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The effect of emotional feedback on behavioral intention to use computer based assessment

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ABSTRACT

This study introduces emotional feedback as a construct in an acceptance model. It explores the effect of emotional feedback on behavioral intention to use Computer Based Assessment (CBA). A female Embodied Conversational Agent (ECA) with empathetic encouragement behavior was displayed as emotional feedback. More specifically, this research aims at investigating the effect of Emotional Feedback on Behavioral Intention to Use a CBA system, Perceived Playfulness, Perceived Usefulness, Perceived Ease of Use, Content and Facilitating Conditions. An appropriate survey questionnaire was completed by 134 students. Results demonstrate that Emotional Feedback has a direct effect on Behavioral Intention to Use a CBA system and on other crucial determinants of Behavioral Intention. Finally, the proposed acceptance model for computer based assessment extended with the Emotional Feedback variable explains approximately 52% of the variance of Behavioral Intention.

1. Introduction

Previous studies showed learners' preference on CBA procedures (Croft, Danson, Dawson, & Ward, 2001; Ricketts & Wilks, 2002; Sambell, Sambell, & Sexton, 1999). The main reasons that learners are pleased with CBA are the following: 1) learners are able to take the assessment anywhere and anytime through a computer. 2) They are also able to take the test as many times as they wish as long as this service is provided. 3) They feel more assured regarding the results' accuracy and fairness since the computer does not care who the test taker is. 4) They are able to see their results as soon as they complete the assessment (Bocij & Greasley, 1999; Cassady & Gridley, 2005). 5) CBA provides them immediate feedback to identify their strengths and weaknesses (Crippen & Brooks, 2002; Gretes & Green, 2000).

Instantaneous or immediate feedback is very important to learners. Educators may use feedback strategies to help learners during the CBA. Feedback could support learners to create knowledge and abilities. Feedback in education has to do with the educator's responses to the learner's actions, thoughts, emotions, needs, attitudes, wills, intentions etc. (Economides, 2006a). Feedback is also useful to guide and support learners during CBA (Thelwall, 2000). It may also try to improve the learner's strengths, performance, and to reduce his/her weaknesses (Economides, 2006a; Wilson, Boyd, Chen, & Jamal, 2011).

A case of immediate feedback is emotional feedback. Emotional feedback has been developed to regulate learners' emotional states towards learning. Prior studies showed that positive emotions enhance problem solving and decision making, leading to cognitive processing that is not only flexible, innovative, and creative, but also thorough and efficient (Isen, 2001; Isen, Daubman, & Nowicki, 1987). On the other hand, negative emotions have been shown to impede performance on learning tasks (Izard, 1984). Moreover, previous studies regarding emotional feedback investigated the implementation and evaluation of emotional regulation strategies concerning the management of learners' emotions and behaviors (Beale & Creed, 2009; Burleson & Picard, 2007; D′ Mello et al., 2008; Robison, McQuiggan, & Lester, 2010).

However, to the best of our knowledge previous studies did not connect the use of emotional feedback with the acceptance and the intention to use a CBA. Thus, the goal of this paper is to identify the effect of emotional feedback on learners' behavioral intention and on

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other crucial variables regarding CBA acceptance. Based on previous studies on technology acceptance and especially towards learning and assessment systems' acceptance, we developed a research questionnaire to evaluate the effect of emotional feedback on CBA's acceptance through a causal model.

2. Literature review

2.1. Computer based assessment acceptance

Computer Based Assessment Acceptance Model (CBAAM) has been proposed regarding the acceptance of a CBA (Terzis & Economides, 2011). CBAAM have adopted variables from previous studies in order to define Behavioral Intention to Use a CBA system. Particularly, it has adopted Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) from Technology Acceptance Model (TAM) (Davis, 1989). Furthermore, from Unified Theory of Acceptance and Use of Technology (UTUAT), it used Facilitating Conditions (FC) and Social Influence (SI) (Venkatesh, Morris, Davis, & Davis, 2003). In addition, from Social Cognitive Theory (SCT), it has implemented Computer Self Efficacy (CSE) (Compeau & Higgins, 1995). Moreover, it adopted Perceived Playfulness (PP) by Moon and Kim's (2001) research study. Furthermore, CBAAM included variables which were found to be more relevant with the context of learning and assessment acceptance. It proposed firstly Goal Expectancy which is based on Self-Management of Learning (Wang, Wu, & Wang, 2009) and secondly Content.

The aim of this study is to further investigate the factors affecting learners' CBA acceptance by introducing feedback and especially the immediate emotional feedback as a determined variable of learners' behavioral intention to use a CBA.

From CBAAM, SI, CSE, and GE variables excluded from the analysis of this study. These variables are expectations and opinions that learners already had formed before the interaction with CBA system and Emotional Feedback. Therefore, an impact of Emotional Feedback on these variables can not be measured.

The type of feedback is essential to our study, thus the literature review continues with an extensive analysis of feedback and especially of the emotional feedback provided in this study through Embodied Conversational Agents (ECAs).

