How student's personality traits affect Computer Based Assessment Acceptance: Integrating BFI with CBAAM

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ABSTRACT

Researchers in the Information Systems (IS) field have put considerable effort on identifying how personality affects technology acceptance. This study is a further step towards this direction within the context of Computer Based Assessment (CBA). Particularly, it investigates how the five personality factors affect the most important variables regarding CBA's acceptance. For this purpose, 117 participants were required to complete a survey questionnaire. The questionnaire included the Big Five Inventory (BFI) questions in order to measure the five personality traits, and 23 items regarding student's perceptions. Partial Least Squares (PLS) was used to test the measurement and the structural model. Results underline that Neuroticism has significant negative effect on Perceived Usefulness and on Goal Expectancy, Agreeableness determines Social Influence and Perceived Ease of Use, Conscientiousness defines Perceived Ease of Use, while Extraversion and Openness explain Perceived Importance. Important implications of these results are discussed.

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1. Introduction

Information system researchers have underlined the importance of personal factors, such as attitudes, beliefs, cognitions, culture and behaviors, regarding technology acceptance (e.g. Agarwal & Karahanna 2000; Compeau, Higgins, & Huff, 1999; Davis, Bagozzi, & Warshaw, 1992; Flaherty, Pearce, & Rubin, 1998; Srite & Karahanna, 2006).

The aforementioned personal factors are determined by personality. Personality reflects the unique thoughts and actions of each human being and it determines human conduct in many types of situations (Barrick & Mount, 1991; Eysenck & Eysenck, 1985). The Five-Factor Model (FFM), known also as the Big Five (Goldberg, 1990), is the most parsimonious and comprehensive framework of personality (Costa & McCrae, 1992) and the most used model (Ehrenberg, Juckes, White, & Walsh, 2008; Landers & Lounsbury, 2006). The stability of the Big Five model has been tested in multiple countries and over time (Costa & McCrae, 1988; Digman, 1989; McCrae & Costa, 1997).

The Big Five model is based on the theory that an individual's personality can be measured through five bipolar factors: extraversion, agreeableness, conscientiousness, neuroticism, and Openness to experience (McCrae & John, 1992).

Recently, the Big Five model has been introduced into technology acceptance field (Devaraj, Easley, & Crant, 2008). Several researchers combined FFM with Technology Acceptance Model (TAM) and found that personality dimensions can be useful determinants of users' intentions and perceptions (e.g. Benlian & Hess, 2010; Wang, 2010; Yu-Ching Lin & Ong, 2010).

An IS related field is Learning Management Systems (LMS). LMS include all the practices such as e-learning, distance learning and Computer Based Assessment (CBA). Specifically, CBA offers enormous prospect for innovations in learning, testing and assessment (e.g. Bennett, 1998). CBA provides many advantages to students and to academics such as: self-evaluation, recognition of students' strengths and weaknesses, personalised learning, useful feedback, security, cost and time reduction (e.g. Birenbaum, 1996; Bugbee, 1996; Drasgow & Olsen-Buchanan, 1999; Economides, 2006).

Based on technology acceptance many researchers focused on what drives students to use learning platforms (e.g. Teo, 2009; Yi & Hwang, 2003). In the CBA context, the Computer Based Assessment Acceptance Model (CBAAM) is a model that satisfactorily explains why students intend to use a CBA (Terzis & Economides, 2011a). Particularly, the CBAAM uses nine variables such as: Perceived Usefulness, Perceived Ease of Use, Perceived Playfulness, Perceived Importance, Social Influence, Facilitating Conditions, Content, Goal Expectancy and Computer Self-Efficacy in order to determine intention to use (Terzis & Economides, 2011a). Following previous studies, the purpose of this study is to examine the relationship of personality with the CBA acceptance through the integration of the Big Five model with the CBAAM. It is very

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important to examine students' personality in order to understand better the students' beliefs and actions regarding school, academic performance and behavior (e.g. Matthews, Zeidner, & Roberts, 2006). Thus, the analysis presented in this paper will contribute towards evaluating the factors that influence learner's intentions to use a CBA.

The rest of this paper is organized as follows. Section 2 displays previous studies that introduced FFM in technology acceptance and demonstrates the CBAAM. Section 3, based on the theories and related prior research, describes the research model and develops the research hypotheses. Section 4 provides the methodology and Section 5 demonstrates the results. Finally, Section 6 discusses the results and Section 7 presents the conclusions of this study with implications for theory and practices.

2. Literature review

2.1. Technology Acceptance and Computer Based Assessment Acceptance Model

There are many important models in the field of technology acceptance. Technology Acceptance Model (TAM) is the first and the most dominant model regarding IT acceptance (Davis, 1989). Davis developed TAM based on Theory of reasoned Action (TRA) (Fishbein & Ajzen, 1975). TAM employs user's perceptions regarding Usefulness and Ease of Use to predict IT acceptance. Another important model that explains user's intentions is the Theory of Planned Behaviour (TPB) (Ajzen, 1991). Taylor and Todd (1995) proposed a hybrid model which combined TAM and TPB. Unified Theory of Acceptance and Use of Technology (UTAUT) integrate previous studies and present the most important variables regarding IT acceptance (Venkatesh, Morris, Davis, & Davis, 2003). These models with some modifications, extensions or combinations with other theories have been used in several studies to explain and predict IT acceptance in many different contexts such as e-commerce (e.g. Pavlou, 2003), e-government e.g. (Wu & Chen, 2005), e-learning (e.g. Ong & Lai, 2006), etc.

The importance of Computer Based Assessment drove researchers to investigate the factors that affect user's perceptions regarding CBA's acceptance (Terzis & Economides, 2011a). Particularly, Computer Based Assessment is an Information Technology (IT) provided through sophisticated tools in order to expand educational assessment in universities, schools and industry. In this regard, Computer-Based Assessment describes the conceptualization and administration of assessments by using IT (Scheuermann et al., 2007). Either formative or summative, CBAs offer many advantages, such as: (a) high interaction and adaptation with test-takers, (b) real-time feedback, (c) real-time score reports, (c) more efficient managing, setting, and delivering of exams (Thelwall, 2000), (d) easier data management (Zakrzewski & Steven, 2000), (e) cost reduction (Hodson, Saunders, & Stubbs, 2002), (f) self-evaluation and recognition of students' strengths and weaknesses. Therefore, it is important to figure out what drives users to adopt CBAs.

