The extension of computer based assessment acceptance model with perceived importance

Abstract—This study identifies the constructs that influence learners' behavioral intention to use a Computer Based Assessment (CBA). It extends the Computer Based Assessment Acceptance Model (CBAAM) by taking into consideration the Perceived Importance construct. An appropriate survey questionnaire was completed by 45 male and 72 female students. Results confirm the previous studies regarding the CBA's acceptance. In addition, they show a direct positive effect of Perceived Importance on learners' Behavioral Intention to use CBA. The extended CBAAM with the Perceived Importance is improved since it explains 52% of the variance of Behavioural Intention. These findings are useful for researchers and educators since it is the first time that Perceived Importance is introduced in an acceptance model regarding CBA.

Index Terms— Computer Based Assessment Acceptance Model, Perceived Ease of Use, Perceived Playfulness, Perceived Usefulness, Perceived Importance.

I. INTRODUCTION

Computer Based Assessment (CBA) is a common learning method which provides many advantages to learners and to educators. Learners use CBA in order to evaluate their strengths and weaknesses [1, 2]. Regarding educators, CBA offers extra advantages such as: test security, reduction of time and cost, automation of records and distance learning [3, 4, 5, 6, 7, 8, 9, 10]. Thus, the use of CBA is continuously increasing. Researchers are interested in identifying the factors that affect CBA's intention to use. Based on previous studies on technology acceptance e.g. [11], researchers develop models to explain learner's acceptance and intention to use learning management systems (LMS) or CBA. Regarding CBA, Computer Based Assessment Acceptance Model (CBAAM) is a model that includes many important variables to explain learner's acceptance on CBA [12]. This paper tries to extend CBAAM by adding a new construct which is called Perceived Importance. Perceived Importance measures how much important is the CBA for the learner.

The Next section presents the most related studies. Literature review is followed by the research model, methodology and the results. Finally, the results are discussed, along with some conclusions.

II. LITERATURE REVIEW

In this section we describe the variables that have been adopted by the previous technology acceptance models in order to explain the acceptance and the intention to use a LMS or a CBA. Perceived Usefulness and Perceived Ease of Use are the two major constructs of Technology Acceptance Model (TAM) [11] that have been used by many researchers regarding LMS acceptance [13, 14]. Another model that was used to explain LMS adoption is Unified Theory of Acceptance and Use of Technology (UTAUT) e.g. [15]. Other researchers used only some constructs like Facilitating Conditions or Social Influence in their research models [16]. Furthermore, other researchers developed variables more relevant with the context of learning and assessment such as: Perceived Playfulness, Self-Management of Learning [13], Enjoyment, Learning Goal Orientation [14], Personal Innovativeness in the domain of IT [17], Personal Outcome Expectations, and Perceived Behavioral Control [18].

A. Computer Based Assessment Acceptance Model (CBAAM)

The CBAAM has been proposed regarding the acceptance of a CBA [12]. The CBAAM has eight constructs to explain Behavioural Intention to Use a CBA. These eight variables are the following: Perceived Playfulness, Perceived Usefulness, Perceived Ease of Use, Computer Self Efficacy, Social Influence, Facilitating Conditions, Goal Expectancy and Content. The CBAAM proves that Behavioural Intention to Use a CBA is significantly attributed to Perceived Playfulness and Perceived Ease of Use. Perceived Usefulness is defined by Goal Expectancy, Content, Social Influence and Perceived Ease of Use. Perceived Playfulness is explained by Usefulness, Content, Ease of Use and Goal Expectancy. Furthermore, Computer Self Efficacy and Facilitating Conditions explain Perceived Ease of Use.

In this study, we firstly aim to confirm the CBAAM and then to extend it by introducing the Perceived Importance (Fig. 1).