2.2. Feedback

Feedback is a very powerful tool during learning and assessment procedures (Harlen & James, 1996; Porter & Brophy, 1988). Especially in computer based educational environments, the proper use of feedback is very important for learners since most of the time learners use these computer based learning platforms on their own without any help and support by a real person tutor (eg. Macdonald, 2001). Thus, feedback in computerized learning and assessment context replaces in some way the tutor. Many different types of feedback have been proposed. Feedback classification is basically connected to two characteristics: 1) "when" feedback is triggered (in advance, immediate and delayed) 2) the context of the feedback targeted to one of the three different mind dimensions (Cognitive, Emotional and Conative) (Economides, 2009).

There are also other feedback features that could be used so as to distinguish various feedback types (Hattie & Timperley, 2007). Such a characteristic is the reason and cause that activates a feedback. Other features include the result, the effect and the outcome that a feedback will produce. Another differentiation could emanate from the pedagogical method that a feedback is based on such as: 1) Reward (positive), 2) Neutral, or 3) Punishment (negative) (eg. Hodges, 2004). Furthermore, the multimedia type of the feedback: text, pictures, audio, video, etc. (eg. Alexander, 2001) could serve as a distinguishing feature. Other feedback characteristics include frequency, duration, interactivity, personalization and educational context. Most feedback types include all or some of the previous characteristics.

2.2.1. Immediate feedback

In this experiment we used immediate feedback, in order to stimulate students' instant emotions. Previous studies have shown the positive impact of immediate feedback on students' learning achievements (Wang, Wang, Wang, Huang, & Chen, 2004). Furthermore, Chickering and Gamson (1987) supported immediate feedback as one of the most effective practices in undergraduate education.

2.2.2. Emotional feedback

Emotional feedback is provided to learners so as to ameliorate their emotional states during LMS and CBA. Contemporarily, researchers are able to measure and recognize learners' current emotional state through special equipment and emotional recognition methods. The core channels/methods for measuring emotions through special equipment are the following: 1) speech recognition, 2) physiological data, and 3) facial expressions.

Several studies proposed a number of universally recognized facial expressions for recognizing emotions such as happiness, surprise, fear, sadness, anger and disgust (Robison, McQuiggan, & Lester, 2008). Therefore, estimating emotional experiences from objectively measured facial expressions has become an important research topic. Other facial recognition systems employ advanced video-based techniques (Davis, 1996) or measure the electrical activity of muscles with EMG (facial electromyography) (Burleson & Picard, 2007).

Moreover, researchers, based on learners' recognized emotions, have integrated emotional feedback capabilities into tutoring systems (Economides, 2006b; Moridis & Economides, 2008). Humor, expressions of sympathy, empathy, reward, pleasant surprises, encouragement, acceptance, praises but also criticism (Economides, 2005) are some of the possible actions that could be practised by a testing system. Each one of these emotional feedback practises could be used in a learning system alone or combined, depending of the desired effects and results.

2.2.3. Empathetic behavior

An ECA was used as a means of displaying emotional feedback, so as to examine the connection of the use of emotional feedback with the acceptance and the intention to use a CBA. Since the ECA employed empathetic behavior to regulate students' emotional states, this kind of behavior has to be further analyzed, before continuing with the main focus of this work.

Empathy is defined as the ability to perceive another person's inner psychological frame of report with precision, but without ever losing consciousness of the fact that it is a hypothetical situation (Rogers, 1959). Therefore, empathy is to feel, for example, someone else's pain or pleasure and to perceive the cause of these feelings as perceived by the other person, without ever loosing self-awareness. Parallel and reactive empathy are the two most applied ways to express empathy (Davis, 1996). In parallel empathy, the agent first identifies and then reproduces the emotional state of the person being involved with that agent in an interaction. For example, if a user feels confused, then the agent performing parallel empathy will act like "I feel confused by this as well". In reactive empathy, the agent first identifies and then tries to recover and alternate this emotional state. Thus, in this case that a user feels confused, the ECA would state something like "Continue trying and you will succeed" (Robison et al., 2008). Sometimes a combination of parallel with reactive empathy is used. This combination first reflects back a user's emotional state (parallel empathy), and then performs an emotional behavior that is different from the user's emotions (reactive empathy), with the aim of altering these emotions. Previous studies showed that users are positively influenced by the presence of computer agents with empathetic behavior (Brave, Nass, & Hutchinson, 2005; Dehn & Van Mulder, 2000). Moreover, empathetic agents have been shown to decrease negative emotions, such as frustration, more effectively than agents without empathetic behavior (Hone, 2005; Klein, Moon, & Picard, 2002). However, a lot of research still needs to be done to define which type of empathetic behavior and under which conditions should be used (Robison et al., 2008).

Based on the previous literature review regarding e-learning adoption, CBA acceptance and feedback, this paper develops a causal model to explain the effect of emotional feedback on the Perceived Playfulness, Perceived Usefulness, and Behavioral Intention to Use a CBA system (Fig. 1). Thus, practitioners, researchers and tutors will be provided with useful insight regarding how emotional feedback influences learners' perceptions and attitudes towards CBA.

3. Research model and hypotheses

3.1. Perceived playfulness

Csikszentimihalyi's (1975) and Deci and Ryan's (1985) studies inspired Moon and Kim to extend TAM with the Perceived Playfulness construct. Perceived Playfulness is an individual's beliefs formed by the interaction with the system (Moon & Kim, 2001). The main dimensions that describe Perceived Playfulness (PP) are the following three:

(a) Concentration: Whether the user is concentrated on the activity.
(b) Curiosity: Whether the user's cognitive curiosity is aroused (Malone, 1981a,b).
(c) Enjoyment: Whether the user enjoys the interaction with the system.

