
An Evaluation of the Model of Acceptance of E-Assessment Among Academics in Saudi Universities

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Abstract: E-assessment was introduced to overcome some of the limitations in paper-test assessment methods. Educational institutions have become more interested in adopting E-assessment, especially in classes with large numbers of students. This paper investigates the factors that influence Saudi academics to accept E-assessment, in order to give a clear picture for institutions before adopting E-assessment. A Model of Acceptance of E-assessment (MAE) has been developed [1] built from the existing theories and models of acceptance and use of information and communication technology (ICT) and other related studies. In previous stage of this study interviews with experts in Saudi Universities were conducted to refine the factors in MAE [2], and a questionnaire was then distributed to confirm the interview results. In the next stage of the study, another questionnaire was distributed to all academics in Saudi universities to evaluate the factors and find the most affecting factors on academics' intention and to examine the relationships between these factors using Structural Equation Modelling (SEM) analysis. Finally, the SEM results were explored by focus group discussions, among ten Saudi academics. The results show that Attitude was the most affecting factor that had an impact on Saudi academics' behavioural intention to accept E-assessment, followed by Subjective Norm, while Perceived Behavioural Control had no effect on their intention to accept E-assessment. Compatibility was found to have the most impact on Attitude, followed by Perceived Ease of Use and Perceived Usefulness, while Awareness of E-assessment had no effect on Attitude. Superior Influence had a strong influence on Subjective Norm, and only Self-Efficacy had an impact on Perceived Behavioural Control. Age was also examined as a moderating factor that might affect the relationships between Attitude, Subjective Norm and Perceived Behavioural Control and Behavioural Intention. The findings revealed that age had a positive and direct effect on the relationship between Attitude and Behavioural Intention, whereas it was found to have a low influence, on the relationship of Subjective Norm and Behavioural Intention.

Keywords: E-Assessment, E-Exam, Electronic Exam, Online Exam, Online Assessment

1. Introduction

Recently, ICT has been used in education in different learning phases. Assessment is one of the learning phases that has been improved by the use of ICT. E-assessment was introduced to help to assess a large number of student and at the same time to obtain accurate and fast results (Ridgway et al., 2004; Gilbert & Gale, 2007; Way, 2012). Educational institutions have started to adopt E-assessment, but few papers have yet discussed the issues of adopting E-assessment in higher education, or specifically in Saudi Arabia. Before adopting E-assessment the institution needs to consider the factors that influence academics to accept E-

assessment. This paper investigates these factors and examines the relationships between them, in order to help developers in Saudi institutions to design E-assessment systems with consideration of these factors to encourage academics to use E-assessment.

The Model of Acceptance of E-assessment has been developed, based on the theories and models of user acceptance of ICT, and other related studies [1]. The MAE consists of: attitude (perceived ease to use, perceived usefulness, and compatibility), subjective norm (peer influence and superior influence) and perceived behavioural control (self-efficacy, resource facilitating conditions, and IT support). These three main factors were used as determinants

of academic behavioural intention to accept E-assessment. Age and gender were added to the model as moderating factors. The study followed a sequential mixed methods approach, which gathered qualitative and quantitative data in an ordered sequence and used different data collection tools (interview, a questionnaire, and focus group discussion).

The developed model (MAE) was validated through interviewing 15 experts (the schools' heads of E-learning and distance learning in Saudi Universities), who confirmed all the factors except gender. Awareness of E-assessment and the

existence of a strong security system were suggested by the experts as factors that should be added to the MAE; awareness was added as a sub-factor under attitude and the availability of a strong security system was included with resource facilitating conditions [2]. After the expert interviews, a questionnaire was distributed to all academics in Saudi Universities to confirm the factors, from which all the factors in the MAE were confirmed. Figure 1 displays the Model of Acceptance of E-assessment after refining by experts and confirming through the questionnaire results.

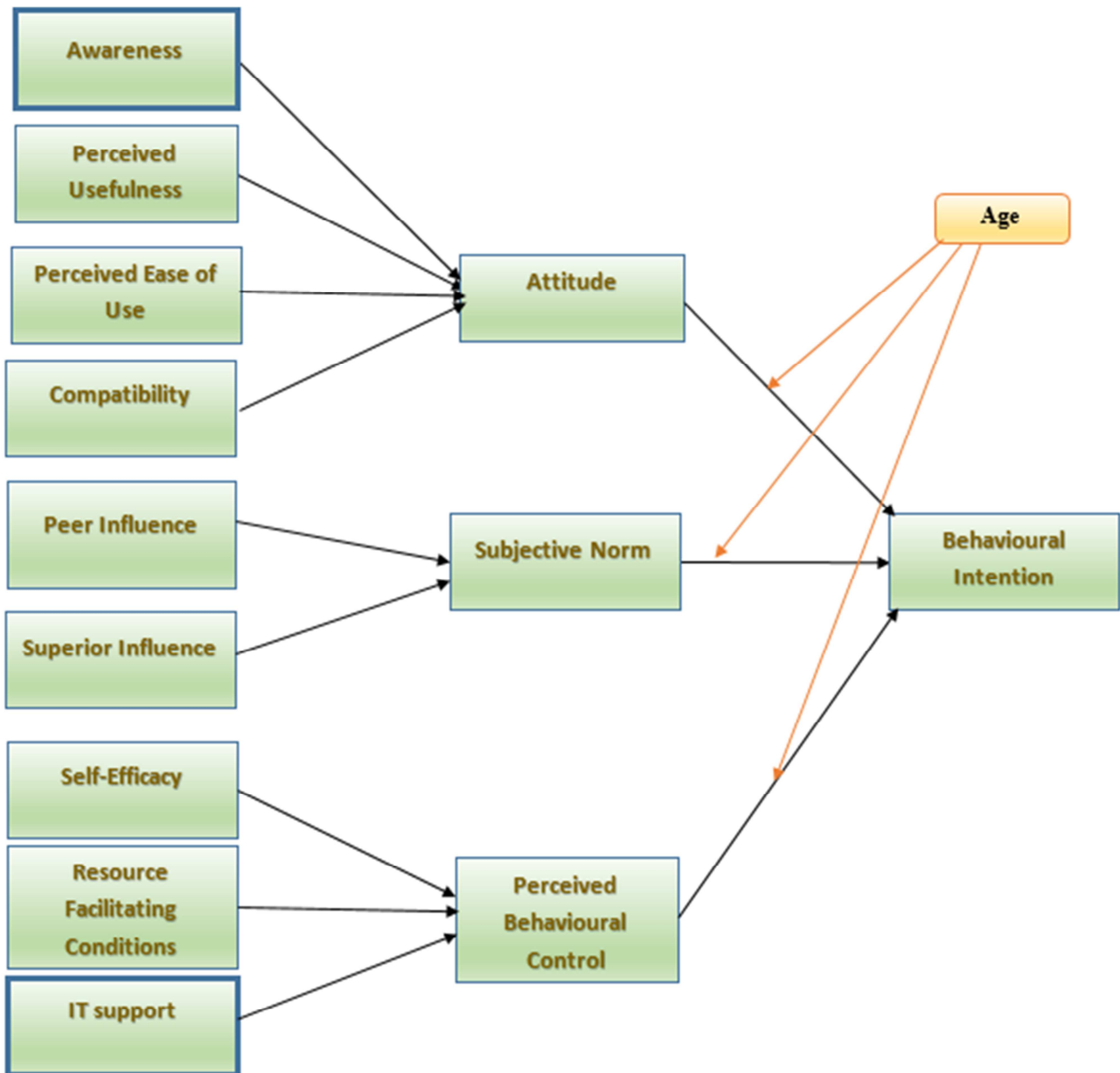


Figure 1. The Model of Acceptance of E-assessment (MAE).

