total | 2.40 | 0.99 | 328 |
| AC1 | Imam Abdurrahman Bin Faisal University | 2.20 | 1.08 | 99 |
| | Saudi Electronic University | 2.40 | 1.15 | 104 |
| | King Abdulaziz University | 2.34 | 1.15 | 125 |
| | Total | 2.32 | 1.13 | 328 |
| AC2 | Imam Abdurrahman Bin Faisal University | 2.40 | 1.13 | 99 |
| | Saudi Electronic University | 2.28 | 1.21 | 104 |
| | King Abdulaziz University | 2.34 | 1.20 | 125 |
| | Total | 2.34 | 1.18 | 328 |
| AC3 | Imam Abdurrahman Bin Faisal University | 3.07 | 1.13 | 99 |
| | Saudi Electronic University | 2.97 | 0.81 | 104 |
| | King Abdulaziz University | 3.00 | 1.16 | 125 |
| | Total | 3.01 | 1.05 | 328 |
| AC4 | Imam Abdurrahman Bin Faisal University | 1.69 | 0.93 | 99 |
| | Saudi Electronic University | 1.63 | 0.88 | 104 |
| | King Abdulaziz University | 1.64 | 0.85 | 125 |
| | Total | 1.65 | 0.88 | 328 |
| AT1 | Imam Abdurrahman Bin Faisal University | 2.18 | 1.06 | 99 |
| | Saudi Electronic University | 1.92 | 1.05 | 104 |
| | King Abdulaziz University | 1.96 | 1.05 | 125 |
| | Total | 2.02 | 1.06 | 328 |
| AT2 | Imam Abdurrahman Bin Faisal University | 2.20 | 1.12 | 99 |
| | Saudi Electronic University | 2.13 | 1.26 | 104 |
| | King Abdulaziz University | 2.19 | 1.22 | 125 |
| | Total | 2.18 | 1.20 | 328 |
| AT3 | Imam Abdurrahman Bin Faisal University | 2.62 | 1.315 | 99 |
| | Saudi Electronic University | 2.49 | 1.39 | 104 |
| | King Abdulaziz University | 2.49 | 1.34 | 125 |
| | Total | 2.53 | 1.35 | 328 |
| AT4 | Imam Abdurrahman Bin Faisal University | 1.75 | 0.93 | 99 |
| | Saudi Electronic University | 1.83 | 1.10 | 104 |
| | King Abdulaziz University | 1.87 | 0.97 | 125 |
| | Total | 1.82 | 0.10 | 328 |

| **Multivariate Tests**[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Intercept | Pillai's Trace | 0.97 | 319.75[b] | 33 | 29 | <0.001 |
| | Wilks' Lambda | 0.03 | 319.75[b] | 33 | 29 | <0.001 |
| | Hotelling's Trace | 36.01 | 319.75[b] | 33 | 29 | <0.001 |
| | Roy's Largest Root | 36.01 | 319.75[b] | 33 | 29 | <0.001 |
| University | Pillai's Trace | 0.06 | 0.59 | 66 | 29 | 0.970 |
| | Wilks' Lambda | 0.94 | 0.59[b] | 66 | 29 | 0.970 |
| | Hotelling's Trace | 0.06 | 0.59 | 66 | 29 | 0.970 |
| | Roy's Largest Root | 0.06 | 0.59[c] | 33 | 29 | 0.970 |
| a. Design: Intercept + University | | | | | | |
| b. Exact statistic | | | | | | |
| c. The statistic is an upper bound on F that yields a lower bound on the significance level. | | | | | | |