These three dimensions are observed during the interaction. Even though the dimensions are connected, they do not always appear together. Thus the total interaction is not explained by each dimension alone. In addition to Moon and Kim's research, Perceived Playfulness has also been introduced to CBA context (Terzis & Economides, 2011). These studies showed a positive effect of Perceived Playfulness on Behavioral intention to use (BI). Thus, we hypothesized:

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

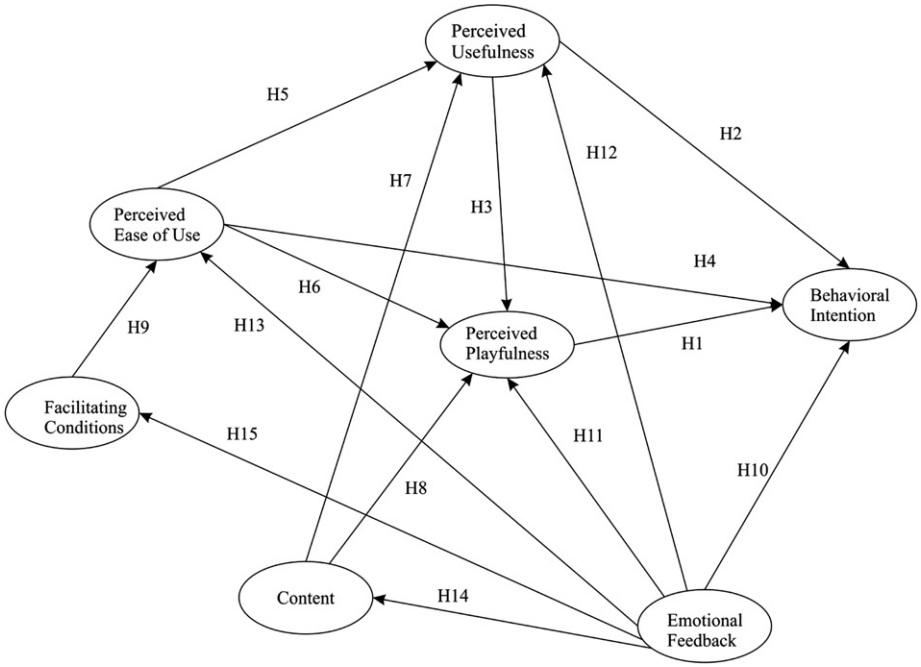

Fig. 1. Research model.

3.2. Perceived usefulness

Perceived Usefulness (PU) is determined as the degree to which a person believes that using a particular system will enhance his/her job performance (Davis, 1989). The strong influence of PU on BI and on PP has been proved in the learning and CBA context (eg. Lee, 2008; Ong & Lai, 2006; Terzis & Economides, 2011; Van Raaij & Schepers, 2008). Thus, we hypothesized:

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

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

3.3. Perceived ease of use

Perceived Ease of Use (PEOU) is defined as the degree to which a person believes that the interaction with the system would be easy (Davis, 1989). Previous studies supported that PU and BI are influenced by PEOU (Agarwal & Prasad, 1999; Hu, Chau, Sheng, & Tam, 1999; Terzis & Economides, 2011; Venkatesh, 1999; Venkatesh & Davis, 1996). Moreover, a positive effect of PEOU on PP has been showed (Terzis & Economides, 2011). So, we hypothesized:

H4. Perceived Ease of Use will have a positive effect on the Behavioral 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.

3.4. Content

LMS and CBA systems deliver learning and assessment content easier, faster and more efficiently to the learners. Previous studies showed that Content is a significant variable to determine e-learner's satisfaction (Wang, 2003). Moreover, tutors have to observe system's construction, operation and maintenance in order to deliver efficient and appropriate content, which it will improve learner's satisfaction (Shih, 2008).

Regarding CBA, Content is related to the course's content and the content (questions) during the system's use (Terzis & Economides, 2011). CBAAM detected that Content had a positive impact on PU, PP. Therefore, we hypothesized:

H7. Content will have a positive effect on Perceived Usefulness.

H8. Content will have a positive effect on Perceived Playfulness.

3.5. Facilitating conditions

Information systems provide facilities to the users in order to perform a procedure. In CBA system, Facilitating Conditions (FC) derived from: 1) the organizational (support) staff, 2) the system's architecture (tools). The organizational staff helps learners to overcome their difficulties, and system's tools provide information concerning the use of the system. CBAAM showed that Facilitating Conditions influences Perceived Ease of Use. Thus, we hypothesized:

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

3.6. Emotional feedback

One aim of this study is to investigate the effect of Emotional Feedback (EF) construct on the learner's intention to use a CBA. Moreover, this paper explores the effects of EF on PP, on PU, on PEOU, on C and on FC. We define Emotional Feedback as a variable that influences an individual's emotional state. In our study, we examine three different dimensions of EF. Firstly, it is the emotional feedback's content. We believe that the content could affect CBA's acceptance, playfulness and usefulness. Learners evaluate the emotional feedback's content based on what information and how this information is provided to them. Specifically, they evaluate if the content of the emotional feedback (video, images, text. sound) was clear, understandable and relative with their emotional state or the procedure. The second dimension is emotional feedback's design. Previous studies showed that the design of an ECA is a very demanding work since there are different aspects that could drive to different results (Yee, Bailenson, & Rickertsen, 2007). Different ECA's characteristics on variables such as sex, skin colour, human or no-human morph, voice's tone, and facial expressions might have different effects on learner's playfulness, usefulness, acceptance and performance. The third dimension concerns with the measurement of the effect of Emotional Feedback on learner's emotional state such as: mood, curiosity, concentration and effectiveness during the CBA. These three dimensions of Emotional Feedback are very important factors for the successful implementation of the Emotional Feedback in a CBA. A well designed Emotional Feedback with the appropriate content to affect the learner's emotional state, curiosity and concentration will hold learner's playfulness and usefulness at high levels. Moreover, an appropriate Emotional Feedback will help towards to: 1) an easier interaction between learner and CBA system 2) better use of facilitating conditions 3) higher content's comprehension. Thus, we hypothesized:

H10. Emotional Feedback will have a positive effect on the Behavioral Intention to use CBA.

H11. Emotional Feedback will have a positive effect on Perceived Playfulness.

H12. Emotional Feedback will have a positive effect on Perceived Usefulness.

H13. Emotional Feedback will have a positive effect on Perceived Ease of Use.

Table 1
ECA's speech and facial expressions.

HAPPY-ECA	SAD-ECA	FEAR-ECA
Voice		
Somehow this test makes you happy. Continue the test with attention.	Somehow this test makes you sad. Cheer up, continue trying and you will succeed.	Somehow this test makes you fear. Cheer up, continue trying and you will succeed.
Facial expression		
Happy and then neutral	Sad and then happy	Fear and then happy

H14. Emotional Feedback will have a positive effect on Content.

H15. Emotional Feedback will have a positive effect on Facilitating Conditions.

4. Methodology

4.1. Design of the ECA

Previous studies showed that a higher realism of an agent is connected to a higher positive learner's attitude regarding ECA (Yee et al., 2007). Moreover, other studies showed better effectiveness of female agents regarding frustration than male agents (Hone, 2005). Furthermore, previous studies showed a variety regarding the expression of empathy through an ECA. Some researchers used only sentences, such as "It seems you did not like this question so much" (Hone, 2005; Prendinger & Ishizuka, 2005). Other works synchronized verbal behavior with simple emotional expressions (Ochs, Pelachaud, & Sadek, 2008), such as happy or anger. Even more, complex emotional expressions have been used regarding different emotions on different areas of the face (Niewiadomski, Ochs, & Pelachaud, 2008).

Thus, in this experiment we displayed a female 3D ECA with empathetic encouragement behavior as emotional feedback to learner's Happy, Sad, and Fear emotions during the CBA. As we mentioned before ECA empathetic encouragement is a combination of parallel and reactive empathy. Parallel empathy is expressed by a relevant to the learner's emotion facial expression and reactive empathy is expressed by a different from the learner's emotion facial expression. Specifically, when a learner displayed a Sad or Fear emotion, the ECA performed firstly a relevant to the learner's emotion (Sad, or Fear) facial and speech expression, followed by a Happy facial and speech expression, so as to alter Sad and Fear emotions. On the other hand, when a learner showed a Happy emotion, the ECA firstly displayed a Happy facial and speech expression, followed by a Neutral facial and speech expression. Finally, the ECA's voice was given by a female actor. Actors are trained to express a variety of emotions (Kappas, Hess, & Scherer, 1991). Table 1 shows the speech and the facial expression of the ECA. In addition, Fig. 2 demonstrates how the ECA looked like with sad and happy facial expressions.

4.2. Research participants and data collection

The course was an introductory informatics course, in the Department of Economic Sciences of a Greek University. The course contains theory and practice. In the theoretic module, students have to learn general concepts of Information & Communication Technology (ICT) (Beekman & Quinn, 2007). In the practical module, students have to learn how to use Word Processing and Internet (Kinkoph, 2007). Computer Based Assessment (CBA) includes questions from both modules.

134 applicants appeared to their appointments to take the CBA. There were 51 males (38%) and 83 females (62%). The average age of students was 19.4 (SD = 1.03). The CBA was voluntary. Each participant signed an informed consent form prior to his/her participation. The informed consent stated that the participant may be monitored during the CBA to prevent cheating. Moreover, the informed consent gave the right to researchers to use any data that may be collected during the CBA by the camera and PC, or questionnaires after the end of CBA for

Fig. 2. The ECA in sad and happy facial expressions.

research purposes. The CBA consisted of 45 multiple choice questions and its duration was 45 min. Each question had 4 possible answers. The questions' sequence was randomized for every student.

The use of the CBA was very simple. Each student had to choose the right answer and then he/she had to push the "next" button. Each page included the question, the 4 possible answers and the "next" button. The text was in Greek. Teachers did not give any other special instruction at the beginning. Few students, that were not very comfortable with the use of the CBA and asked for help on its use, received further information and instructions. The CBA's appearance was simple too in order to avoid any effects of design and aesthetics.