III. RESEARCH MODEL

A. Perceived Playfulness

Previous studies showed that Perceived Playfulness has a significant positive effect on behavioural intention to use the Web [19] and on the Behavioural Intention to use a CBA [12]. Thus, we hypothesized:

H1: Perceived Playfulness will have a positive effect on the Behavioural Intention.

B. Perceived Usefulness

The strong effect of Perceived Usefulness on Behavioral Intention and on Perceived Playfulness has been proved [12, 17, 20, 21,]. Therefore, we hypothesized:

H2: Perceived Usefulness will have a positive effect on the Behavioural Intention to use CBA.

H3: Perceived Usefulness will have a positive effect on Perceived Playfulness.

C. Perceived Ease of Use

Perceived Usefulness and Behavioral Intention are explained by Perceived Ease of Use [22, 23, 24, 25]. Moreover, the CBAAM proved that Perceived Ease of Use enhances Perceived Playfulness. So, we hypothesized:

H4: Perceived Ease of Use will have a positive effect on the Behavioural Intention to use CBA.

H5: Perceived Ease of Use will have a positive effect on Perceived Usefulness.

H6: Perceived Ease of Use will have a positive effect on Perceived Playfulness.

D. Computer Self Efficacy

Previous studies confirmed a causal link between Computer Self Efficacy and Perceived Ease of Use [12, 25, 26, 27]. Thus, we hypothesized:

H7: Computer Self Efficacy will have a positive effect on Perceived Ease of Use.

E. Social Influence

Regarding Social Influence researchers showed a positive effect on Behavioural Intention especially through Perceived Usefulness [15, 28, 29, 30, 31, 32, 33]. Thus, we hypothesized:

H8: Social Influence will have a positive effect on Perceived Usefulness.

F. Facilitating Conditions

Regarding Facilitating Conditions, the CBAAM supported that Facilitating Conditions have a positive effect on Perceived Ease of Use [12]. Therefore, we hypothesized:

H9: Facilitating Conditions will have a positive effect on Perceived Ease of Use.

G. Goal Expectancy

Goal Expectancy (GE) is a variable that influences an individual's belief that he/she is prepared properly to use CBA based on two dimensions: 1) learner's perceptions regarding their preparation to take the CBA. 2) Learner's desirable level of success [12]. In a summative assessment, CBAAM suggested a positive effect of Goal Expectancy on Perceived Usefulness and on Perceived Playfulness. So, we hypothesized:

H10: Goal Expectancy will have a positive effect on Perceived Usefulness.

H11: Goal Expectancy will have a positive effect on Perceived Playfulness.

H. Content

CBA's content is actually described by the course's content and the questions during the CBA. Thus, the learners firstly evaluate the content based on their experience during the course, if it is difficult, interesting and useful and secondly during the CBA, if the questions are clear and understandable. The CBAAM proposed that Content has a positive impact on Perceived Usefulness, Perceived Playfulness, Goal Expectancy and Behavioural Intention to use CBA [12]. Thus, we examine:

H12: Content will have a positive effect on Perceived Usefulness.

H13: Content will have a positive effect on Perceived Playfulness.

H14: Content will have a positive effect on Goal Expectancy.

H15: Content will have a positive effect on the Behavioral Intention to Use CBA.

I. Perceived Importance

Perceived Importance is the new variable that we intend to introduce in the CBAAM. This variable tries to measure how much important is the CBA for the learner. We believe that if the learner perceives CBA as a very important procedure regarding his/her grades or his/her academic performance, he/she will probably find the CBA more useful, playful and he/she will intend to use it. Thus, in order to measure Perceived Importance, we ask the students to rate the importance of CBA regarding their courses, their academic performance and their academic future. Therefore, we examine:

H16: Perceived Importance will have a positive effect on the Behavioral Intention to Use CBA.
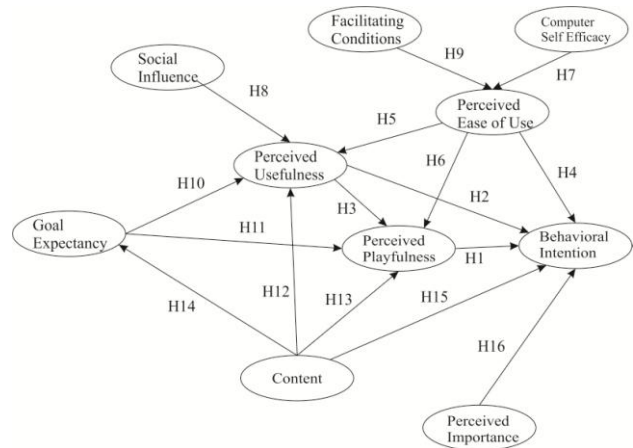

Figure 1. Research Model.

IV. DATA COLLECTION

117 first-year students enrolled at the introductory informatics course, in the Department of Economic Sciences of a Greek University took place in our research. The course introduces informatics to the students. Students learn general concepts of Information Technology. The CBA includes questions from this course.

There were 45 males (38%) and 72 females (62%). The average age of students was 19.2 (SD=1.03). The participation to the CBA was voluntary. CBA consists of 45 multiple choice questions and its duration was 45 min. Each question had 4 possible answers. The questions' appearance to a student was randomized. After the end of the CBA, each student had to answer the questionnaire which consisted of 33 questions (Table 1). We adapted 30 items from the CBAAM and added 3 new items regarding Perceived Importance. These 33 questions correspond to 10 latent variables. The seven point Likert-type scale with 1 = "strongly disagree" to 7 = "strongly agree" was used to measure the items.

We used the technique of partial least-squares (PLS) analysis to analyze the measurement and the structural model [34, 35, 36]. Our sample was large enough, since it

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was more than 10 times the largest number of independent variables impacting a dependent variable [34].

The measurement model's reliability and validity are proved by the internal consistency, convergent validity and discriminant validity [37, 38]. The required values and our model values regarding reliability and validity are presented in tables 1 and 2.

Concerning the structural model we used two criteria: 1) the variance measured (R^2) by the antecedent constructs. Values of the variance equal to 0.02, 0.13 and 0.26 are considered as small, medium and large respectively [39]; (2) t-values or p-values through the bootstrapping procedure in order to measure the significance of the path coefficients and total effects.

Finally, SmartPLS 2.0 was used for data analysis [40]. SmartPLS uses the partial least squares (PLS) method.

V. RESULTS

In this section we demonstrate the data analysis' results. Table 1 confirms the convergent validity since the items' factor loadings, composite reliability and the average variance extracted exceed the adequate values, respectively.