Based on previous acceptance models and statistical analysis such as Structural Equation Modeling (SEM) and Partial Least Squares (PLS), Computer Based Assessment Acceptance Model (CBAAM) was proposed as a technology acceptance model in order to determine why students intent to use CBAs. CBAAM adopted variables from previous IT acceptance models, as well as introduced new variables that could be also used in other contexts. Similar to other studies, CBAAM adopted Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) from TAM and used them in the LMS and CBA domains (Landry, Griffeth, & Hartman, 2006; Lee, 2008; Ong & Lai, 2006; Ong, Lai, & Wang, 2004; Padilla-Melen-

dez, Garrido-Moreno, & Del Aguila-Obra, 2008; Teo, 2009; Van Raaij & Schepers, 2008; Yi & Hwang, 2003). Usefulness can be defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Rogers called Usefulness as "relative advantage" and defined it as "the degree to which an innovation is perceived as being better than its precursor" (Rogers, 2003). CBAAM showed that students will use a CBA if the system is useful regarding their academic tasks. On the other hand, Ease of Use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989; Rogers, 2003, Thompson, Higgins, & Howell, 1991). CBAAM showed that a CBA which is easy to use it might affect user's perceptions regarding CBA's usefulness, Playfulness and intention to use it.

From Unified Theory of Acceptance and Use of Technology (UTAUT), Facilitating Conditions (Teo, 2009; Teo, Lee, & Chai, 2008) and Social Influence have been integrated in CBAAM. These variables have been used in LMS acceptance models as well (Van Raaij & Schepers, 2008; Wang, Wu, & Wang, 2009). Social Influence can be described in terms of one's predetermined beliefs of how others will judge a specific person's behavior (Fishbein & Ajzen, 1975; Triandis, 1980; Venkatesh et al., 2003). In other words, Social Influence is a variable that measures how a person is influenced by others (colleagues, friends, family) opinions. CBAAM found a significant positive effect of Social Influence only on Perceived Usefulness. This means that individuals were not affected directly by others' opinions to use CBA, however they are influenced regarding the relative advantages and the enhancement of their academic performance if they use the CBA. Thus, Social Influence determines users' behavioral intentions to use a CBA indirectly through Perceived Usefulness.

Furthermore, CBAAM included variables which were found to be more relevant with the context of learning and assessment acceptance. First, it adopted Perceived Playfulness (Moon & Kim, 2001; Wang et al., 2009). Davis et al. (1992) incorporated intrinsic motivation in the discussion about Technology Acceptance Model (TAM) and believed that the intrinsic enjoyment a user obtains from using computer technology to engage in work related behavior also promotes behavior intention. Moon and Kim (2001) defined Playfulness as "the pleasure the individual feels objectively when committing a particular behavior or carrying out a particular activity" and found that Playfulness is a key factor for user's acceptance of the Internet. CBAAM presented Perceived Playfulness as the most significant variable to explain students' behavioral intention to use a CBA system. Also, CBAAM proposed the following three new variables: (1) Goal Expectancy, which is based on Self-Management of Learning (Wang et al., 2009), (2) Content, which was a variable modified from previous studies in order to fit in CBA context (Shee & Wang, 2008; Wang, 2003), and (3) Perceived Importance, which measures how much important is the CBA for the learner (Terzis, Moridis, & Economides, 2011).

Summarizing, CBAAM suggests that user's intentions to use a CBA are defined by Perceived Playfulness, Perceived Ease of Use, Perceived Usefulness and Perceived Importance. Perceived Usefulness is significantly attributed by Goal Expectancy, Content, Social Influence and Perceived Ease of Use. Usefulness, Content, Ease of Use and Goal Expectancy explain Perceived Playfulness Furthermore, Perceived Ease of Use is explained by Computer Self Efficacy and Facilitating Conditions (Fig. 1).

2.2. Five Factor Model and Technology Acceptance

Researchers have concluded to five factors that describe personality traits. These factors are: (a) conscientiousness is described as the degree of organization, persistence, and motivation in goal-oriented behavior; (b) extraversion, which is described as being soci-
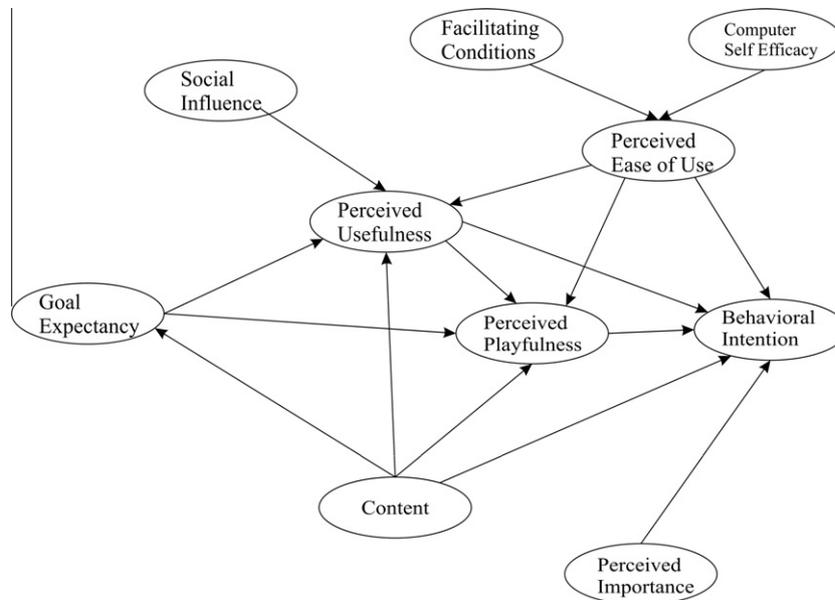
Fig. 1. Computer Based Assessment Acceptance Model (CBAAM).

able, gregarious, assertive, active and ambitious; (c) neuroticism, or emotional instability which represents the insecurity, anxiousness, depression and hostility; (d) Openness to experience which is associated with flexibility of thought and tolerance of new ideas; and (e) agreeableness which is represented by a compassionate interpersonal orientation such as trust, goodnature, cooperation, forgiveness, soft-heart, and tolerance (Costa & McCrae, 1992; Barrick & Mount 1991).

The aforementioned factors were used by Devaraj et al. (2008) in order to investigate the relationships between personality constructs and the TAM. This previous study confirms the following: (1) Conscientiousness significantly moderates the relationship between Perceived Usefulness (PU) and intention to use and secondly moderates the relationship between subjective norms and intention to use. (2) Extraversion moderates the relationship between subjective norms and intention to use. (3) Neuroticism is negatively associated with Perceived Usefulness. (4) Openness is positively associated with Perceived Usefulness and (5) Agreeableness is positively associated with Perceived Usefulness and moderates the relationship between subjective norms and intention to use.