To find the most affecting factors that influence academics' intention to accept E-assessment and to examine the relationships between the factors, another questionnaire was sent to all academics in Saudi Universities and 306 responses were received from different universities in Saudi Arabia. Structural Equation Modelling (SEM) was used to

analysis the results of the questionnaire. The structural model in SEM was used to assess the hypotheses that proposed the relationships between the latent constructs, and the factors should affect each other's positively. Table 1 presents the hypotheses of the latent constructs' relationships. SEM also helps to check the model fit with collected data, reliability

and validity of the instruments through two stages: the measurement model and structural model. The following sections will discuss the design, model fit, reliability, validity and the results of the questionnaire.

In order to clarify the questionnaire results, focus groups were conducted with two groups of Saudi academics. This

technique is usually used after a questionnaire to obtain a deeper understanding of the implications and reasons behind the quantitative data. Ten members participated in focus group discussions and they provided different underlying reasons for the questionnaire results.

Table 1. Hypotheses to be assessed in the structural model.

Construct	Hypotheses	Hypothesised relationships
Attitude (ATU)	H1	ATU → BI
Attitude (ATU) & Age	H1a	ATU (age) → BI
Awareness (AW)	H2	AW → ATU
Perceived Ease of Use (PEU)	H3	PEU → ATU
Perceived Usefulness (PU)	H4	PU → ATU
Compatibility (COM)	H5	COM → ATU
Subjective Norm (SN)	H6	SN → BI
Subjective Norm (SN) & Age	H6a	SN (age) → BI
Superior Influence (SI)	H7	SI → SN
Perceived Behavioural Control (PBC)	H8	PBC → BI
Perceived Behavioural Control (PBC) & Age	H8a	PBC (age) → BI
Self-Efficacy (SE)	H9	SE → PBC
Resource facilitating conditions (FC)	H10	FC → PBC
IT Support (ITS)	H11	ITS → PBC

Note: Behavioural Intention (BI)

2. Questionnaire Design and Procedures

As this study required a large number of attitudes and beliefs to be gathered from different respondents, a self-administered questionnaire was considered appropriate to collect data in this stage. Thus, a self-administered questionnaire was designed to help in accepting or rejecting the hypotheses [6]. The statements in the questionnaire designed to validate the study were adopted based on a literature review of models of user acceptance and use of ICT [7–10], and previous relevant research [11–13].

The questionnaire consisted of five pages, starting with a covering letter, which included: a welcome statement, the description of E-assessment and consent information. The other four pages covered different parts of the study: demographic questions, questions regarding the use of E-assessment, and statements designed to evaluate the relationships between factors in MAE.

The questionnaire was presented in both English and Arabic. iSurvey software was used to generate English and Arabic versions of the questionnaire, with a five-level Likert scale implemented for all statements, with the following ratings: Completely agree = 5; agree = 4; neutral = 3; disagree = 2 and Completely disagree = 1 [14].

It is essential to have a sufficient sample size in order to produce reliable results. This study used Structural Equation Modelling (SEM) for data analysis, for which different recommendations have been provided for an adequate sample size to obtain credible results, ranging from 100 cases or more [15] to about 200 cases [16]. Thus, although here is no agreement about the sample size, 200 cases can be considered as a general rule of thumb [16]. Hence, this study aimed to collect at least 200 responses. The researcher sent

the questionnaire to largest possible number of academics in Saudi Universities, in order to obtain more than 200 responses. The sample size collected in this study was 306 cases.

3. Structural Equation Modelling

To determine whether the proposed model of acceptance of E-assessment is the appropriate model to predict the academics' behaviour towards accepting E-assessment, it was examined using Structural Equation Modelling (SEM), which is a confirmatory analysis technique to test the model based on current theory.

Using SEM the MAE was examined, in two steps. The first step was the measurement model that tests the inter-relationships between latent constructs and observed variables. The structural model was used in the second step to evaluate the logical meaning of the relationships between latent constructs based on the hypotheses. Both steps are discussed in detail in the following sections.

3.1. Measurement Model

It is important to be sure that the instruments measure the factors correctly. This can be achieved using reliability and validity tests to help to produce credible results [17]. Therefore, the validity and reliability of the instrument were checked in this study. To ensure that the instruments were good, the reliability and validity tests were used in the measurement level analysis. This level of analysis is essential before conducting any other type of analysis. The measurement level was performed using 13 latent constructs and 48 observed variables (Table 2).

Table 2. Latent constructs and observed variables.

Latent Constructs	Constructs' Code	Observed variables
Awareness	AW	AW1, AW2, AW3, AW4
Perceived Ease of Use	PEU	PEU1, PEU2, PEU3, PEU4
Perceived Usefulness	PU	PU1, PU2, PU3, PU4
Compatibility	COM	COM1, COM2, COM3, COM4
Attitude	ATU	ATU1, ATU2, ATU3
Superior Influence	SI	SI1, SI2, SI3, SI4
Peer Influence	PI	PI1, PI2, PI3, PI4
Subjective Norm	SN	SN1, SN2, SN3
Resource facilitating conditions	FC	FC1, FC2, FC3, FC4, FC5
IT Support	ITS	ITS1, ITS2, ITS3
Self-Efficacy	SE	SE1, SE2, SE3
Perceived Behavioural Control	PBC	PBC1, PBC2, PBC3, PBC4
Behavioural Intention	BI	BI1, BI2, BI3

3.1.1. Validity of Instruments

The validity of instrument helps to assess if the instrument measure what it was designed to measure [18]. The instrument used in this research was assessed for content and construct validity. In SEM there are three different forms of construct validity test: convergent validity and discriminant validity [15].

Convergent validity examines if the item correlates with other items on the same construct [18]. The items can be said to measure their constructs if the correlation is high [15]. A construct's factor loading, average variance extracted (AVE), and construct reliability are used to test the convergent validity [15]. Average Variance Extracted (AVE) is calculated using the following formula [15], where L_i is the standardised factor loading, and n is the number of items.

$$Average\ Variance\ Extracted\ (AVE) = \frac{\sum_{i=1}^n L_i^2}{n}$$

Hair *et al.* [15] suggest an AVE score of 0.5 or above, and factor loading scores ranging from 0.5 and above; 0.7 indicates the ideal score for factor loading. All the observed variables' factor loadings are above 0.5, which are acceptable, and most of them have ideal scores (above 0.7). However, the AVEs for the latent constructs superior influence, resource facilitating conditions and self-efficacy are lower than 0.5. Hair *et al.* [15] suggest

removing the variables with low factor loading to improve the AVE. Therefore, some of the variables were deleted to improve the AVE for latent constructs. For example, SI3, the lowest variable factor loading in superior influence was deleted, and the AVE is increased from 0.486 to 0.616, and FC4 and FC5 were also removed, to raise the AVE for FC to 0.602.