Table 1. Results for the Measurement Model

Constructs / Items	F. L. (>.7)[a]	Cr. a (>.7)[a]	C.R. (>.7)[a]	AVE (>.5)[a]
Perceived Usefulness		.88	.93	.82
PU1: Using the Computer Based Assessment (CBA) will improve my work.	.90			
PU2: Using the Computer Based Assessment (CBA) will enhance my effectiveness.	.93			
PU3: Using the Computer Based Assessment (CBA) will increase my productivity.	.88			
Perceived Ease of Use		.77	.87	.69
PEOU1: My interaction with the system is clear and understandable.	.84			
PEOU2: It is easy for me to become skilful at using the system.	.87			
PEOU3: I find the system easy to use.	.77			
Computer Self Efficacy		.84	.89	.67
CSE1: I could complete a job or task using the computer.	.83			
CSE2: I could complete a job or task using the computer if someone showed how to do it first.	.82			
CSE3: I can navigate easily through the Web to find any information I need.	.77			
CSE4: I was fully able to use the computer and Internet before I began using the Computer Based Assessment (CBA).	.86			
Social Influence		.83	.89	.66
SI1: People who influence my behaviour think that I should use CBA.	.78			
SI2: People who are important to me think that I should use CBA.	.85			
SI3: The seniors in my university have been helpful in the use of CBA.	.81			
SI4: In general, my university has supported the use of CBA.	.81			
Facilitating Conditions		.80	.91	.83
FC1: When I need help to use the CBA, someone is there to help me.	.89			
FC2: When I need help to learn to use the CBA, system's help support is there to teach me.	.93			
Content		.83	.89	.67
C1: CBA's questions were clear and understandable.	.87			
C2: CBA's questions were easy to answer.	.85			
C3: CBA's questions were relative with the course's syllabus.	.73			
C4: CBA's questions were useful for my course.	.80			
Goal Expectancy		.83	.90	.75
GE1: Courses' preparation was sufficient for the CBA	.88			
GE2: My personal preparation for the CBA.	.86			
GE3: My performance expectations for the CBA.	.86			
Perceived Playfulness		.86	.91	.71
PP1: Using CBA keeps me happy for my task.	.77			
PP2: Using CBA gives me enjoyment for my learning.	.87			
PP3: Using CBA, my curiosity stimulates.	.86			
PP4: Using CBA will lead to my exploration.	.87			
Perceived Importance		.77	.86	.68
PI1: I believe that CBA is important for my course	.85			
PI2: I believe that CBA is important for my academic performance	.84			
PI3: I believe that CBA is important for my future	.78			
Behavioural Intention to use CBA		.89	.93	.81
BI1: I intend to use CBA in the future.	.92			
BI2: I predict I would use CBA in the future.	.88			
BI3: I plan to use CBA in the future.	.92			

[a] Indicates an acceptable level of reliability and validity, F. L. Factor Loading, Cr. a Cronbach a, C.R. Composite Reliability, A.V.E. Average Variance Extracted

Moreover, the discriminant validity is supported since the square root of the average variance extracted (AVE) of a construct is larger than any correlation with another construct. In table 2, the diagonal values are the AVEs and the rest values are the correlations between the variables.

Table 3 and fig. 2 demonstrate the statistical significance of the structural model. In order to measure p-values we applied a bootstrap procedure with 1000 resamples.

Table 2. Discriminant validity for the measurement model

	bi	c	cs e	fc	ge	pe ou	pi	pp	pu	si
bi	**.81**									
c	.54	**.66**								
cs e	.24	.32	**.67**							
fc	.34	.49	.17	**.83**						
ge	.41	.60	.41	.23	**.75**					
pe ou	.57	.61	.34	.54	.40	**.68**				
pi	.35	.23	.08	.32	.23	.19	**.68**			
pp	.63	.65	.34	.30	.63	.46	.32	**.71**		
pu	.60	.65	.31	.33	.65	.66	.28	.69	**.81**	
si	.48	.50	.27	.54	.44	.48	.32	.41	.46	**.66**

Table 3. R^2 and Direct, Indirect and Total effects

Dependent Variables	R^2	Independent Variables	Direct effect	Indirect effect	Total effect
Perceived behavioral intention	.52	Perceived Playfulness	.38***	.00	.38***
		Perceived Usefulness	.08 ns	.17	.25**
		Perceived Ease of Use	.31**	.05	.36***
		Perceived Importance	.15**	.00	.15**
		Computer Self Efficacy	.00	.09	.09**
		Social Influence	.00	.01	.01 ns
		Facilitating Conditions	.00	.18	.18**
		Goal Expectancy	.00	.17	.17***
		Content	.02 ns	.26	.28**
Perceived Playfulness	.60	Perceived Usefulness	.48***	.13	.48***
		Perceived Ease of Use	-.12 ns	.18	.06 ns
		Computer Self Efficacy	.00	.02	.02 ns
		Social Influence	.00	.01	.01 ns
		Facilitating Conditions	.00	.03	.03 ns
		Goal Expectancy	.19**	.18	.37***
		Content	.30***	.30	.60***
Perceived Usefulness	.62	Perceived Ease of Use	.39***	.05	.39***
		Computer Self Efficacy	.00	.10	.10***
		Social Influence	.03 ns	.00	.03 ns
		Facilitating Conditions	.00	.20	.20***
		Goal Expectancy	.38***	.00	.38***
		Content	.18*	.22	.40***
Perceived Ease of Use	.36	Computer Self Efficacy	.26***	.00	.26***
		Facilitating Conditions	.50***	.00	.50***
Goal Expectancy	.36	Content	.60***	.00	.60***