- **How discipline affected the responses**

| Between-Subjects Factors | | | |
|---|---|---|---|
| | | **Value label** | **N** |
| **Discipline** | 1 | Social Science (SS) | 155 |
| | 2 | Natural Science (NS) | 173 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Discipline** | **Mean** | **Std. deviation** | **N** |
| PU1 | SS | 1.79 | 1.00 | 155 |
| | NS | 1.92 | 0.90 | 173 |
| | Total | 1.86 | 0.95 | 328 |
| PU2 | SS | 2.05 | 1.11 | 155 |
| | NS | 2.08 | 0.91 | 173 |
| | Total | 2.07 | 1.01 | 328 |
| PU3 | SS | 2.03 | 1.13 | 155 |
| | NS | 2.09 | 0.94 | 173 |
| | Total | 2.06 | 1.03 | 328 |
| PU4 | SS | 2.15 | 1.21 | 155 |
| | NS | 2.22 | 1.16 | 173 |
| | Total | 2.19 | 1.18 | 328 |
| PEU1 | SS | 1.52 | 0.80 | 155 |
| | NS | 1.63 | 0.76 | 173 |
| | Total | 1.58 | 0.78 | 328 |
| PEU2 | SS | 1.64 | 0.88 | 155 |
| | NS | 1.64 | 0.76 | 173 |
| | Total | 1.64 | 0.82 | 328 |
| PEU3 | SS | 1.88 | 1.14 | 155 |
| | NS | 1.94 | 1.04 | 173 |
| | Total | 1.91 | 1.09 | 328 |
| PEU4 | SS | 2.28 | 1.08 | 155 |
| | NS | 2.42 | 1.12 | 173 |
| | Total | 2.35 | 1.10 | 328 |
| SE1 | SS | 1.43 | 0.82 | 155 |
| | NS | 1.49 | 0.65 | 173 |
| | Total | 1.46 | 0.74 | 328 |
| SE2 | SS | 1.94 | 0.98 | 155 |
| | NS | 1.99 | 0.90 | 173 |
| | Total | 1.96 | 0.94 | 328 |
| SE3 | SS | 1.65 | 0.90 | 155 |
| | NS | 1.80 | 0.84 | 173 |

| | | | | |
|---|---|---|---|---|
| | Total | 1.73 | 0.87 | 328 |
| SE4 | SS | 1.77 | 1.01 | 155 |
| | NS | 1.90 | 0.90 | 173 |
| | Total | 1.84 | 0.95 | 328 |
| SI1 | SS | 2.64 | 1.16 | 155 |
| | NS | 2.80 | 1.32 | 173 |
| | Total | 2.72 | 1.25 | 328 |
| SI2 | SS | 2.54 | 1.09 | 155 |
| | NS | 2.64 | 1.10 | 173 |
| | Total | 2.59 | 1.09 | 328 |
| SI3 | SS | 2.41 | 1.13 | 155 |
| | NS | 2.53 | 0.10 | 173 |
| | Total | 2.47 | 1.06 | 328 |
| SI4 | SS | 2.25 | 1.12 | 155 |
| | NS | 2.16 | 0.96 | 173 |
| | Total | 2.20 | 1.04 | 328 |
| FEI | SS | 2.42 | 1.16 | 155 |
| | NS | 2.57 | 1.10 | 173 |
| | Total | 2.50 | 1.13 | 328 |
| FE2 | SS | 2.74 | 1.11 | 155 |
| | NS | 2.85 | 1.18 | 173 |
| | Total | 2.80 | 1.15 | 328 |
| FE5 | SS | 2.56 | 1.28 | 155 |
| | NS | 2.66 | 1.32 | 173 |
| | Total | 2.61 | 1.30 | 328 |
| FE6 | SS | 2.41 | 1.25 | 155 |
| | NS | 2.58 | 1.25 | 173 |
| | Total | 2.50 | 1.25 | 328 |
| CO1 | SS | 2.48 | 1.26 | 155 |
| | NS | 2.64 | 1.39 | 173 |
| | Total | 2.57 | 1.33 | 328 |
| CO3 | SS | 1.99 | 1.13 | 155 |
| | NS | 2.11 | 0.99 | 173 |
| | Total | 2.05 | 1.06 | 328 |
| CO4 | SS | 2.08 | 1.12 | 155 |
| | NS | 2.06 | 1.04 | 173 |
| | Total | 2.07 | 1.08 | 328 |
| CO5 | SS | 2.14 | 1.04 | 155 |
| | NS | 2.14 | 0.94 | 173 |
| | Total | 2.14 | 0.99 | 328 |
| CO6 | SS | 2.35 | 0.96 | 155 |
| | NS | 2.44 | 1.02 | 173 |

| | | | | |
|---|---|---|---|---|
| | Total | 2.40 | 0.99 | 328 |
| AC1 | SS | 2.23 | 1.10 | 155 |
| | NS | 2.40 | 1.15 | 173 |
| | Total | 2.32 | 1.13 | 328 |
| AC2 | SS | 2.32 | 1.20 | 155 |
| | NS | 2.36 | 1.17 | 173 |
| | Total | 2.34 | 1.18 | 328 |
| AC3 | SS | 2.88 | 1.22 | 155 |
| | NS | 2.95 | 1.15 | 173 |
| | Total | 2.92 | 1.18 | 328 |
| AC4 | SS | 1.65 | 0.94 | 155 |
| | NS | 1.65 | 0.83 | 173 |
| | Total | 1.65 | 0.88 | 328 |
| AT1 | SS | 2.04 | 1.08 | 155 |
| | NS | 1.99 | 1.04 | 173 |
| | Total | 2.02 | 1.06 | 328 |
| AT2 | SS | 2.16 | 1.17 | 155 |
| | NS | 2.19 | 1.23 | 173 |
| | Total | 2.18 | 1.20 | 328 |
| AT3 | SS | 2.54 | 1.33 | 155 |
| | NS | 2.52 | 1.37 | 173 |
| | Total | 2.53 | 1.35 | 328 |
| AT4 | SS | 1.76 | 1.05 | 155 |
| | NS | 1.87 | 0.95 | 173 |
| | Total | 1.82 | 0.10 | 328 |