Discriminant validity means to what extent that measure is different from the other measures [19]. Discriminant validity can be examined by comparing the square root of AVE with the construct correlations [15]. In this study, the constructs did not pass the discriminant validity test unless the peer influence latent construct was removed. The peer influence latent construct was cross-loaded with the subjective norm construct. The result for the subjective norm was 0.755, which is below that for peer influence (0.851). Farrell [20] suggests solutions for lack of discriminant validity, one of which is removing the item that is cross-loaded on the others. For example, Chien *et al.* [21] removed the peer influence factor from the model investigating the teacher beliefs about use of technology-based assessment, because they found that only 5% of teachers considered peer opinions. Therefore, the peer influence latent construct was removed from the present model, and the constructs in the model then pass the discriminant validity test. Table 3 shows the results of the discriminant validity test.

Table 3. Discriminant validity test results.

	AW	PEU	PU	COM	ATU	SI	PBC	FC	ITS	SN	BI	SE
AW	0.868											
PEU	0.821	0.797										
PU	0.447	0.648	0.935									
COM	0.496	0.660	0.853	0.892								
ATU	0.499	0.718	0.813	0.866	0.891							
SI	0.420	0.480	0.522	0.486	0.458	0.784						
PBC	0.651	0.681	0.430	0.444	0.445	0.368	0.881					
FC	0.492	0.434	0.384	0.407	0.419	0.462	0.416	0.776				
ITS	0.552	0.514	0.380	0.379	0.408	0.537	0.453	0.637	0.858			
SN	0.359	0.470	0.720	0.636	0.627	0.701	0.391	0.381	0.440	0.952		
BI	0.351	0.550	0.766	0.772	0.808	0.451	0.382	0.420	0.368	0.600	0.917	
SE	0.595	0.714	0.648	0.630	0.629	0.480	0.697	0.466	0.519	0.516	0.608	0.715

3.1.2. Reliability of Instrument

Composite reliability is usually used to examine the reliability of the constructs in SEM. Hair *et al.* [15] defined

composite reliability as measuring “reliability and internal consistency of the measured variables representing a latent construct”. Bentler [22] points out that the study may be

misleading if the composite reliability test is not conducted. The following formula is recommended to calculate the composite reliability [15], where L_i is the standardised factor loading, n is the number of items and e_i is the error variance terms for a construct:

$$\text{Composite Reliability} = \frac{(\sum_{i=1}^n L_i)^2}{(\sum_{i=1}^n L_i)^2 + (\sum_{i=1}^n e_i)^2}$$

The CR is calculated using Cronbach's Alpha (α). A reliability result of between 0.6 and 0.7 is acceptable, but a good reliability is higher than 0.7, and with high reliability the internal consistency also increases [15]. Table 4 shows the reliability scores for each latent construct. All the reliability scores are above 0.7, which indicates that all the constructs are reliable. Only the self-efficacy latent construct has a score slightly less than 0.7 (0.689), but this is still considered reliable.

Table 4. Latent constructs' reliability.

Construct	Composite Reliability (CR)
Awareness	0.903
Perceived Ease of Use	0.847
Perceived Usefulness	0.919
Compatibility	0.918
Attitude	0.732
Superior Influence	0.786
Peer Influence	0.829
Subjective Norm	0.760
Resource Facilitating Conditions	0.820
IT Support	0.881
Self-Efficacy	0.689
Perceived Behavioural Control	0.847
Behavioural Intention	0.774

Table 5. The indices of GoF.

Chi-square $\chi^2 = 745.211, p < .001$	The proposed model fit	Model fit indices for sample size > 250 (Hair et al. 2010)
Df	418	
Normed chi-square χ^2/df	1.78	< 3.0
RMSEA	0.051	< 0.07
CFI	0.951	> 0.90
RMR	0.062	< 0.1
SRMR	0.066	=0.08

3.2.2. Examination of Latent Constructs' Relationships

After assessing the GoF of the proposed model, the hypothesised relationships between the latent constructs should be tested. The standardised path coefficient or regression coefficient (β), Critical Ratio (CR), P-value and squared multiple correlations (SMC or R^2) were assessed to evaluate the relationships among latent constructs.

P-value is used to evaluate how statistically significant the relationship is between measured variables and latent variables at the level 0.05. The standardised path coefficient (β) means the path that represents a causal relationship between two constructs [15]. It is used to evaluate the effect size of different variables in the model. Their values are assessed using the Critical Ratio (CR). The CR can be calculated by dividing the regression coefficient (β) by the standard error (SE), and it is considered significant at the

3.2. Structural Model

After checking the reliability and validity of the constructs, the examination of the relationships between the latent constructs should be established. The structural model in SEM was used to assess the hypotheses that proposed the relationships between latent constructs (Table 1).

3.2.1. Goodness of Fit (GoF)

The first step in a structural model is examine the Goodness of Fit, which means how well the proposed model fits with the real data. That means the hypotheses of the model should fit with the collected data [23]. The GoF results are obtained by comparing the covariance matrix (of the data collected) [23] with the hypotheses proposed. There are different measures to test the GoF. A chi-square (χ^2) was used in this study, which is a primary statistical test in SEM that assesses the difference between the sample covariance matrix and the predicted model covariance matrix [16]. Most of the studies recommend that chi-square and normed chi-square are adequate to examine the GoF of the model, and some of them suggest adding two or three fit indices with the chi-square [15]. This study used the widely recommended GoF indices, based on the sample size and the number of the items in the proposed model, following the guidelines of Hair et al. [15] to evaluate the model's fit with the collected data.

All the indices in the proposed model of this study are in the ranges recommended by Hair et al. [15], which indicates that the proposed model fits with the collected data. Table 5 shows the results of the indices of GoF for the structural model, compared with the indices suggested by Hair et al. [15].

0.05 level, if the CR is equal to or above 1.96 [15].

In this study, causal paths were analysed using the P-value, path estimation and critical ratio. The results are presented in Table 6, and the shaded rows represent insignificant results. Most the hypotheses were found to be significant, except H2, H8, H10, and H11. The paths estimated for hypotheses H1, H3, H5, H7 and H9 are positive and statistically significant and the exogenous variables have strong relationships with the endogenous variables. In addition, the path estimated for H4 and H6 is significant and positive, and the relationship between PU and ATU (H4) is moderate, while the relationship between SN and BI (H6) is weak.

The P-values of H2, H8, H10 and H11 are greater than 0.05, which indicates that these relationships are not statistically significant. The P-value of H2 is 0.066 > 0.05, which means that there is no effect of awareness on academic attitudes towards accepting E-assessment. The same is true

for H10 and H11, as they have P-values of 0.980 and 0.726, respectively. This indicates that there are no relationships between facilitating conditions and perceived behavioural control, nor between IT support and perceived behavioural

control. Surprisingly, H8 is not statistically significant, which shows that there is no effect of perceived behavioural control on behavioural intention to accept E-assessment.

Table 6. Analysis of Hypotheses.