During the CBA, each student took the test alone in a properly designed room. The room had two spaces. There was a bulkhead between the two spaces. At the first space, there was the PC on which the student took the CBA. Moreover, a camera was hidden in a bookcase. We followed the "wizard of oz mode" in order to evaluate the effects of human–computer interaction (HCI) (Cassell & Miller, 2007). Therefore, in the second space two researchers were seated to control the system and make observations without disturbing the examinee. Besides, it is well known that people express themselves more freely when they feel that they are on their own. At researchers' PC, special equipment which recognizes emotional states from facial expressions called FacerReader was connected. FaceReader is developed by Vicar Vision and Noldus Information Technology bv. The FaceReader recognizes facial expressions by distinguishing six basic emotions (happy, angry, sad, surprised, scared, disgusted, and neutral) with an accuracy of 89% (Den Uyl & Van Kuilenburg, 2005) and 87% in a CBA's context (Terzis, Moridis, & Economides, 2010). The system is based on Ekman and Friesen's theory of the Facial Action Coding System (FACS) that states that basic emotions correspond with facial models (Ekman & Friesen, 1977). Several studies have used Facereader for different purposes (Benţa, Cremene, & Todica, 2009; Truong, Neerincx, & Van Leeuwen, 2008).

The researchers were able to watch the facial expressions and the emotions of the participants in real time. Emotional Feedback was triggered manually only when both the FaceReader and the researchers recorded a Happy, Sad, or Fear emotion. After the end of the CBA, each learner had to answer two questionnaires: 1) the survey which consisted of 32 questions (Appendix 1) and 2) a questionnaire to correspond each ECA's facial and voice expressions with the appropriate emotional state among Angry, Neutral, Sad, Happy and Fear. Results showed that facial expressions were easily recognized by the participants with high percentages. Neutral, Happy, Sad and Fear were recognized with 99%, 98%, 97% and 95% respectively.

4.3. Measures

In order to examine the six latent constructs of the model, we adapted items based on previous studies. A modification of the items was necessary regarding the learners' language and the use of the CBA, in order to be relevant to our study. The first modification of the items was the substitution of the word Learning System or Information System with the word CBA. For example, the item "Using the e-learning system enhances my effectiveness" was substituted by the "Using the CBA enhances my effectiveness". Moreover, the questionnaire was developed in English and then translated into Greek. The translation was made by certified translators to ensure linguistic equivalence. All items were measured on a seven point Likert-type scale with 1 = "strongly disagree" to 7 = "strongly agree". These items have been used extensively in several previous studies of acceptance. For Perceived Usefulness (PU) and for Perceived Ease of Use (PEOU) three items for each construct were adopted from Davis (1989). The four Items for Perceived Playfulness (PP) were based on two studies (Moon & Kim, 2001; Wang et al., 2009). Content (C) construct was measured using four items from Terzis and Economides (2011). For Facilitating Conditions (FC) we used two items (Thompson, Higgins, & Howell, 1991). Emotional Feedback variable was measured by using thirteen items that were developed by us. Finally, for Behavioral Intention to Use (BI), we adapted three items from Davis (1989). To conclude, our measurement instrument consists of thirty two items and our research model consists of seven constructs (Appendix 1).

5. Results

The technique of partial least-squares (PLS) analysis was used to analyze the measurement and the structural model. Many studies on technology acceptance on learning systems used PLS analysis (eg. Han, 2003; Hsu, Chen, Chiu, & Ju, 2007; Van Raaij & Schepers, 2008; Zhang, Zhao, & Tan, 2008; Yi & Hwang, 2003). Regarding the sample size, the minimum recommended value is defined by the two following guidelines: (a) 10 times larger than the number of items for the most complex construct; (b) 10 times the largest number of independent variables impacting a dependent variable (Chin, 1998). If the larger value of the two guidelines is supported then the sample size is large enough. The proposed model has four independent variables impacting a dependent variable (Perceived Playfulness or Behavioral Intention). Thus, our sample of 134 participants exceeded the recommended value of 130.

Reliability and validity of the measurement model is proved by the internal consistency, convergent validity and discriminant validity (Barclay, Higgins, & Thompson, 1995; Wixon & Watson, 2001). Firstly, we measured the items' factor loadings on the corresponded variables. A value equal or larger than 0.7 is acceptable (eg. Teo, 2009). Regarding the discriminant validity, the AVE (Average Variance Extracted) should be higher than 0.5 and the AVE's squared root of each construct should be greater than any correlation with every other construct (Barclay et al., 1995; Chin, 1998; Fornell & Larcker, 1981). Furthermore, a composite reliability greater than 0.7 is considered adequate (Agarwal & Karahanna, 2000; Compeau, Higgins, & Huff, 1999). These criteria regarding our measurement model are satisfied and demonstrated at Tables 2 and 3.

The structural model and hypotheses are assessed mainly by two criteria: (1) by examining the variance measured for (R^2) by the antecedent constructs. Cohen (1988) proposed 0.2, 0.13 and 0.26 as small, medium and large variance respectively; (2) the significance of the path coefficients and total effects by using bootstrapping procedure and calculating the t-values. Results regarding our structural model are presented at Tables 4 and 5. SmartPLS 2.0 was used for data analysis (Ringle, Wende, & Will, 2005).

5.1. Convergent validity

Table 2 confirms the convergent validity. All the factor loadings of the items for each construct in the measurement model are over 0.7. Furthermore, the composite reliability is over 0.7 and the average variance extracted exceeds the adequate value.

Table 2
Results for the measurement model.