Before the first study regarding the connection between FFM and TAM, other researchers tried to investigate the moderating effects of personality on intention to use. Specifically, Zweig and Webster (2003) used personality traits as moderators regarding the relationship between workplace monitoring system characteristics, fairness, privacy and acceptance. Moreover, Sharma and Citurs (2004) examined the moderation effect of personality variables on the Unified Theory of Acceptance and Use of Technology (UTAUT) model constructs.

Moreover, the five personality traits have been introduced in many different contexts. One context is internet use acceptance. Specifically, neuroticism predicts internet use. Neurotic people use internet to interact since internet does not include face-to-face interaction. Openness is also a significant determinant of internet use, since open-minded people use internet to communicate and find information (McElroy, Kendrickson, Townsend, & Demarie, 2007). Another context has been social networks (e.g. Facebook) acceptance (Rosen & Kluemper, 2008; Ryan & Xenos, 2011). Rosen and Kluemper (2008) found that behavioral intention regarding

Facebook is described by three relationships between Big Five and TAM variables such as: (1) extroversion to perceived ease of use, (2) extroversion to Perceived Usefulness, (3) conscientiousness to perceived ease of use. Additionally, Ryan and Xenos (2011) supported that extraversion is a characteristic of Facebook users, while Facebook nonusers are described as conscientious. Another implementation of Big Five personality factors was delivered in the domain of e-books (Bansal, 2010). Another study associated IS managers' personality traits with ERP's likelihood of acquisition and supported that neurotic IS managers emphasize on functional aspects and reliability, conscientious IS managers consider cost, agreeable IS managers emphasize on ease of use and vendor support, open IS managers consider ease of customization and extravert IS managers emphasize vendor support and ease of implementation (Benlian & Hess, 2010).

Furthermore, Big Five has been linked to the Information Systems (IS) continuance model. First, Yu-Ching Lin and Ong (2010) showed that agreeableness has a positive effect on Perceived Usefulness in a university's bulletin board system. Another study associated Perceived Enjoyment with Big Five factors into the IS continuance model and it supported that Conscientiousness and Extraversion determine Perceived Enjoyment in the context of instant messaging (Wang, 2010).

Finally, a new framework for technology acceptance has been proposed which takes into consideration an information-system specific belief context, an individual's personality context and an overall technology-related context (Devolder, Pynoo, Duyck, & Sijnave, 2008).

Table 1 summarizes the causal links that have been developed regarding the Big Five factors and the most recognized variables of technology acceptance.

The present study explores and proposes a model to connect personality traits to CBA acceptance through the introduction of Big Five into CBAAM.

3. Research model and hypotheses

First, in the research model (Fig. 2) we examine the relationships between CBAAM's constructs. Second, we examine the effect of each personality trait on CBAAM's variables.

Table 1

Previous studies: Causal links between Big Five factors and the most recognized variables of technology acceptance.

Personality traits	Related causal links	Support evidence
Neuroticism (N)	N → PU (negative)	Devaraj et al. (2008)
	N moderates PU → BI	Zweig and Webster (2003)
Agreeableness (A)	A → PU	Ong and Lai (2006) and Devaraj et al. (2008)
	A moderates SN → BI	Devaraj et al. (2008)
	A → PEOU	Benlian and Hess (2010)
Extroversion (E)	E moderates SN → BI	Devaraj et al. (2008)
	E → PU, E → PEOU	Rosen and Kluemper (2008)
	E → PE	Wang (2010)
Conscientiousness (C)	C moderates PU → BI, SN → BI	Devaraj et al. (2008)
	C → PEOU	Rosen and Kluemper (2008)
	C → PE	Wang (2010)

3.1. Variables and hypotheses regarding CBAAM's constructs

3.1.1. Perceived Playfulness

Perceived Playfulness (PP) is determined by three dimensions: (a) Concentration, (b) Curiosity, (c) Enjoyment. This means that Perceived Playfulness is a more complex variable than Enjoyment and it also measures how much individuals' cognitive curiosity and concentration is aroused during the activity. Perceived Playfulness was first introduced in TAM by Moon and Kim (2001). In addition, previous studies showed the positive effect of Perceived Playfulness on Intention to use a CBA (Terzis & Economides, 2011a).

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

3.1.2. Perceived Usefulness

Perceived Usefulness is one of the major constructs introduced by TAM (Davis, 1989). Perceived Usefulness measures a person's beliefs regarding the enhancement of his/her task performance through the use of a particular system. The positive effect of Perceived Usefulness on Behavioral Intention has been supported by many previous studies in different contexts (e.g. Van Raaij &

Schepers, 2008). In the context of CBA, it was found that a useful CBA might increase the three dimensions of Perceived Playfulness. However, the positive effect of Perceived Usefulness on Behavioral Intention to use a CBA is doubtful with controversial previous results (Terzis & Economides, 2011a). Thus, we hypothesize:

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

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

3.1.3. Perceived Ease of Use

Perceived Ease of Use (PEOU) is the second major variable of TAM (Davis, 1989). Perceived Ease of Use measures an individual's beliefs regarding his/her needed effort to use a system satisfactorily. Previous researchers provided evidences of the positive effect of Perceived Ease of Use on Behavioral Intention, on Perceived Usefulness and on Perceived Playfulness (Agarwal & Prasad, 1999; Hu, Chau, Sheng, & Tam, 1999; Terzis & Economides, 2011a; Venkatesh, 1999; Venkatesh & Davis, 1996). Therefore, we hypothesize:

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.