Hypothesised Path	β (≥ 0.1)	CR (≥ 1.96)	P (< 0.05)
H1: ATU → BI	0.702	11.107	<0.001
H2: AW → ATU	-0.166	-1.837	0.066
H3: PEU → ATU	0.361	3.340	<0.001
H4: PU → ATU	0.164	2.207	<0.001
H5: COM → ATU	0.556	6.925	<0.001
H6: SN → BI	0.092	1.982	<0.001
H7: SI → SN	0.612	8.599	<0.001
H8: PBC → BI	0.045	0.937	0.349
H9: SE → PBC	0.978	7.981	<0.001
H10: FC → PBC	-0.002	-0.025	0.980
H11: ITS → PBC	-0.032	-0.346	0.726

After assessing the relationships among latent constructs', the effect of moderating variables on some constructs need to be evaluated. In the MAE, age is proposed as moderating factor that influence the relations between attitude, subjective norm, perceived behavioural control and behavioural intention. Using multi-groups in SEM, the effect of age on these constructs was assessed. As shown in Table 7, age has a positive and significant impact on the relation between

attitude and behavioural intention. The respondents' age also has positive and significant effects on the relation of subjective norm to behavioural intention in the younger group (20 to 40), while for the older group (41 to over 50) an insignificant effect was found on subjective norm ($\beta = 0.029$ and $P = 0.723$). There is no effect of age on perceived behavioural control, as the statistical result was insignificant.

Table 7. Analysis of age effects on constructs.

Age/Hypothesised	Group age (20- 40)			Group age (41- over 50)		
	Hypothesised Path	β (≥ 0.1)	CR	P (< 0.05)	β (≥ 0.1)	CR
H1a: ATU → BI	0.639	6.991	<0.001	0.892	8.465	<0.001
H6a: SN → BI	0.109	2.156	<0.001	0.029	0.354	0.723
H8a: PBC → BI	0.052	0.863	0.388	0.018	0.204	0.838

4. Questionnaire Findings

4.1. E-Assessment Usage Results

It was important to initially discover the percentage of the academics, who were using E-assessment, in order to know the extent of use of E-assessment among academics in Saudi universities. Therefore, the questionnaire included a question asking if they had used E-assessment. The majority of respondents, about 60%, answered "No", of the academics, and 40% answered "Yes".

This section of the questionnaire consisted of three further questions about E-assessment for the 40% of participants

who had answered "Yes". The next question was: "Which E-assessment systems did you use?". The E-assessment system in Blackboard was the popular system utilized by most of the academic users. They were also asked "How many years have you been using the E-assessment system?". 36 from 120 of academics start using the E-assessment less than two years ago, while 41 of them had used E-assessment for more than two years ago. The participants were also asked to estimate the daily average time that they spent using E-assessment. About half of the respondents spent about 30 minutes to one hour every day using E-assessment. Table 8 shows the detailed results of E-assessment usage.

Table 8. E-assessment usage results.

Question	Choices	Number of Respondents
Did you use an E-assessment system?	Yes	120
	No	186
Which E-assessment systems did you use?	E-assessment system in Blackboard system	65
	E-assessment system in MS system	6
	Quiz Creator	14
	Articulate Quiz-maker	2
	Other	33
How many years you have been using the E-assessment system?	Just started	26
	Less than 2 years	36
	2-5 years	41
	6-10 years	11

Question	Choices	Number of Respondents
How do you estimate the daily average amount of time you spend on the E-assessment system?	More than 10 years	6
	Less than 30 minutes	24
	30- 60 minutes	50
	1-2 hours	24
	Over 2 hours	22

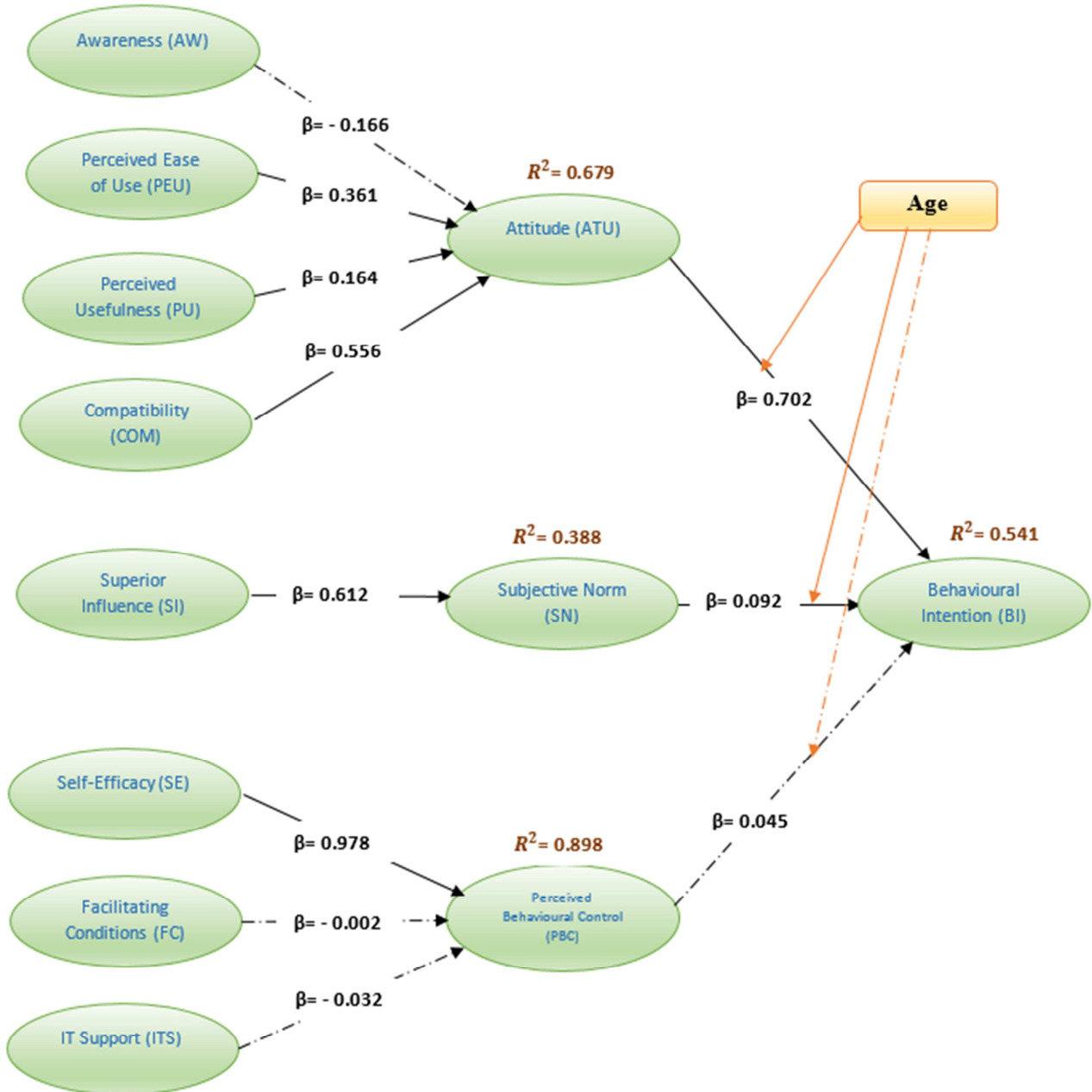


Figure 2. Path diagram for the proposed structural model.

Path Coefficients:

→ Significant relationship; β = standardised coefficients

→ Insignificant relationship; R^2 = squared correlations

4.2. Results of Hypothesised Relationships

The hypothesised relationships in the proposed model (MAE) were examined through path analysis using standardised path coefficients as shown in Figure 2. Each arrow comes from a latent construct and points to other latent

construct, representing the relationship between these two variables and the hypotheses. All these relationships were assessed. This section will discuss the result of the analysis for each hypotheses.