Construct items	Mean	Standard deviation	Factor loading (>0.7)[a]	Cronbach α (>0.7)[a]	Composite reliability (>0.7)[a]	Average variance extracted (>0.5)[a]
Perceived playfulness	5.45	0.99		0.85	0.90	0.69
PP1			0.76			
PP2			0.86			
PP3			0.85			
PP4			0.86			
Perceived usefulness	5.8	0.89		0.80	0.88	0.71
PU1			0.83			
PU2			0.86			
PU3			0.85			
Perceived ease of use	5.89	0.89		0.75	0.86	0.67
PEOU1			0.80			
PEOU2			0.87			
PEOU3			0.79			
Content	5.69	0.81		0.75	0.84	0.56
C1			0.74			
C2			0.71			
C3			0.74			
C4			0.86			
Facilitating conditions	6.63	0.67		0.88	0.94	0.89
FC1			0.95			
FC2			0.94			
Emotional feedback	5.42	1.03		0.96	0.96	0.67
EF1			0.72			
EF2			0.78			
EF3			0.83			
EF4			0.89			
EF5			0.89			
EF6			0.88			
EF7			0.90			
EF8			0.86			
EF9			0.84			
EF10			0.85			
EF11			0.71			
EF12			0.77			
EF13			0.74			
Behavioral intention to use	5.99	1.04		0.89	0.93	0.82
BI1			0.94			
BI2			0.92			
BI3			0.84			

[a] Indicates an acceptable level of reliability and validity.

5.2. Discriminant validity

Discriminant validity is confirmed when the square root of the average variance extracted (AVE) of a construct is greater than any correlation with another variable (Fornell & Larcker, 1981). Table 3 shows the correlations of the variables and the square roots of the AVEs which are the diagonal elements of the table. All the square roots of the AVEs are higher than any other correlation. Therefore, the discriminant validity of the proposed research model is confirmed.

5.3. Testing hypotheses

A bootstrap procedure with 1000 resamples was used to test the statistical significance of the relations in the model. The results for the hypotheses are summarized in Table 4 and Fig. 3. Emotional Feedback has significant direct positive effects on Behavioral Intention, on Perceived Playfulness, on Perceived Usefulness, on Perceived Ease of Use, on Content and on Facilitating Conditions.

Table 3
Discriminant validity for the measurement model.

Construct	PP	PU	PEOU	C	FC	EF	BI
PP	**0.83**						
PU	0.57	**0.84**					
PEOU	0.48	0.38	**0.82**				
C	0.53	0.48	0.45	**0.75**			
FC	0.33	0.21	0.50	0.48	**0.94**		
EF	0.58	0.44	0.36	0.35	0.24	**0.82**	
BI	0.65	0.49	0.48	0.44	0.29	0.56	**0.91**

Bold values indicate the square root of the average variance extracted (AVE) of each construct.

Table 4
Hypothesis testing results.

Hypothesis	Path	Path coefficient	t value	Results
H1	PP → BI	0.37***	3.49	Support
H2	PU → BI	0.11	1.12	Not support
H3	PU → PP	0.25**	3.10	Support
H4	PEOU → BI	0.18*	2.22	Support
H5	PEOU → PU	0.14	1.30	Not support
H6	PEOU → PP	0.20*	2.14	Support
H7	C → PU	0.32***	3.71	Support
H8	C → PP	0.22*	2.36	Support
H9	FC → PEOU	0.44***	5.48	Support
H10	EF → BI	0.24*	2.31	Support
H11	EF → PP	0.34***	4.26	Support
H12	EF → PU	0.28**	2.83	Support
H13	EF → PEOU	0.25**	2.72	Support
H14	EF → C	0.35***	4.22	Support
H15	EF → FC	0.24**	2.77	Support

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Regarding Behavioral Intention to Use a CBA system, Perceived Playfulness and Perceived Ease of Use have also a direct positive effect. However a direct positive effect of Perceived Usefulness to Behavioral Intention was not confirmed.

Perceived Playfulness is also defined directly by Perceived Usefulness, Perceived Ease of Use and Content. Content has also a direct positive impact on Perceived Usefulness. Furthermore, Facilitating Conditions is a determinant of Perceived Ease of Use.

Thus, all the hypotheses were confirmed except the direct effects of Perceived Usefulness on Behavioral Intention and Perceived Ease of Use on Perceived Usefulness. Besides the direct effects, the structural model includes also indirect and total effects among variables (Table 5).

Moreover, in the PLS analysis the R^2 values are used as a goodeness-of-fit measure (Hulland, 1999). The model explains almost the 52% of variance in Behavioral Intention to Use. The total effects of EF (0.57), PP (0.37), PU (0.20), PEOU (0.27), C (0.15) and FC (0.12) are strong. This indicates that these 6 variables are very important for the definition of the Behavioral Intention to Use. Furthermore, EF (0.59), PU (0.25), PEOU (0.20), C (0.30) and FC (0.09) explain 53% of the variance in Perceived Playfulness. Moreover, EF (0.44), C (0.32), PEOU (0.20) and FC (0.06) explain 36% of the variance in Perceived Usefulness. FC (0.44) and EF (0.36) explain 31% of the variance in Perceived Ease of Use. EF also explains 12% of the variance in Content and 6% of the variance in Facilitating Conditions (Fig. 3, Table 5).