3.1.4. Perceived Importance

Perceived Importance (PI) measures how much important is the CBA for the student. Specifically, if a learner perceives CBA as a very important procedure, it is more likely that he/she will intend to use it. Terzis et al. (2011) provided evidences regarding the positive effect of Perceived Importance to behavioral intention to use a CBA. Therefore, we assume:
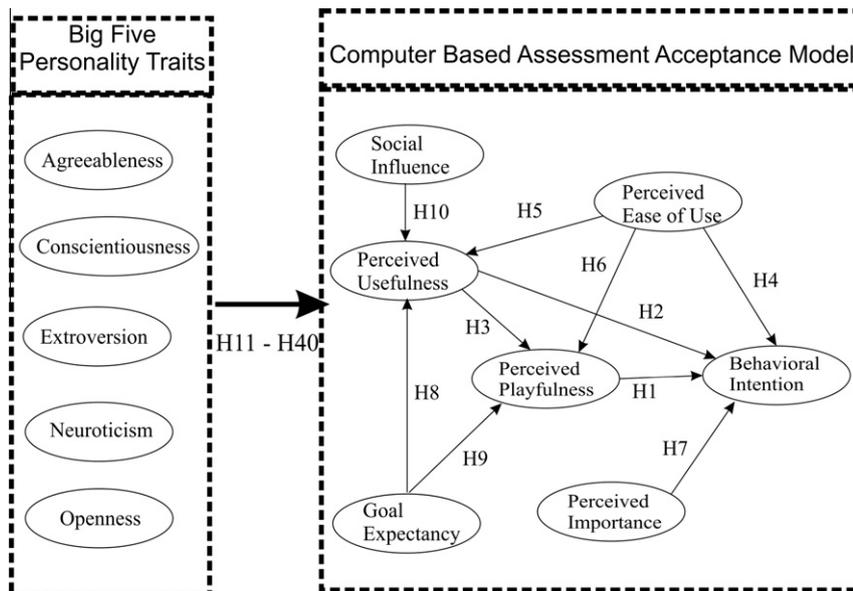
Fig. 2. Research model.

H7. Perceived Importance will have a positive effect on Behavioral Intention to use CBA.

3.1.5. Goal Expectancy

Goal Expectancy (GE) examines as student's belief regarding his/her preparation for the CBA. Goal Expectancy has two dimensions: (a) student's satisfaction regarding his/her preparation for the CBA, (b) student's desirable level of success. Our research examines a summative assessment. In a summative assessment, previous studies have indicated a positive effect of Goal Expectancy on Perceived Usefulness and Perceived Playfulness. Thus, we hypothesize:

H8. Goal Expectancy will have a positive effect on Perceived Usefulness.

H9. Goal Expectancy will have a positive effect on Perceived Playfulness.

3.1.6. Social Influence

The effect of other people's opinion is defined as Social Influence (Taylor & Todd, 1995). Subjective Norm and Image are relative variables which have been used in previous models in order to measure Social Influence (Venkatesh et al., 2003). The most well-known IT acceptance models, such as TAM2 and UTAUT, suggested Social Influence as one of the major determinants to explain behavioral intention. Previous researchers provided evidence regarding the positive effect of Social Influence on Perceived Usefulness in LMS and CBA contexts (e.g. Terzis & Economides, 2011a; Wang et al., 2009).

H10. Social Influence will have a positive effect on Perceived Usefulness.

It is widely accepted that personality is associated with behavior through cognitive processes (Costa & McCrae, 1980). CBA's acceptance is also a cognitive procedure, describing student's perceptions regarding CBA. Since all personality traits could play an important role in student's behavior regarding CBA acceptance, this study will examine the potential effect of each personality variable on the most important CBA's determinants.

3.2. Personality traits and hypothetical relationships with CBAAM's variables

3.2.1. Agreeableness

Agreeableness characterizes a person which is likable, kind, considerate, helpful and cooperative (Graziano & Eisenberg, 1997). Previous studies argued that Agreeableness has significant effect on Perceived Usefulness (Devaraj et al., 2008) and on Perceived Ease of Use (Benlian & Hess, 2010). Agreeable students are more likely to use technologies that enhance collaboration and cooperation (Devaraj et al., 2008). Despite the fact that CBA is mainly a self-assessment tool, at the stage of preparation it includes cooperation among students through the exchange of notes and knowledge that contribute towards these ideas; therefore agreeable students might find CBA more playful. Furthermore, agreeableness was linked with academic performance (O'Connor and Paunonen, 2007) and goal learning orientations (Payne, Youngcourt, & Beaubien, 2007). Consequently, agreeable students are more likely to have larger goal expectancy and perceived importance. Moreover, agreeable persons are influenced by others opinions (Devaraj et al., 2008), therefore Agreeableness might have a positive effect on Social Influence. Thus, we hypothesize that:

H11. Agreeableness will have a positive effect on Perceived Usefulness.

H12. Agreeableness will have a positive effect on Perceived Ease of Use.

H13. Agreeableness will have a positive effect on Perceived Playfulness.

H14. Agreeableness will have a positive effect on Perceived Importance.

H15. Agreeableness will have a positive effect on Goal Expectancy.

H16. Agreeableness will have a positive effect on Social Influence.

3.2.2. Neuroticism

Neuroticism determines anxious and depressed persons that produce negative emotions when they come up against changes. Previous research has shown that Neuroticism has a negative effect on Perceived Usefulness (Devaraj et al., 2008). Likewise, one could assume that neurotic students will face CBA as a stressful procedure. These students are likely to find it difficult to relax and enjoy CBA and its advantages. Therefore, this personality trait could be associated negatively with Perceived Playfulness, Perceived Importance and Perceived Ease of Use. Moreover, neurotic students may also feel embarrassed and their negative reactions might create difficulties in their social interactions. Hence, neuroticism could have a negative effect on Social Influence. Furthermore, their general negativity will probably have a negative effect on their Goal Expectancy. Thus, we hypothesized:

H17. Neuroticism will have a negative effect on Perceived Usefulness.

H18. Neuroticism will have a negative effect on Perceived Ease of Use.

H19. Neuroticism will have a negative effect on Perceived Playfulness.

H20. Neuroticism will have a negative effect on Perceived Importance.

H21. Neuroticism will have a negative effect on Goal Expectancy.

H22. Neuroticism will have a negative effect on Social Influence.

3.2.3. Extroversion

Extrovert students are social, gregarious, assertive, outgoing and tend to be optimistic (Rosen & Kluemper, 2008; Watson & Clark, 1997). Extrovert students are associated with self-efficacy motivation, positive perceptions (Judge & Ilies, 2002) and goal learning orientations (Payne et al., 2007). Thus, extrovert students are more likely to find CBA more useful and important to succeed on their goal learning orientations. Based on the previous analysis, CBA might flush their enjoyment and curiosity. In addition, extroverts use information technology to extend their sociability through social networks and to fulfill their goal learning orienta-

tions; hence it is more likely that they are familiar with personal computer's use. Students high in extroversion tend to protect their image and other social behaviors (Devaraj et al., 2008). Thus, we hypothesized:

H23. Extroversion will have a positive effect on Perceived Usefulness.