H1: Attitude towards E-assessment acceptance has a positive influence on academics' Behavioural Intention to

use E-assessment.

Attitude is one of three factors that affect behavioural intention. From the results in Table 6, attitude is the most affecting factor among the three factors that influence behavioural intention. The standardised regression weight is $\beta = 0.702$, $CR = 11.107$ and the P -value < 0.001 , which indicates that relationship between attitude and behavioural intention is statistically significant. Moreover, as the result was positive that means the attitude positively affects the academics' behavioural intention to accept E-assessment. This result supports the hypotheses H1 which is proposed in MAE.

Attitude towards Behaviour (ATU) is influenced by four factors: Awareness (AW), Perceived Ease of Use (PEU), Perceived Usefulness (PU) and Compatibility (COM). The influences of these three factors on ATU were found to be as follows:

H2: Awareness has a positive influence on the academics' Attitude to accept E-assessment.

Awareness was found to have no direct effect on Behavioural Intention to accept E-assessment, at level of P -value $= 0.066 > 0.05$. Thus, hypotheses H2 was not supported.

H3: Perceived Ease of Use has a positive influence on the academics' Attitude to accept E-assessment.

The results of this latent variable support this hypothesis. Perceived Ease of Use has a significant and positive relationship with Attitude, with P -value < 0.001 . The standardised regression weight is $\beta = 0.361$ and $CR = 3.340$, which indicates a positive and strong relationship between these two factors. This confirms that, Perceived Ease of Use has a positive and strong effect on Attitude. Moreover, the results show that Perceived Ease of Use is the second most affecting factor, after Compatibility, among the four factors that influence Saudi academics' attitude to accepting E-assessment.

H4: Perceived Usefulness has a positive influence on the academics' Attitude to accepting E-assessment.

Perceived Usefulness was found to have a significant and positive effect on academics' Attitude; P -value was < 0.001 . However, this factor considered the less influencing factor on attitude comparing with Compatibility and Perceived Ease of Use; the standardised regression weight is $\beta = 0.164$ and $CR = 2.207$.

H5: Compatibility has a positive influence on the academics' Attitude to accepting E-assessment.

Compatibility was found to have a significant strong and positive effect on Attitude. The standardised regression weight is $\beta = 0.556$, $CR = 6.925$ and P -value < 0.001 , indicating a positive and strong relationship between Compatibility and Attitude. The results also show that Compatibility is the most affecting factor among the four factors influencing academics' Attitude.

H6: Subjective Norm has a positive influence on academics' Behavioural Intention to accept E-assessment.

The results show that there is an effect of Subjective Norm on academic's behavioural intention at P -value < 0.001 .

However, the influence of subjective norm on behavioural intention is low, with $\beta = 0.092$ and $CR = 1.982$, although, the results do support hypothesis (H6).

H7: Superior Influence has a positive effect on the Subjective Norms towards acceptance of E-assessment by academics.

The standardised regression weight of Superior Influence is 0.612 with a critical ratio of 8.599. This means that the path between SI and SN is statistically significant at the $p < 0.001$ level, and there is a positive and strong relationship between Superior Influence and Subjective Norm on academics' intention towards accepting E-assessment. These results support hypothesis (H7).

H8: Perceived Behavioural Control has a positive influence on academics' Behavioural Intention to accept E-assessment.

Perceived Behavioural Control was found to have no direct effect on Behavioural Intention to accept E-assessment among academics in Saudi universities. The P -value was $0.349 > 0.05$ and the standardised regression weight < 0.1 . As a result, the hypothesis H8 was not supported.

H9: Self-Efficacy has a positive influence on Perceived Behavioural Control towards Intentions of academics to accept E-assessment.

Self-efficacy is one of three factors that influence Perceived Behavioural Control (the other two are FC and ITS). The results indicate a significant strong and positive path between Self-Efficacy and Perceived Behavioural Control at the level of P -value < 0.001 . The standardised regression weight is $\beta = 0.978$ and $CR = 7.981$. Self-Efficacy is the only factor of the three which affects Perceived Behavioural Control. Thus, this result supports hypothesis (H9) proposed in the model.

H10: Resource Facilitating Conditions has a positive influence on Perceived Behavioural Control towards academics' Intention to accept E-assessment.

Resource Facilitating Conditions was found to have no direct effect on Perceived Behavioural Control, at the level of P -value $= 0.980 > 0.05$. Therefore, this hypothesis was not supported.

H11: IT Support has a positive influence on Perceived Behavioural Control towards academics' Intention to accept E-assessment.

IT support was found to have no direct effect on perceived behavioural control. The P -value was $0.726 > 0.05$, and the standardised regression weight < 0.1 . Thus, the hypotheses H11 was not supported.

H1a: Age moderates the relationship between Attitude and Behavioural Intention.

There is a significant and positive interaction between Age and Attitude in the effect on Behavioural Intention to accept E-assessment, and the results for the group aged between 41 and over 50 showed a stronger effect ($\beta = 0.892$) on attitude than the group aged between 20 and 40 ($\beta = 0.639$). Therefore, this hypothesis was confirmed.

H6a: Age moderates the relationship between Subjective Norm and Behavioural Intention.

There is an interaction between Age and Subjective Norm in the effect on Behavioural Intention. A significant and positive effect was shown by the younger group on Subjective Norm ($\beta=0.109$ and $p<0.05$), while an insignificant effect in the older group was found on Subjective Norm ($\beta=0.029$ and $p=0.723$). Thus, this hypothesis was accepted.

H8a: Age moderates the relationship between Perceived Behavioural Control and Behavioural Intention.

Since there is no effect of Perceived Behavioural Control on Behavioural Intention, there is no effect of age between these two latent variables. The P-value was > 0.05 for two age groups.

5. Focus Group

Focus groups help to collect information regarding a group of individuals' views and explain the meaning behind these views [24] which assists in obtaining a richer understanding of group members' experiences and beliefs [25]. A purpose for using focus groups is "To clarify, extend, qualify or

challenge data collected through other methods" [26], a focus group discussion helps to verify that a questionnaire result is accurate [27]. Therefore, the focus group method was considered as the appropriate method to clarify the SEM results, and understand the MAE.

The focus group approach was used to explain the SEM results, and obtain insights and understanding of the MAE.

5.1. Focus Group Design and Procedures

The questions the participants were asked in the focus group are presented in Table 9. These questions were ordered to promote discussion of the relationships between the constructs in MAE. In the discussion the researcher focused on the unexpected results of relationships between constructs. The questions were written in both English and Arabic (Appendix D), in case there was any difficulty in understanding the English language, but all participants were able to read and speak English and for this reason, the discussion was conducted in English.

Table 9. Focus group questions.