**Multivariate Tests[a]**

| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
|---|---|---|---|---|---|---|
| Intercept | Pillai's Trace | 0.95 | 168.98[b] | 33 | 29 | <0.001 |
| | Wilks' Lambda | 0.05 | 168.98[b] | 33 | 29 | <0.001 |
| | Hotelling's Trace | 18.97 | 168.98[b] | 33 | 29 | <0.001 |
| | Roy's Largest Root | 18.97 | 168.98[b] | 33 | 29 | <0.001 |
| Discipline | Pillai's Trace | 0.06 | 0.55[b] | 33 | 29 | 0.980 |
| | Wilks' Lambda | 0.94 | 0.55[b] | 33 | 29 | 0.980 |
| | Hotelling's Trace | 0.06 | 0.55[b] | 33 | 29 | 0.980 |
| | Roy's Largest Root | 0.06 | 0.55[b] | 33 | 29 | 0.980 |

a. Design: Intercept + Discipline

b. Exact statistic

Appendix C

- **How gender affected the responses**

| Between-Subjects Factors | | | |
|---|---|---|---|
| | | **Value label** | **N** |
| **Gender** | 1 | Male | 160 |
| | 2 | Female | 168 |

| Descriptive Statistics | | | | |
|---|---|---|---|---|
| | **Gender** | **Mean** | **Std. deviation** | **N** |
| PU1 | Male | 1.78 | 0.99 | 160 |
| | Female | 1.93 | 0.91 | 168 |
| | Total | 1.86 | 0.95 | 328 |
| PU2 | Male | 2.03 | 1.10 | 160 |
| | Female | 2.10 | 0.91 | 168 |
| | Total | 2.07 | 1.01 | 328 |
| PU3 | Male | 2.02 | 1.11 | 160 |
| | Female | 2.11 | 0.95 | 168 |
| | Total | 2.06 | 1.03 | 328 |
| PU4 | Male | 2.14 | 1.20 | 160 |
| | Female | 2.23 | 1.16 | 168 |
| | Total | 2.19 | 1.18 | 328 |
| PEU1 | Male | 1.53 | 0.80 | 160 |
| | Female | 1.63 | 0.76 | 168 |
| | Total | 1.58 | 0.78 | 328 |
| PEU2 | Male | 1.63 | 0.88 | 160 |
| | Female | 1.65 | 0.76 | 168 |
| | Total | 1.64 | 0.82 | 328 |
| PEU3 | Male | 1.85 | 1.13 | 160 |
| | Female | 1.96 | 1.04 | 168 |
| | Total | 1.91 | 1.09 | 328 |
| PEU4 | Male | 2.28 | 1.08 | 160 |
| | Female | 2.42 | 1.12 | 168 |
| | Total | 2.35 | 1.10 | 328 |
| SE1 | Male | 1.43 | 0.81 | 160 |
| | Female | 1.49 | 0.66 | 168 |
| | Total | 1.46 | 0.74 | 328 |
| SE2 | Male | 1.94 | 0.97 | 160 |
| | Female | 1.98 | 0.91 | 168 |
| | Total | 1.96 | 0.94 | 328 |
| SE3 | Male | 1.64 | 0.90 | 160 |