H24. Extroversion will have a positive effect on Perceived Ease of Use.

H25. Extroversion will have a positive effect on Perceived Playfulness.

H26. Extroversion will have a positive effect on Perceived Importance.

H27. Extroversion will have a positive effect on Goal Expectancy.

H28. Extroversion will have a positive effect on Social Influence.

3.2.4. Conscientiousness

Conscientiousness is a personality trait used to describe persons being careful, responsible, with high level performance and with a strong sense of purpose and will (Devaraj et al., 2008; George & Zhou, 2001). Conscientious students are described as achievement oriented (McCrae, 1987) with high grades in exams (e.g., Conard, 2006), therefore it is more probable that they will find the CBA useful and important. Responsible and achievement oriented students are more likely to use often similar software in order to improve their grades, so they might find CBA easier to use. Given the fact that conscientiousness is a strong determinant of goal learning orientations (Payne et al., 2007), we believe that conscientious students are more likely to appreciate and enjoy CBA, since CBA gives the opportunity to the students to fulfill their goal learning orientations. Since, conscientious students are responsible, they will definitely learn more regarding CBA before they use it; therefore they will consider others opinions.

H29. Conscientiousness will have a positive effect on Perceived Usefulness.

H30. Conscientiousness will have a positive effect on Perceived Ease of Use.

H31. Conscientiousness will have a positive effect on Perceived Playfulness.

H32. Conscientiousness will have a positive effect on Perceived Importance.

H33. Conscientiousness will have a positive effect on Goal Expectancy.

H34. Conscientiousness will have a positive effect on Social Influence.

3.2.5. Openness

Openness is a trait that describes intelligent, intellectual and cultured people searching for new experiences and knowledge

(McCrae, 1987). These personal characteristics lead researchers to link Openness with engaging in learning experiences (Barrick, Mount, & Judge, 2001). Openness is associated with deep learning, which is actually the need to know everything about a given issue (Chamorro-Premuzic, Furnham, & Lewis, 2007). CBA provides new experiences and learning opportunities; therefore people who scored high in Openness, should find CBA useful, playful and important. In addition their willingness to acquire more and deeper knowledge indicates that they may be familiar with similar systems, so they probably will find CBA easy to use. Moreover, individuals high in Openness-to-experience are more likely to be influenced by other people's suggestions since they are naturally programmed to try new things. Thus, we hypothesized:

H35. Openness will have a positive effect on Perceived Usefulness.

H36. Openness will have a positive effect on Perceived Ease of Use.

H37. Openness will have a positive effect on Perceived Playfulness.

H38. Openness will have a positive effect on Perceived Importance.

H39. Openness will have a positive effect on Goal Expectancy.

H40. Openness will have a positive effect on Social Influence.

4. Methodology

4.1. Research participants and data collection

During, fall 2011, 117 first-year students enrolled to an introductory informatics course of a European University participated in this research. The course introduces basic information technology to students and it contains two modules: (a) theory and (b) practice. In theory, students learn the fundamentals of hardware and software. In practice they learn how to use Word Processing and Internet (Beekman & Quinn, 2007; Kinkoph, 2007). The CBA contained questions from both modules.

45 males (38%) and 72 females (62%) signed up and appeared to the procedure. The average age of students was 19.2 (SD = 1.03). Participation to the CBA was voluntary. Each participant signed an informed consent form prior to his/her participation. The informed consent explains to the participants the procedure and it gave the right to researchers to use any data that may be collected during the CBA or questionnaires after the end of CBA for research purposes. CBA was developed in a Windows XP machine using JavaScript with Perl CGI on Apache web server with MySQL (Moridis & Economides, 2009). The CBA consisted of 45 multiple choice questions and its duration was 45 min. CBA was a simple form of a multiple choice questionnaire. Each question had 4 possible answers. Since the question appeared to the participant, he/she was obliged to answer the question in order to proceed to the next one. The appearance of the questions was random alleging by 450 questions overall. The graphics were a simple white page with the necessary text to describe the question and the four possible answers. We keep the design of the system simple in order to minimize potential factors that might influence our research results. After the end of the CBA, each student had to answer the research questionnaire. The questionnaire had two parts: (a) 44 questions regarding the five personality traits, and (b) 23 items for the 7 variables of the CBAAM.

For the first part we used the Big Five Inventory (BFI) (John, Donahue, & Kentle, 1991). BFI has 44 items to measure the Big Five personality factors: extraversion (eight items), agreeableness (nine items), conscientiousness (nine items), and neuroticism (eight items), and openness to experience (ten items). The five point Likert-type scale with 1 = strongly disagree to 5 = strongly agree was used to measure each item. We selected BFI, because it can be answered in less than 5 min, and it has been known for its reliability, validity and clear factor structure (e.g. Srivastava, John, Gosling, & Potter, 2003). For the second part, the items regarding the seven variables from CBAAM used the seven point Likert-type scale with 1 = strongly disagree to 7 = strongly agree.

The analysis of the measurement and the structural model was delivered through the technique of partial least-squares (PLS) analysis (Chin, 1998; Falk & Miller, 1992; Wold, 1982). We used PLS, because it suits better in researches that have small sample and/or testing theories in early stages of development (Fornell & Bookstein, 1982).

The minimum recommended sample size has to exceed 10 times the number of items for the most complex construct or 10 times the number of independent variables affecting a dependent variable (Chin, 1998). Our study has Openness to experience as the most complex construct with ten items, thus our minimum sample size should be 100, which is lower than the 117 participants.

Measurement model's reliability and validity are proved through internal consistency, convergent validity and discriminant validity (Barclay, Higgins, & Thompson, 1995; Wixon & Watson, 2001). Specifically, each construct's items must have a factor loading value higher than 0.7 or the items' factor loading must be strongest on their corresponded variable than the other variables in the model. Moreover, average variance extracted (AVE) should exceed 0.5 and the AVE's squared root of each construct should be higher than any correlation with every other construct (Barclay et al., 1995; Chin, 1998; Fornell & Larcker, 1981). In addition, the composite reliability has to be higher than 0.7 (Agarwal & Karahanna, 2000; Compeau et al., 1999).

Structural model and hypotheses are tested by two criteria: (a) the variance measured (R^2) by the independent variables affecting a dependent variable. Variance's values are described as small (0.02), medium (0.13) and large (0.26) (Cohen, 1988); (b) t-values produced by bootstrapping procedure showing the significance of the path coefficients. Finally, in order to apply PLS and measure measurement and structural models, we used SmartPLS software (Ringle, Wende, & Will, 2005).