Construct relationships	Questions
ATU→BI	To what extent you think that an academic's attitude can affect the academic's behavioural intention to accept E-assessment in the future? Why?
ATU (age)→BI	To what extent you think that academics' age can affect academics' attitude toward accepting E-assessment in future? Why?
AW → ATU	To what extent you think that there is an effect of the awareness of E-assessment and its benefits on academics' attitude toward accepting E-assessment?
PU →ATU	To what extent you think that benefits of E-assessment affect the Saudi academics' attitude toward accepting E-assessment? Why?
PEU→ATU	To what extent you think ease of use of E-assessment can affect the Saudi academics' attitude toward accepting E-assessment? Why?
COM→ATU	To what extent you think if E-assessment is compatible with an academic's work and his/her needs, this will affect the Saudi academic's attitude toward accepting E-assessment? Why?
SN→BI	To what extent you think that an academic's social influence (people around the academic) can affect the academic's behavioural intention towards accepting E-assessment in the future? Why?
SN (age)→BI	To what extent you think that an academics' age can affect the academic's social influence (people around the academic) to accept E-assessment in future? Why?
SI→SN	To what extent you think that the manager or the supervisor of the academic can have an impact on the academic's social behaviour toward accept E-assessment? Or the manager can be one of the people that may have influence on an academic's willingness to accept E-assessment? Why?
PBC→BI	To what extent you think that an academic's ability to control the use of E-assessment can affect that academic's behavioural intention to accept E-assessment in the future? Why?
PBC (age)→BI	To what extent you think that an academics' age can affect that academic's ability to control the use of E-assessment in future? Why?
SE→PBC	If E-assessment matches the academic's knowledge and skills, to what extent you think this can affect the academic's ability to control E-assessment use? Why?
FC→PBC	To what extent do you think the availability of resources that the academic needs to use E-assessment (e.g. computers, internet connection), has an effect on the academic's ability to use E-assessment? Why?
ITS→PBC	To what extent you think the availability of E-assessment training courses and staff support to use E-assessment has an effect on the academic's ability to use the E-assessment? Why?

It is essential to consider the adequate group size for a focus group discussion. In the focus group method, using a small group may limit the range of the discussion, while using a large group means it will be hard to manage the discussion and it may limit the opportunities for some participants to share their views [26]. Stewart and Shamdasani [28] suggest that the researcher should be careful of having a large group, which may lead to an unsatisfactory discussion. Gill et al. [24] propose that the appropriate number of participants in a focus group is between six to eight participants; however they suggest that a focus group can successfully conducted with at least three participants

and a maximum of 14 participants. This study used two focus groups, one of them with six participants and the other with four, to avoid the risk of misleading the discussion and give opportunities for each group member to speak and share his/her view. To obtain an adequate range of views and have a rich discussion, the members of the focus groups were from different universities in different regions in Saudi Arabia.

The targeted members of the focus groups were conducted by e-mail or phone asked to participate and the researcher proposed dates and times for focus groups meetings. After obtaining approval to participate from six Saudi academics for the first group and four academics for the second group,

the researcher allocated quiet rooms for the focus group discussions. At the beginning of the focus group meeting the researcher gave the participants a written overview of the research aims and methods and a consent form to sign, to confirm that they agree to participate in this discussion. The model, the MAE, and the results from the SEM were presented, with all the results had been printed out and illustrated for the focus group members. Meanwhile, the researcher gave the opportunity for the participants to ask any questions about the research or the model and answered them. The members asked some questions about the results and some of them were looking for details, such as the standardised regression weight between two constructs. After clarifying all the misunderstandings of the model, the researcher started asking their opinions about each relationship between factors, using the focus group questions shown in Table 9. The discussion took about an hour and half for the first group and hour for the second group. Each focus group's discussion was recorded and later transcribed.

5.2. Focus Group Results

The aim of the focus group discussions was to shed light on the results obtain from SEM, in order to have a deep understanding of these results and to elicit the reasons behind these results. This section will present the views expressed by the focus group members about each factor and its relationships in answer to the questions shown in Table 9.

Attitude → Behavioural intention: When asked whether *“the attitude of an academic can affect the academic's behavioural intention to accept E-assessment in future?”*, all of the academics agreed that attitude has strong impact on academics' behavioural intention to accept E-assessment in Saudi universities.

Attitude (age) → Behavioural intention: In answer to the second question, regarding the effect of age on an academic's attitude towards accepting E-assessment, one of the members said *“There is an effect of age on the relation between academics' attitude and academics' behavioural intention to accept E-assessment”*. All the members also agreed that the attitude of younger academics had more influence on behavioural intention compared with older academics. One of the group justified her answer by explaining *“The younger academics more flexible for change and they like to adopt the new technology more than older academics”*. Another said, *“Older academic does not like to change his/her method of teaching or assessing the student”*, while, one of the members explained, *“I agree with the results that you (the researcher) have, the older academic has a routine and specific way to assess students and he/she does not like to change it”*. Member M in the second group provided an example: *“My mother was lecturer and she decided to retire when the computer and technology were emerged in her university”*.

Thus the members' views confirmed that age has an influence on the relation between attitude and behavioural intention of academics to accept E-assessment. However, the attitude of younger academics can have a more positive affect

on their behavioural intention to accept E-assessment compared with older academics, for whom it has less influence.

Awareness → Attitude: The focus group members were asked if they thought that awareness of E-assessment and its benefits would affect their attitude to accepting E-assessment. Four members from the first group and two from the second group argued that *“awareness does not have an effect on attitude”*. However, they gave different justifications for this. Member N in first group said, *“The E-assessment now is known by most of the academics, so this factor does not affect the attitude”*. Another member said *“Even if I know the E-assessment I prefer to assess the students in the university and use the paper-test method”*.

Member A in the first group explained a significant experience in her university: she said, *“King Khalid University was the first university that applied E-learning and E-assessment in Saudi Arabia, and it provides fully equipped labs, training courses, IT support staff and awareness of E-assessment. Also, it offers bonuses and awards for academics who use E-assessment. However, few academics now in my university use E-assessment, and I think this is because they do not have the desire to use E-assessment”*.

In contrast, other members confirmed the importance of awareness in influencing the academics' attitudes. Member A in first group said, *“it is important, and we need awareness of new technology systems in our Universities”*. Member T in the second group justified her answer, saying: *“The awareness may be important if there are training courses accompanied with it”*. Member MM said, *“The awareness may have influence in academics' attitude if the universities prove that E-assessment useful for academics' tasks or for student”*.

Perceived usefulness → Attitude: The focus group members were asked if the perceived usefulness had an influence on academics' attitude towards accepting E-assessment. Two members confirmed the effect of perceived usefulness, saying that if the E-assessment was useful this would affect their attitude and increase their desire to use it. Another member in the same group said, *“It is very important factor that affect my attitude”*.

Another member said that perceived usefulness and perceived ease of use are the most important factors that influence the academics' attitude: *“The benefits and simplicity of E- assessment use are the most important factors that influence the academics' attitude”*. One member also linked the influence of perceived usefulness with perceived ease of use; she said, *“The benefits of E-assessment is relation to how it easy to use it, if it easy to use this will affect my attitude and increase my desire to use E-assessment”*. Member A in first group said, *“Even I have all the facilities and the important equipment to use E-assessment, I will not use it if it is not useful and easy to use”*.

Perceived ease of use → Attitude: The members of the focus groups were asked whether if the E-assessment is easy to use, this might affect their attitude. All the ten group members confirmed that perceived ease of use would

strongly influence the academics' attitude. They expressed that by saying, "It is a very important factor" or "It is the most important factor that can affect academics' attitude. Member A in the first group said, "If the E-assessment difficult to use I will not use it". Another member linked perceived ease of use with perceived usefulness; she said, "These two factors are the most important factors that can affect academics' attitude to use E-assessment".