| | | | | |
|---|---|---|---|---|
| | Female | 1.80 | 0.84 | 168 |
| | Total | 1.73 | 0.87 | 328 |
| SE4 | Male | 1.80 | 1.03 | 160 |
| | Female | 1.88 | 0.88 | 168 |
| | Total | 1.84 | 0.95 | 328 |
| SI1 | Male | 2.61 | 1.16 | 160 |
| | Female | 2.83 | 1.32 | 168 |
| | Total | 2.72 | 1.25 | 328 |
| SI2 | Male | 2.52 | 1.09 | 160 |
| | Female | 2.66 | 1.10 | 168 |
| | Total | 2.59 | 1.09 | 328 |
| SI3 | Male | 2.39 | 1.12 | 160 |
| | Female | 2.54 | 1.00 | 168 |
| | Total | 2.47 | 1.06 | 328 |
| SI4 | Male | 2.23 | 1.12 | 160 |
| | Female | 2.17 | 0.96 | 168 |
| | Total | 2.20 | 1.04 | 328 |
| FEI | Male | 2.42 | 1.15 | 160 |
| | Female | 2.57 | 1.10 | 168 |
| | Total | 2.50 | 1.13 | 328 |
| FE2 | Male | 2.74 | 1.12 | 160 |
| | Female | 2.85 | 1.17 | 168 |
| | Total | 2.80 | 1.15 | 328 |
| FE5 | Male | 2.55 | 1.29 | 160 |
| | Female | 2.67 | 1.31 | 168 |
| | Total | 2.61 | 1.30 | 328 |
| FE6 | Male | 2.39 | 1.24 | 160 |
| | Female | 2.61 | 1.26 | 168 |
| | Total | 2.50 | 1.25 | 328 |
| CO1 | Male | 2.45 | 1.26 | 160 |
| | Female | 2.68 | 1.39 | 168 |
| | Total | 2.57 | 1.33 | 328 |
| CO3 | Male | 1.98 | 1.12 | 160 |
| | Female | 2.13 | 0.99 | 168 |
| | Total | 2.05 | 1.06 | 328 |
| CO4 | Male | 2.07 | 1.11 | 160 |
| | Female | 2.07 | 1.05 | 168 |
| | Total | 2.07 | 1.08 | 328 |
| CO5 | Male | 2.13 | 1.03 | 160 |
| | Female | 2.15 | 0.95 | 168 |
| | Total | 2.14 | 0.99 | 328 |
| CO6 | Male | 2.34 | 0.96 | 160 |
| | Female | 2.45 | 1.02 | 168 |
| | Total | 2.40 | 0.99 | 328 |

| | | | | |
|---|---|---|---|---|
| AC1 | Male | 2.22 | 1.09 | 160 |
| | Female | 2.41 | 1.16 | 168 |
| | Total | 2.32 | 1.13 | 328 |
| AC2 | Male | 2.31 | 1.19 | 160 |
| | Female | 2.38 | 1.18 | 168 |
| | Total | 2.34 | 1.18 | 328 |
| AC3 | Male | 2.86 | 1.22 | 160 |
| | Female | 2.98 | 1.15 | 168 |
| | Total | 2.92 | 1.18 | 328 |
| AC4 | Male | 1.65 | 0.93 | 160 |
| | Female | 1.65 | 0.83 | 168 |
| | Total | 1.65 | 0.88 | 328 |
| AT1 | Male | 2.02 | 1.07 | 160 |
| | Female | 2.01 | 1.04 | 168 |
| | Total | 2.02 | 1.06 | 328 |
| AT2 | Male | 2.14 | 1.16 | 160 |
| | Female | 2.21 | 1.23 | 168 |
| | Total | 2.18 | 1.20 | 328 |
| AT3 | Male | 2.49 | 1.33 | 160 |
| | Female | 2.56 | 1.37 | 168 |
| | Total | 2.53 | 1.35 | 328 |
| AT4 | Male | 1.75 | 1.04 | 160 |
| | Female | 1.89 | 0.96 | 168 |
| | Total | 1.82 | 0.10 | 328 |

| **Multivariate Tests[a]** | | | | | | |
|---|---|---|---|---|---|---|
| **Effect** | | **Value** | ***F*** | **Hypothesis df** | **Error df** | ***p*** |
| Intercept | Pillai's Trace | 0.95 | 169.90[b] | 33 | 29 | <0.001 |
| | Wilks' Lambda | 0.05 | 169.90[b] | 33 | 29 | <0.001 |
| | Hotelling's Trace | 19.07 | 169.90[b] | 33 | 29 | <0.001 |
| | Roy's Largest Root | 19.07 | 169.90[b] | 33 | 29 | <0.001 |
| Gender | Pillai's Trace | 0.06 | 0.56[b] | 33 | 29 | 0.978 |
| | Wilks' Lambda | 0.94 | 0.56[b] | 33 | 29 | 0.978 |
| | Hotelling's Trace | 0.06 | 0.56[b] | 33 | 29 | 0.978 |
| | Roy's Largest Root | 0.06 | 0.56[b] | 33 | 29 | 0.978 |
| a. Design: Intercept + Gender | | | | | | |
| b. Exact statistic | | | | | | |

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