* $p<0.1$, ** $p<0.05$, *** $p<0.001$, ns not support
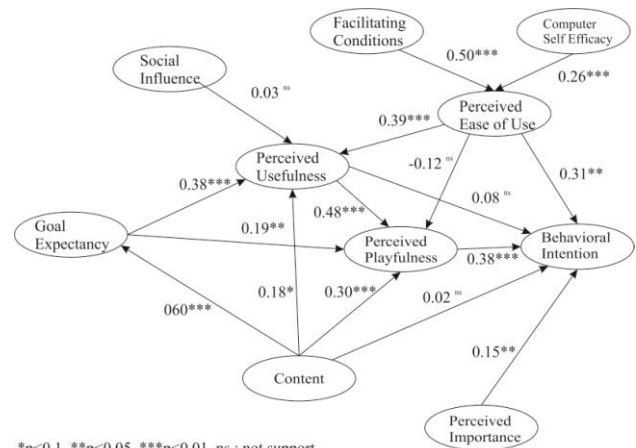
*$p<0.1$, **$p<0.05$, ***$p<0.01$, ns : not support

Figure 2. Extended CBAAM.

VI. Discussions & Conclusions

Regarding the Behavioral Intention to Use, our results confirmed the CBAAM. Specifically, we find a direct positive effect of Perceived Playfulness, Perceived Ease of Use, but no direct effect of Perceived Usefulness and Content. In addition, the new variable Perceived Importance has also a direct effect on Behavioral Intention to Use. Moreover, Perceived Playfulness is determined directly by Perceived Usefulness, Content and Goal Expectancy. However, our results did not confirm the direct effect of Perceived Ease of Use on Perceived Playfulness. Furthermore, we confirmed the direct effects of Perceived Ease of Use, Content and Goal Expectancy on Perceived Usefulness; however the effect of Social Influence was not large enough in order to be significant. Moreover, Computer Self Efficacy and Facilitating Conditions both have a direct effect on Perceived Ease of Use. Finally, Content has a direct positive effect on Goal Expectancy. Thus, all the hypotheses were supported except the direct effects of Perceived Usefulness and Content on Behavioral Intention as at CBAAM and the direct effect of Perceived Ease of Use on Perceived Playfulness and Social Influence on Perceived Usefulness. Despite the direct effects, the structural model has also indirect and total effects. So, even if the direct effects of Perceived Usefulness and Content on Behavioral Intention were not supported, the total effects are supported.

The model explains the 52% of variance in Behavioral Intention to Use. By adding the Perceived Importance construct, we ameliorate the R^2 value of the model, since the original CBAAM explained the 50% of variance in Behavioral Intention to Use. The total effects of PP (0.38), PEOU (0.36), C (0.28), PU (0.25), FC (0.18), GE (0.17) and PI (0.15) are strong. Thus, a computer based assessment has to satisfy these variables in order to be used by learners. Specifically a CBA has to be playful, useful, and easy to use with careful design of the content. Moreover, practitioners and educators have to facilitate learners during the procedure in person or through the facilities of the system. However, the most important influence of educators is the development of students' expectations regarding their goals and the sense of how much important is CBA for them.

To conclude, our paper provides useful information to practitioners, researchers and educators regarding CBA's acceptance. Moreover, it firstly confirms CBAAM and then it extends it successfully with a new variable,

Perceived Importance. Future studies have to be applied in this direction with different samples for further confirmation.

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