5.4. Overall model fit

Goodness of fit (GoF) is a criterion to predict the overall performance of the model (Tenenhaus, Amato, & Esposito Vinzi, 2004). GoF measures the model's performance based on the performance of the measurement and the structural model together. The GoF is estimated as the geometric mean of the average communality in the measurement model (AVE) and the average R^2 of the endogenous variables. The values of GoF were defined as small (0.10), medium (0.25) and large (0.36). Our model has a value of **GoF = 0.47**. Thus, our model has a good fit.

6. Discussion

The main aim of this study was to investigate the effects of Emotional Feedback on Behavioral Intention to use a CBA, and on other crucial determinants of Behavioral Intention to use a CBA system.

Table 5
R^2 and direct, indirect and total effects.

Dependent variables	R^2	Independent variables	Direct effect	Indirect effect	Total effect
Behavioral intention	0.52	Perceived playfulness	0.37	0.00	0.37***
		Perceived usefulness	0.11	0.09	0.20*
		Perceived ease of use	0.18	0.09	0.27**
		Content	0.00	0.15	0.15***
		Facilitating conditions	0.00	0.12	0.12**
		Emotional feedback	0.24	0.33	0.57***
Perceived playfulness	0.53	Perceived usefulness	0.25	0.00	0.25**
		Perceived ease of use	0.20	0.00	0.20**
		Content	0.22	0.08	0.30***
		Facilitating conditions	0.00	0.09	0.09*
		Emotional feedback	0.34	0.25	0.59***
Perceived usefulness	0.36	Perceived ease of use	0.14	0.00	0.14
		Content	0.32	0.00	0.32***
		Facilitating conditions	0.00	0.06	0.06
		Emotional feedback	0.28	0.16	0.44***
Perceived ease of use	0.31	Facilitating conditions	0.44	0.00	0.44***
		Emotional feedback	0.36	0.00	0.36***
Content	0.12	Emotional feedback	0.35	0.00	0.35***
Facilitating conditions	0.06	Emotional feedback	0.24	0.00	0.24**

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

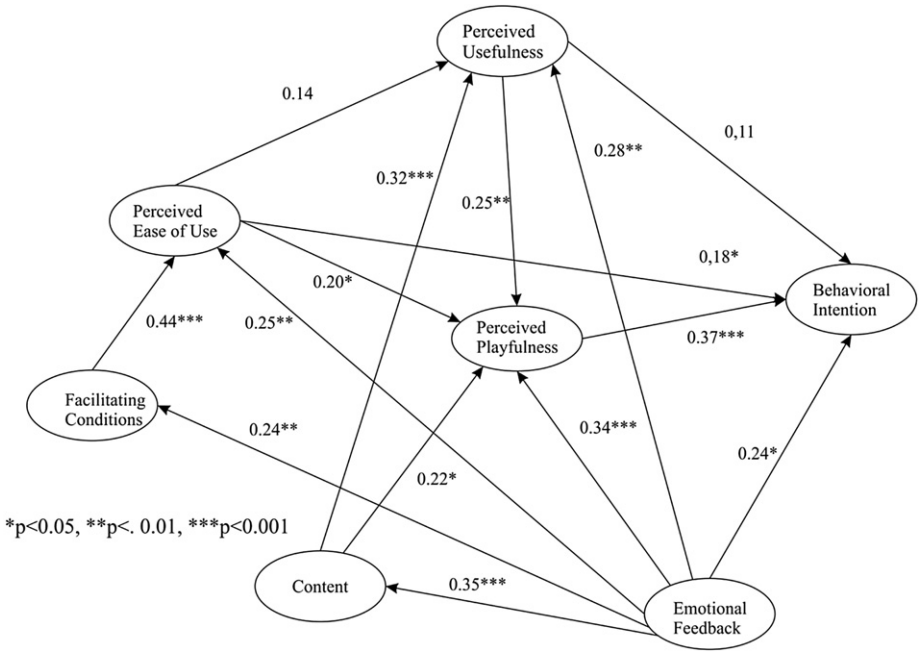

Fig. 3. Path coefficients of the research model.

Prior knowledge regarding the technology acceptance and emotional feedback was used and customized for CBA. The results demonstrate that Emotional Feedback has a direct effect on Behavioral Intention to Use, on Perceived Playfulness, on Perceived Usefulness, on Perceived Ease of use, on Content and on Facilitating Conditions.

Moreover, Perceived Playfulness and Perceived Ease of Use have also a direct effect on Behavioral Intention to use a CBA, while Perceived Usefulness, Content and Facilitating Conditions have an indirect impact on Behavioral Intention to use a CBA system. Our study supports previous researchers and the data confirm our research measurement and structural model.

Regarding the direct effects on Behavioral Intention to Use, we found that when a CBA is playful and easy to use, it would be more likely for learners to use it. These results were expected. Perceived Ease of Use is one of the major variables in TAM and the direct effect on Behavioral Intention has been confirmed many times in different studies (eg. Davis, 1989). Likewise, the direct effect of Perceived Playfulness has also been proven (Moon & Kim, 2001; Terzis & Economides, 2011; Wang et al., 2009).