5. Results

Table 2 demonstrates the item's factor loadings, the AVE, the Cronbach's α and the composite reliability. Regarding the CBAAM's constructs, the results concerning the measurement model satisfied all the minimum values. On the other hand, the results regarding Personality traits face some limitations. Specifically, some factor loadings on Agreeableness, Conscientiousness and Openness are below the acceptable value. However, these items had larger factor loading on their corresponding variable than on the other variables. In addition, Cronbach's α, composite reliability and AVE exceed the recommended values; therefore we assume that the reliability and the validity of the BFI variables are sufficient. Furthermore, Table 3 shows the correlations among the variables and the AVE of each variable. The AVE's square root is higher than any other correlation regarding all the variables. Thus, we argue that the validity and the reliability of the measurement model are supported by the results.

Table 4 and Fig. 3 display the results regarding the hypotheses and the variance measured (R^2). Regarding the CBAAM's

constructs, the direct positive effects of Perceived Playfulness, Perceived Ease of Use and Perceived Importance on behavioral intention were significant. Perceived Usefulness and Goal Expectancy are strong indirect determinants of Behavioral Intention to use the CBA through Perceived Playfulness. Moreover, Social Influence's direct positive effect on Perceived Usefulness is significant. However, the analysis did not confirm some hypotheses. Unexpectedly, the direct effect of Perceived Usefulness on Behavioral Intention and the direct effect of Perceived Ease of Use on Perceived Playfulness are not significant.

Regarding personality traits, the analysis presents some useful and interesting results. First, Agreeableness has a positive impact on Social Influence and on Perceived Ease of Use. Perceived Ease of Use is also determined by Conscientiousness. Neuroticism's direct negative effects on Perceived Usefulness and Goal Expectancy are significant. Extroversion and Openness appear as strong determinants of Perceived Importance. All the other hypotheses regarding the effects of the five personality traits on the important CBAAM' variables were not significant.

Despite the significant path coefficients, Fig. 3 includes the variance measured (R^2) of dependent variables by the antecedent constructs. The combination of the CBAAM's constructs with personality traits explains the 61% of the variance in behavioral intention to use the CBA. This value is considered as very large, since the criterion for a large value equals with 26%. Furthermore, the antecedent constructs of Perceived Playfulness and Perceived Usefulness explain 60% and 67% of the variance respectively. The (R^2), for the remaining variables, range between small and medium values.

6. Discussions

Personality traits can be useful determinants of learners' perceptions and beliefs. The aim of this study is to introduce personality dimensions into the Computer Based Assessment Acceptance Model (CBAAM). The results could be classified in two categories. The first category analyzes results regarding the relationships among the CBAAM's variables. The second category demonstrates the effects of personality variables on the most significant determinants of the behavioral intention to use a CBA.

6.1. Computer Based Assessment Acceptance Model

The results highlighted the Perceived Playfulness, Perceived Importance and Perceived Ease of Use to be the most important determinants regarding Behavioral Intention to use CBA. This means that if a CBA is playful, easy to use, and perceived as important, it would be more likely for students to use it. Therefore, practitioners and educators should provide CBA systems that challenge learners' curiosity and enjoyment, while being easy to use. In addition, educators have to clarify to the students the importance to use these systems. Students' interaction with CBA has to be essential, beneficial and longitudinal in order to enhance perceived importance.

Furthermore, results indicate the Perceived Usefulness, Goal Expectancy and Social Influence as significant indirect determinants of Behavioral Intention to use CBA. Specifically, if a CBA is useful, it would be more likely that students will find it playful and consequently they would like to use it. In addition, students with high expectations regarding their goals, are more likely to have been properly prepared; therefore they might be more efficient and consequently they might find CBA more useful and more playful. Furthermore, results display Social Influence as crucial determinant of Perceived Usefulness, in line with previous studies (e.g. Terzis & Economides, 2011a; Venkatesh & Davis, 2000). This

Table 2
Results for the measurement model.

Construct Items		Factor loading (>0.7)[a]	Mean	Standard deviation	Cronbach α (>0.7)[a]	Composite Reliability (>0.7)[a]	Average variance extracted (>0.5)[a]
Agreeableness	1	0.72	4.06	0.56	0.89	0.91	0.52
	2	0.74					
	3	0.73					
	4	0.70					
	5	0.79					
	6	0.69					
	7	0.73					
	8	0.70					
	9	0.70					
Conscientiousness	1	0.59	3.82	0.63	0.88	0.90	0.51
	2	0.75					
	3	0.78					
	4	0.79					
	5	0.62					
	6	0.75					
	7	0.70					
	8	0.68					
	9	0.70					
Extroversion	1	0.79	3.58	0.69	0.93	0.94	0.65
	2	0.78					
	3	0.85					
	4	0.80					
	5	0.83					
	6	0.80					
	7	0.83					
	8	0.80					
Neuroticism	1	0.76	3.01	0.79	0.89	0.91	0.57
	2	0.78					
	3	0.72					
	4	0.73					
	5	0.80					
	6	0.74					
	7	0.76					
	8	0.71					
Openness	1	0.68	3.61	0.56	0.89	0.91	0.50
	2	0.67					
	3	0.63					
	4	0.63					
	5	0.69					
	6	0.76					
	7	0.75					
	8	0.68					
	9	0.74					
	10	0.80					
Perceived Playfulness	1	0.85	4.97	1.16	0.91	0.94	0.79
	2	0.91					
	3	0.89					
	4	0.91					
Perceived Usefulness	1	0.90	5.10	1.18	0.90	0.94	0.83
	2	0.94					
	3	0.90					
Perceived Ease of Use	1	0.87	5.55	1.15	0.83	0.89	0.74
	2	0.89					
	3	0.81					
Social Influence	1	0.87	5.83	1	0.88	0.92	0.74
	2	0.91					
	3	0.80					
	4	0.85					
Goal Expectancy	1	0.85	5.17	1.13	0.84	0.90	0.76
	2	0.86					
	3	0.90					
Perceived Importance	1	0.90	5.39	1.05	0.83	0.90	0.75
	2	0.92					
	3	0.78					
Behavioral Intention to Use	1	0.94	5.44	1.23	0.94	0.96	0.89
	2	0.94					
	3	0.95					

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

Table 3
Discriminant validity for the measurement model.