Compatibility → Attitude: The members of the focus groups discussed how important the compatibility of E-assessment with academic tasks was in influencing attitudes. Eight members from both groups agreed that E-assessment should be compatible with the nature of the course that the academics were teaching. For example, one member said, "It is important that E-assessment be compatible with the course type that academic teach it, some of the courses are difficult to sort questions to assess students using E-assessment". Another said "E-assessment should match the questions type that teacher use to assess students". One member believed that E-assessment should be used in test quizzes not in the final test. Member AM in the first group said, "E-assessment should be compatible with the type of exam, for example quiz exam can be compatible with E-assessment, because in quiz the teacher usually used multiple choices question or short answer question, but in final exam it should be at least one or two long explanation questions, which will be hard and not very accurate to assess it using E-assessment. Also, there is the risk of having a final exam using E-assessment, may be the internet is suddenly cut off, or one of the student's PC is break down".

Subjective norm → Behavioural intention: The focus groups were asked if other people's opinions can affect the academics' behavioural intention to accept E-assessment in future. All the members agreed that there is a strong influence of subjective norm on academics' behavioural intention. Confirmed this by saying that society has a very strong effect on academics. One of the members justified her answer saying: "If most of the school teachers use E-assessment, this will affect the others and encourage them to use E-assessment". Member N in the first group said "In our society (Saudi society) the individual strongly influence by the others opinions, so the subjective norm has a strong impact on academics' behavioural intention to accept E-assessment". Member A provided an explanation for his answer, "If the other universities use E-assessment this will affect the head of the university and he/she will encourage the academics in all the university schools to use it".

Subjective norm (age) → Behavioural intention: When asked whether age can affect the relationship of social influences with academics' intentions to adopt E-assessment, all 10 members confirmed that age has an effect on the relation between subjective norm and behavioural intention. One of the members said "There is an effect of age, and the results is correct. The younger academic can affect more by the others view, than older academic. Because the older academics avoid the change and do not accept the new methods for teaching like the younger academic". Another member justified his answer by saying, "The older academics

has less influence by the others, because they have along experience, and they feel that they do not need to consider the others opinion. The older academics think that they should influence the others by their experience".

Superior influence → Subjective norm: This section aimed to investigate if the superior influence has an effect on subjective norm. The focus groups members were asked if they thought that the academic can be influenced by his/ her manager or school head. All 10 members agreed that the academics' manager has strong social influence on them, particularly in influencing them to accept E-assessment. One of the members said, "It happened with me before, my boss asked me to use specific software and I used it; if he did not ask me I will not use this software".

Perceived behavioural control → Behavioural intention: focus group members were asked if the ability to control the use of E-assessment can affect an academic's behavioural intention to accept E-assessment in the future. Four members from the first group and two from the second group disagreed that perceived behavioural control has an influence on academics' behavioural intention to accept E-assessment. They provided different reasons for this view. Member A said "I have all the facilities that I need, but I do not have the desire to use E-assessment". Another member gave a similar answer: "Even if I have the ability to use E-assessment, I do not have the desire to use it, because I do not want to change my assessment method". Member N from the first group justified her answer by saying, "The most important factors are the usefulness and ease of use of E-assessment, even if I have all other facilities I will not use E-assessment if it is not useful or not easy to use".

However, other members agreed that the ability to control the use of E-assessment can affect the academics' behavioural intention to accept E-assessment. One of these members explained that: "If I have the ability to control the use of E-assessment and I have an experience and skills to use it, this will affect my intention towards to accept E-assessment".

Perceived behavioural control (age) → Behavioural intention: This section aimed to check if age can affect the relationship between perceived behavioural control and behavioural intention. The focus groups members confirmed the results, that there is no effect of age on the relationship between perceived behavioural control and behavioural intention. One of them said "There is no influence of age on this relationship". Another member said "If the academic has the ability to control the use of E-assessment, the academics age will not affect if he/she young or old". Member N said "As there is no relationship between perceived behavioural control and behavioural intention, so there is no effect of age on this relation".

Self-efficacy → Perceived behavioural control: To examine the relationship between self-efficacy and perceived behavioural control, the focus groups were asked their opinion about this relationship. All the members agreed that there is a strong influence of self-efficacy on perceived behavioural control to accept E-assessment. Member N from the first group said, "Yes, there is a strong effect, because if I have the skills and the ability to use E-assessment, so I will

have the ability to control the use of E-assessment". Another member said "It is very important to have the skills and experience to control the use of E-assessment". Member M justified her answer by saying, "The self-efficacy gives the academic the confidence to use and control E-assessment".

Resource facilitating conditions → Perceived behavioural control: The focus group members were asked their view about the relationship between resource facilitating conditions and perceived behavioural control. Four of the members from both groups agreed these factors have an effect on perceived behavioural control, some of them linked this with IT support. For example, one of them said, "It is important to provide all the facilities that academics need to use E-assessment, but it is also important to have training courses and IT support staff to help them when they need".

However, other members did not agree that there is a relation between resource facilitating conditions and perceived behavioural control. Member T said "Even I have all the facilities that I need to use E-assessment, I do not use it because I do not have the desire to change my way". Another member justified her answer by explaining that the currently available resources in the universities are low quality with poor conditions which discourages the academics from accepting E-assessment. Others explained that some academics avoid change and they do not like to adopt new technology.

IT support → Perceived behavioural control: The group members were asked to what extent the availability of E-assessment training courses and staff support would affect an academics' ability to use E-assessment. Three of the members said that it was an important factor that affects academics' behavioural control and thus willingness to accept E-assessment. One member explained, "If there is no IT support I will not use E-assessment, especially during the exam period, I need one or two of IT support staff to help me in case of any problem arise". Member T explained her answer by saying, "The availability of IT support is more important than the availability of resource, because I can bring my laptop and internet connection to use E-assessment, but I cannot use it if there is no IT support and training courses".

However, other focus group members believed that IT support does not have a relation with perceived behavioural control in accepting E-assessment. Member M justified his answer by saying, "The availability of IT support is not important for me, even if I have all the facilities and the support, I do not have the desire to use E-assessment and change my method to assess students". A similar answer was obtained from another member "I have everything I need including IT support to use E-assessment, but I do not like to change my way to test the students". Member A explained her answer by providing an example from her university, as quoted above, that although her university was the first to apply E-learning and E-assessment in Saudi Arabia, and it provided a high level of support and even rewards, few of the academics were using E-assessment, presumably because they had no desire to use it. Another member clarified his answer by saying, "The currently available IT support staffs

are with low experience and there is no enough staff for each school". Moreover, Member M justified her answer by "For me it is not important to have IT support, because I have a good background in using technology and I can solve any problem that I face".

6. Discussion

The questionnaire findings concluded that attitude has a strong positive and direct relationship with behavioural intention and the relationship between subjective norm and behavioural intention is weak, while there is no relationship between perceived behavioural control and behavioural intention. Attitude can be determined by three factors: perceived ease of use, perceived usefulness and compatibility. The most effective factor on attitude is compatibility ($\beta = 0.556$), followed by perceived ease of use ($\beta = 0.361$) and perceived usefulness ($\beta = 0.164$). In addition, subjective norm can be predicted by superior influence, with a high path coefficient ($\beta = 0.612$). Moreover, perceived behavioural control in the proposed model was decomposed into three factors: self-efficacy, resource facilitating conditions and IT support. However, only self-efficacy has an effect on perceived behavioural control, and the other two factors have no correlations with perceived behavioural control. Age was examined as a moderating factor that influences attitude, subjective norm and perceived behavioural control. The results and analysis revealed that although age has effect on attitude for both age groups, and on subjective norm for the younger group, there is no influence of age on perceived behavioural control.