To the best of our knowledge, Emotional Feedback is a construct that has not been considered before in an acceptance model. Our hypotheses for a direct impact of the Emotional Feedback on Behavioral Intention, and on the other five crucial determinants of Behavioral Intention are confirmed. Based on our results, when a CBA uses emotional feedback and especially in our case (an ECA with empathetic encouragement), it would be more likely for learners to find the CBA playful, useful, and easier to use. Moreover the appropriate implementation of emotional feedback will drive learners to identify better Facilitating Conditions and they will have higher appreciation of CBA's Content. In this point, we have to mention that the effects of Emotional Feedback are not only strong directly on Behavioral Intention but also indirectly through the other five determinants of Behavioral Intention. Thus, the Emotional Feedback is highlighted as a very important variable regarding the CBA's acceptance. This means that the implementation of the emotional feedback is crucial for a CBA.

As we have already discussed, the design, the content and the desired effect of the emotional feedback must be carefully selected. Regarding the design, if the ECA's sex, hair, clothes, voice, facial expressions were different, the effects could also have been different. Likewise, content's quality of the feedback impacts the desired effects of the emotional feedback. For example, what the ECA will say and how much clear and understandable will be, may change the learner's perceptions towards to playfulness, usefulness, ease of use and content of the system.

7. Conclusions

This research aimed to investigate the impact of the emotional feedback on the Behavioral Intention to Use a computer based assessment. Data supports the measurement and the structural model. Our study indicates that Emotional Feedback is a significant determinant for Behavioral Intention to Use a CBA, Perceived Playfulness, Perceived Usefulness, Perceived Ease of Use, Content and Facilitating Conditions.

Researchers and tutors will find the study useful since it introduces for first time the Emotional Feedback construct in an acceptance model in the context of CBA. The interaction of the Emotional Feedback with the other crucial variables of the acceptance model provides interesting results. Previous studies confirmed that a CBA must be playful, easy to use and useful. This study extends previous results considering the impact of Emotional Feedback. This research proposes that educators in order to enhance learner's intentions to use CBA systems, they should provide an emotional feedback during the CBA with careful and relevant design and content.

Future Work is triggered by the limitations of this study. First, other important variables such as Social Influence or Goal Expectancy should be added in the research model. In this study other variables were avoided in order to analyze better the effects of Emotional Feedback. Second, the effect of the emotional feedback must be applied in other samples with different age, occupation, nationality and other courses for further confirmation. Third, a different emotional feedback has to be studied in order to investigate the potential of

different aspects. For example, a male ECA or a non-human ECA or an ECA with different emotional behaviors may produce different results concerning the effect on Perceived Playfulness, Perceived Usefulness and Behavioral Intention to Use a CBA. Fourth, future studies might consider different feedback (eg. cognitive) to explore its effects on Behavioral Intention to Use a CBA. Finally, validity and reliability of Emotional Feedback construct have to be studied further and confirmed from other researchers too.

To conclude, this paper introduces for first time the emotional feedback as construct in an acceptance model regarding CBA. It investigates the effects of Emotional Feedback on Behavioral Intention to Use a CBA system and on other crucial determinants of Behavioral Intention. Therefore, it proposes a basic acceptance model for computer based assessment extended with the Emotional Feedback variable which explains approximately 52% of the variance of Behavioral Intention.

Appendix 1

Constructs	Items	
Perceived usefulness	PU1	Using the Computer Based Assessment (CBA) will improve my work.
	PU2	Using the Computer Based Assessment (CBA) will enhance my effectiveness.
	PU3	Using the Computer Based Assessment (CBA) will increase my productivity.
Perceived ease of use	PEOU1	My interaction with the system is clear and understandable.
	PEOU2	It is easy for me to become skillful at using the system.
	PEOU3	I find the system easy to use.
Content	C1	CBA's questions were clear and understandable.
	C2	CBA's questions were easy to answer.
	C3	CBA's questions were relative with the course's syllabus.
	C4	CBA's questions were useful for my course.
Facilitating conditions	FC1	When I need help to use the CBA, someone is there to help me.
	FC2	When I need help to learn to use the CBA, system's help support is there to teach me.
Perceived playfulness	PP1	Using CBA keeps me happy for my task.
	PP2	Using CBA gives me enjoyment for my learning.
	PP3	Using CBA, my curiosity stimulates.
	PP4	Using CBA will lead to my exploration.
Emotional feedback	EF1	Videos' content between the questions was clear and understandable.
	EF2	Videos' content between the questions was relevant to the procedure.
	EF3	Videos' content between the questions helped me towards to the procedure
	EF4	Videos between the questions affected positively my emotional state during the procedure.
	EF5	Videos between the questions affected positively my psychological state during the procedure.
	EF6	Videos between the questions affected positively my mood during the procedure.
	EF7	Videos between the questions affected positively my perceptions toward the procedure.
	EF8	Videos between the questions affected positively my concentration.
	EF9	Videos between the questions affected positively my effectiveness.
	EF10	Videos between the questions made me to dedicate more time for the procedure.
	EF11	Videos between the questions had pleasant colors and images.
	EF12	The face that you watched during the videos between the questions had pleasant and understandable facial characteristics and motions.
	EF13	The voice of the face that you watched during the videos between the questions was pleasant and understandable.
Behavioral intention to use CBA	BI1	I intend to use CBA in the future.
	BI2	I predict I would use CBA in the future.
	BI3	I plan to use CBA in the future.

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