	PP	PU	PEOU	SI	GE	PI	A	C	E	O	N	BI
PP	**0.89**											
PU	0.73	**0.91**										
PEOU	0.48	0.64	**0.86**									
SI	0.44	0.46	0.37	**0.86**								
GE	0.67	0.70	0.44	0.41	**0.87**							
PI	0.50	0.44	0.31	0.35	0.32	**0.87**						
A	0.15	0.17	0.28	0.38	0.20	0.19	**0.72**					
C	0.26	0.24	0.26	0.22	0.24	0.23	0.30	**0.71**				
E	0.10	0.09	0.15	0.08	0.01	0.27	0.12	0.26	**0.81**			
O	0.26	0.18	0.07	0.17	0.18	0.29	0.13	0.30	0.35	**0.71**		
N	−0.20	−0.20	0.01	−0.11	−0.19	−0.03	−0.07	−0.05	−0.13	−0.01	**0.75**	
BI	0.62	0.58	0.52	0.36	0.42	0.67	0.18	0.27	0.04	0.16	−0.01	**0.95**

Bold values: 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	0.23**	2.46	Support
H2	PU → BI	0.08	0.75	Not support
H3	PU → PP	0.43***	3.69	Support
H4	PEOU → BI	0.22***	2.84	Support
H5	PEOU → PU	0.42***	4.80	Support
H6	PEOU → PP	0.07	0.68	Not support
H7	PI → BI	0.45***	6.92	Support
H8	GE → PU	0.45***	6.06	Support
H9	GE → PP	0.30***	2.81	Support
H10	SI → PU	0.15*	1.94	Support
H11	A → PU	−0.11**	2.06	Support the opposite
H12	A → PEOU	0.22**	2.17	Support
H13	A → PP	−0.03	0.35	Not support
H14	A → PI	0.12	1.09	Not support
H15	A → GE	0.12	1.13	Not support
H16	A → SI	0.33***	3.27	Support
H17	N → PU	−0.11**	1.80	Support
H18	N → PEOU	0.04	0.38	Not support
H19	N → PP	−0.06	0.74	Not support
H20	N → PI	0.02	0.02	Not support
H21	N → GE	−0.18*	1.68	Support
H22	N → SI	−0.09	0.87	Not support
H23	E → PU	−0.01	0.18	Not support
H24	E → PEOU	0.10	0.90	Not support
H25	E → PP	−0.01	0.07	Not support
H26	E → PI	0.17*	1.71	Support
H27	E → GE	−0.12	1.13	Not support
H28	E → SI	−0.02	0.25	Not support
H29	C → PU	−0.01	0.08	Not support
H30	C → PEOU	0.18*	1.78	Support
H31	C → PP	−0.04	0.70	Not support
H32	C → PI	0.08	0.86	Not support
H33	C → GE	0.18	1.84	Not support
H34	C → SI	0.08	0.80	Not support
H35	O → PU	0.06	1.05	Not support
H36	O → PEOU	−0.04	0.44	Not support
H37	O → PP	0.12	1.43	Not support
H38	O → PI	0.20**	2.05	Support
H39	O → GE	0.15	1.45	Not support
H40	O → SI	0.11	1.01	Not support

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

means that students' social environment might influence students' perceptions regarding CBA's usefulness and eventually student's behavioral intention to use CBA.

Moreover, the sample was not equally divided between male (45) and female (72) participants. Female dominance might affect results. For example, previous studies regarding CBA acceptance showed that female users' behavioral intentions are not influenced by Perceived Usefulness (Terzis & Economides, 2011b). This element might explain why in this study the path coefficient of

Perceived Usefulness on Behavioral Intention to use a CBA was not significant. In addition, female users' Perceived Playfulness is partially influenced by Perceived Ease of Use (Terzis & Economides, 2011b). Therefore, in this research Perceived Ease of Use did not have any significant effect on Perceived Playfulness. This evidence might also be explained by the fact that in our days, users feel more and more familiar with the use of information technology, therefore Perceived Ease of Use does not offer any added value on Perceived Playfulness.

6.2. Personality traits

The main research topic of this study is the personality traits' effects on the most important determinants of Behavioral Intention to use CBA. Data analysis revealed some useful and interesting outcomes. First, Agreeableness has a significant direct positive effect on Social Influence and on Perceived Ease of Use. This means that an individual with high agreeableness is more likely to be influenced by his/her environment and he/she might find CBA easy to use. This is very useful information for tutors, since they could reclaim it in order to persuade students to use CBA. Particularly, if tutors could distinguish agreeable learners, they could demonstrate to them the CBA's advantages and ease of use since these variables are important for them. These results are in line with previous studies that indicated a significant positive effect of Agreeableness on Perceived Ease of Use (Benlian & Hess, 2010).

Our hypotheses regarding neurotic students were significant only on Perceived Usefulness and Goal Expectancy. Specifically, neurotic students are less likely to find the CBA useful. This result confirms prior research evidences regarding the effect of neuroticism on Perceived Usefulness (Devaraj et al., 2008). Furthermore, neuroticism has a significant negative impact on Goal Expectancy. Goal Expectancy measures student's predictions regarding his/her performance based on his/her study and the hypothetical difficulty level of the assessment. Neurotic students have a negative point of view; therefore we assume that learners with high neuroticism are less likely to expect a good performance and/or a low difficulty level of the CBA.

Extroversion and Openness direct effects were significant only on Perceived Importance. This means that Perceived Importance is an interesting variable which depends on two personality traits. Extrovert students are more likely to find CBA important since CBA might satisfy their goal learning orientations. Furthermore, students scored high in Openness are more likely to find CBA important since it might indulge their need to know everything about a given issue (Chamorro-Premuzic et al., 2007).