The focus groups' results confirmed the questionnaire findings and provided reasons for these findings. According to the group members, the academics' attitude has a strong effect on their behavioural intention to accept E-assessment in Saudi Universities. The groups also confirmed that age has an influence on the relation between attitude and behavioural intention of academics to accept E-assessment. They suggested that the attitude of younger academics can have more positive affect on their behavioural intention to accept E-assessment compare with older academics, which has less influence. This is due to older academics not accepting change, and preferring to use their traditional way to assess students, while younger academics are more accepting towards adopting new technology. Regarding the awareness factor, different reasons were given for the finding that awareness does not have an effect on attitude mainly that E-assessment is already known by most of the academics, yet only a few of them use it. However, some respondents believed that the academics' desire and the ability to change the traditional method of testing the students are crucial to acceptance of E-assessment. Moreover, it was believed that if the awareness is accompanied by training courses, this may affect the academics' attitude. From the focus group discussions it was clear that perceived usefulness and perceived ease of use have a strong influence on Saudi academics' attitude towards accepting E-assessment. It

appears there is a relation between the perceived usefulness and perceived ease of use, and that these two factors together have a strong effect on academics' attitude towards accepting E-assessment in Saudi universities. The compatibility of E-assessment with academic tasks also has an influence on academics' attitude towards accepting E-assessment. More than half of the focus group members confirmed that compatibility of the E-assessment with the type of course that academic was teaching was essential. All the focus group participants agreed that subjective norm has a strong influence on academics' behavioural intention to accept E-assessment. This is because Saudi society has a strong influence on individuals, which explain why in this context the subjective norm has a strong impact on academics' behavioural intention. Age was also found to have an effect on the relation between subjective norm and behavioural intention to accept E-assessment. It appeared that the younger academics were more affected than older academics by the opinions of others'. This is because the younger academics are more accepting towards change and considering innovations, while the older academics do not accept change, and feel that they have adequate experience and the others should be influenced by them. The academics in this study confirmed that superior influence has a strong effect on subjective norm in accepting E-assessment in Saudi universities. It appears from focus group members' views that perceived behavioural control does not greatly affect the academics' behavioural intention to accept E-assessment in Saudi universities. The ease of use and usefulness of E-assessment are regarded as more important than the ability to control the use of E-assessment. They believed that the academic's desire is the factor that determines the acceptance of E-assessment, even if all the facilities are provided for him or her. They agreed that age has no effect as a moderating factor on the relationship between perceived behavioural control and behavioural intention. However, they believed that self-efficacy has a strong impact on perceived behavioural control towards accepting E-assessment in Saudi universities. Self-efficacy can increase the academic's confidence to use and control E-assessment. Thus it is important to have the ability and skills to control the use of E-assessment. There were differing opinions about the relationship between resource facilitating conditions and perceived behavioural control. Four members confirmed this relation, whereas the other six members had different opinions. Some members disagree with this relationship, explaining that academics do not have the desire to use E-assessment, even if the resources are available. The academics prefer to use their existing methods to assess the students. The low quality of resources that are currently available may discourage the academics from accepting E-assessment. Similarly, for the IT support factor, the academics expressed different opinions: a few of them agreed that there is a relationship between the availability of IT support and academics' ability to control the use of E-assessment. Those who agreed explained that the availability of IT support staff is important specifically during the exam

time. Some of these confirmed that they could not use E-assessment without training courses and IT support staff. However, the other seven members disagreed, saying that there is no relationship between IT support and academics' behavioural control in influencing acceptance of E-assessment. They clarified their opinions by explaining that they had strong technology backgrounds and did not need any training courses or assistance to use E-assessment. Some of them explained that although they had all the resources, training courses and IT support staff, they did not have the desire to use E assessment and preferred to use their own methods to test students. Moreover, they explained that academics do not use E-assessment because the current IT support staff have a low level of experience and there is not an adequate number of support staff in each faculty.

7. Conclusion

The aim of this study was to find the most affecting factors that influence Saudi academics to accept E-assessment and to identify the relationships between these factors in the proposed model (MAE), in order to facilitate the adoption of E-assessment in Saudi institutions. A questionnaire was sent to all academics in Saudi Universities. Questionnaire responses were received from 23 different universities in different cities in Saudi Arabia, and the majority of the responses were from King Saud University and Princess Nora University in Riyadh. Most of the participants had long teaching experience, and they used the internet more than two hours daily. Significantly, 60% of the academics participating did not use E-assessment. Only 126 participants answered "Yes", and most of them used E-assessment in the Blackboard system. Half of the respondents reported spending about 30 minutes to one hour every day using E-assessment.

Structural Equation Modelling (SEM) was chosen for the data analysis. The proposed model (MAE) was tested using a two-step approach. In the first step (measurement model), construct reliability (composite reliability) and validity (convergent and discriminant) were established to examine the measures used to test the model. In the second step of SEM, the structural model was analysed. The Goodness of Fit was tested, to check if the proposed model fitted with the collected data. The recommended GoF indices (CFI, RMR, SRMR, RMSEA, and Normed chi-square) were used to examine the model's fit. All the indices results were in the ranges that were suggested as acceptable. The hypothesised relationships among latent constructs were then analysed. The results supported all the hypotheses, except for H2, H8, H8a, H10, and H11. The results indicate that Attitude is the most influencing factor on Behavioural Intention, followed by Subjective Norm, and that Perceived Behavioural Control has no effect on Behavioural Intention. Attitude has a strong positive and direct relationship with Behavioural Intention, and Compatibility has the most impact on Attitude, among the other three factors, followed by Perceived Ease of Use then Perceived Usefulness. Significantly, Awareness has no effect on Attitude. Subjective Norm has a low influence on

Behavioural Intention, and Superior Influence has strong influence on Subjective Norm. Perceived Behavioural Control has no influence on Behavioural Intention, and only Self-efficacy has effect on Perceived Behavioural Control among the other two factors (Resource Facilitating Conditions and IT support). Age has positive and direct effect on the relationship between Attitude and Behavioural Intention in both groups age. A low effect was found for the younger group in the relationship between Subjective Norm and Behavioural Intention and an indirect effect for the older age group. Age was found to have no influence on Perceived Behavioural Control.

The questionnaire analysis was followed by focus group discussions, to confirm these results and to obtain reasons behind these findings. This study used two focus groups, with 6 members for the first group and 4 members in the second group. Overall it was found that most of the members broadly agreed with SEM results, while a few disagreed.

We can suggestion focusing on the Attitude factor when designing an E-assessment system, as the acceptance of E-assessment was determined by Saudi the academics' attitude more than by the other two factors (Subjective Norm and Perceived Behavioural Control). That means a more positive evaluation towards E-assessment usage, will increase Saudi academics' intention to accept E-assessment. Additionally, the E-assessment should be easy to use for academics and have a user friendly face to encourage them to accept and use it. Particularly, E-assessment has to be useful and compatible with an academic's job and the courses taught.

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