Conscientiousness has a significant direct effect only on Perceived Ease of Use. Students who scored high in Conscientiousness are more likely to find CBA easy to use. This might be explained by
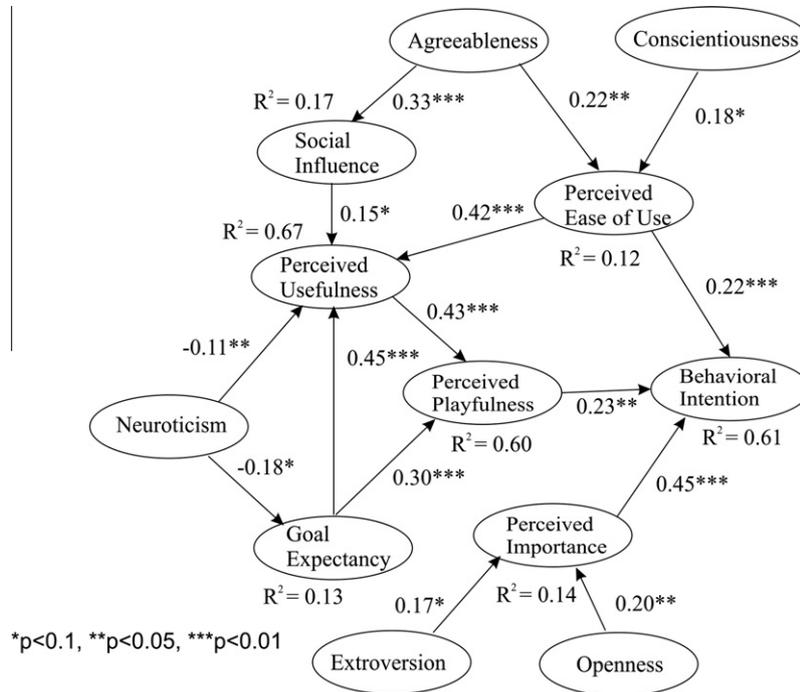
Fig. 3. Path coefficients of the research model.

the fact that these students have a strong sense of purpose; therefore they might have used other similar systems and consequently they might be familiar with the use of a CBA. This evidence confirms prior research regarding the effect of Conscientiousness on Perceived Ease of Use (Rosen & Kluemper, 2008).

All the other hypotheses regarding the direct effects of each personality trait on each CBA acceptance determinant were not significant. Further studies may reveal more connections between personality traits and CBA's acceptance determinants. For example, the effect of Personality traits on CBAAM's variables might be influenced by other personal factors such as gender or age (e.g. Chapman, Duberstein, Sorensen, & Lyness, 2007; Costa, Terracciano, & McCrae, 2001). Some studies showed that females have higher levels of neuroticism, extraversion, and agreeableness, while men are more open to experience (Lehmann, Denissen, Allemand, & Penke, 2012). Gender differences might not be very large, however they are consistent with gender stereotypes in many different cultures (Costa et al., 2001). In addition, age also influences personality traits. In adolescence, extraversion and Openness to experience tend to increase, while neuroticism tends to decrease (Lucas & Donnellan, 2009). From adulthood to middle age, research showed that conscientiousness and agreeableness have positive age trends, while neuroticism has a negative trend (Soto, John, Gosling, & Potter, 2011). Age and gender could also be studied together in order to demonstrate their combined effect. For instance, boys aged 16 to 20 indicated an increase in emotional stability, while girls augmented in extraversion and Openness to experience (Klimstra, Hale, Raaijmakers, Branje, & Meeus, 2009). Therefore, it is understood that age and gender are very important and they should be taken under consideration by future studies regarding the effects of personality traits on information technology acceptance.

7. Conclusions

The aim of this study is to integrate the big five constructs of personality traits into the exploration of CBA acceptance and test potential effects of personality variables on behavioral intention

to use a CBA. The analysis showed that only 7 out of 30 direct effects of personality traits on the most important determinants of behavioral intention to use a CBA were significant. However, all five personality traits have a direct positive effect on a determinant of CBA acceptance; therefore we could assume that personality traits are useful predictors in exploring CBA acceptance. Particularly, Neuroticism has significant negative effect on Perceived Usefulness and on Goal Expectancy, Agreeableness determines Social Influence and Perceived Ease of Use, Conscientiousness defines Perceived Ease of Use, while Extroversion and Openness explain Perceived Importance.

The CBAAM extended with the BFI explains 61% of the variance of Behavioral Intention. When we applied our data to the CBAAM's variables without the Big Five variables the variance of Behavioral Intention was almost 50% as it was at Terzis and Economides (2011a) study. Thus, the addition of the Big Five factors of personality increases the CBAAM's explanatory power. Furthermore, the current model explains very well the variances of Perceived Usefulness and Perceived Playfulness by 67% and 60% respectively.

From the practitioners' viewpoint, this research sheds light to how students' personality traits might influence their behavioral intention to use CBA. Specifically, practitioners could use this information in order to create a personalized CBA or to customize its promotion in such way that might satisfy each student's personality. This idea is in line with the employment of mass-customization in education (Nistor, Dehne, & Drews, 2010). Mass-customization serves individual needs through educational process, while at the same time the cost of educational tools used for this purpose is at the same level with these educational tools used for large-scale and mass training (Nistor et al., 2010).

From the perspective of academics, this study provides useful information which could be used in order to persuade students to use CBA. Educators might apply personalized approach strategies to each student based on each student's personality.

However, this study faces some limitations. First, the analysis could benefit from a larger sample. The model should be applied in other samples with greater variety of characteristics such as age, culture, courses and CBAs. For example, students in a different

year of study might have different perceptions regarding CBA's variables or they might have different personality traits. Furthermore, it would be interesting to investigate how the model works on high school students. Moreover, all the students came from the same European country. Students with different culture might have changed the significant path coefficients of the model. Hofstede and McCrae (2004) indicated that personality traits are associated with cultural dimensions. Further research would shed light on how culture affects personality traits and consequently how determine user's intentions regarding CBA acceptance directly or indirectly through personality. The course and the CBA are also very important. In a different course or a different department, there might be students with different associations regarding personality traits or/and perceptions regarding behavioral intention to use a CBA. In addition, CBA's characteristics might change the relationships in the proposed model. Another limitation is the .10 level of significance that we used, which is lenient. We decided to use it, since the purpose of this study is exploratory and we would like to display all the potential trends.

Moreover our study did not include three variables of the original CBAAM. These variables are: Computer Self Efficacy, Facilitating Conditions and Content. These variables were excluded from the current analysis, because previous studies did not find any significant relationship between them and the Big Five constructs, and also were not the most important determinants of CBA acceptance. However, other studies should include these variables in order to expand and explain even more the variance of Behavioral Intention to use CBA. In addition, this study did not examine the moderating effects of personality traits on the relationships between the CBA's acceptance determinants and Behavioral Intention to use CBA. The explained variance of Behavioral Intention to use CBA and the significant coefficients might be influenced if we had explored the potential moderating effects of the personality traits.

To conclude, this study contributes by introducing the Big Five personality traits into the Computer Based Acceptance Model (CBAAM). Results reveal that students' personality traits could influence students' perceptions and behavioral intention to use CBA. Further studies should be conducted for confirmation and generalization of these results.

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