

E-Assessment Adaptation at a Military Vocational College: Student Perceptions

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This survey study examines an assessment methodology through e-quizzes administered at a military vocational college and subsequent student perceptions in spring 2013 at the “Computer Networks” course. A total of 30 Computer Technologies and 261 Electronic and Communication Technologies students took three e-quizzes. Data were gathered via an online questionnaire. A model derived from Technology Acceptance Model 2 (TAM2) was proposed to examine perceptions about the e-assessment system. A structural equation modeling analysis employed to examine relationships among age, type of high school student graduated from, computer ownership, course grade, technological complexity, content of questions in online quizzes, perceived usefulness and intention to use. Also, content analysis was performed on qualitative data. Results showed that perceptions about question contents significantly affected perceived usefulness. Perceived usefulness had great influence on behavioral intention – substantiating the TAM literature. Student perceptions were neither overly optimistic nor pessimistic qualitatively. All in all, students appear to require training about e-assessment to benefit from it. The overall implication is that to boost use of e-quizzes, it is imperative to help students recognize the e-quizzes are useful for themselves.

Keywords: e-assessment, technology acceptance model, computer networks course, military vocational college, online quiz

INTRODUCTION

Assessment is an activity used primarily for selection and certification in higher education (Schwartz & Webb, 2002). The level of student understanding is determined to enhance learning as well as to make sure students meet desired learning outcomes (Quality Assurance Agency for Higher Education, 2006). Assessment strongly influences learning characteristics and study habits as well as perception of the learning environment (Stöddberg, 2012). If assessment and specific feedback can be applied properly, it can offer great contribution to effective learning (Nicol 2007).

Information technology (IT) has provided so many opportunities for e-learning,

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which is now widely used at educational institutions all around the world (Allen & Seaman 2007; Gyambrah, 2007). IT technically supports assessment and evaluation tasks in e learning, such as test preparation, automated grading and reporting (Llamas-Nistal, Fernandez-Iglesias, Gonzalez-Tato & Mikic-Fonte, 2013).

E-assessment is able to improve assessment procedures and methods in comparison to classroom assessment, as it has the advantages of time saving, immediate feedback, enhanced resource use, record keeping, and convenience (Bull & McKenna, 2004; Chen, Wei, & Huang 2009; Morris 2008). Considering learning benefits, e-assessment reinforces student understanding of main concepts (McCausland, 2003) and narrows the gap between actual and desired performance through timely feedback (Nicol, 2007). E-assessment supports individual learning and engages learners with crucial learning experiences (Gikandi, Morrow, & Davis, 2011). Zakrzewski and Bull (1998) report three advantages of e-assessment: students can take the assessment whenever they want, however many times they want, and e-assessment can provide immediate feedback. They also claim that student anxiety can be reduced if formative assessment is applied before summative. A valid e-assessment system needs to offer authentic assessment activities; feedback must be meaningful, timely and effective; and system should support multidimensional perspectives and learners (Gikandi, Morrow & Davis 2011).

E-assessment practice is becoming widespread in educational institutions, as many faculty realize they can create, implement, and manage assessment as part of learning management systems (LMSs) such as Claroline, MOODLE, and WebCT-Blackboard (Llamas-Nistal et al. 2013). Although in many disciplines e-learning and e-assessment are now routinely/widely used as well as several companies and institutions plan to incorporate e-assessment in their agendas, the military vocational college, embodying the context of this study, has been slow to take action about this subject. There may be several reasons underlying this fact. It is perhaps not because e-learning is considered unimportant, but rather it is because of staff time constraints in the Department of Computer Technology, partly due to soaring number of students per staff. Despite all the negativities, the department has started using MOODLE through intranet as an LMS in 2012–2013 academic year and all courses have been available on MOODLE since.

E-assessment is a technological advancement in comparison to traditional assessment techniques. Literature presents several models to explain student perceptions about acceptance of technology and behavioral intention to use technology such as theory of reasoned action (TRA) (Ajzen & Fishbein, 1980), theory of planned behavior (TPB) (Ajzen, 1991), technology acceptance model (TAM)

State of the literature

- The literature concerning e-assessment, suggests that e-assessment is able to improve assessment procedures and methods in comparison to classroom assessment, as it has the advantages of time saving, immediate feedback, enhanced resource use, record keeping, and convenience.
- Although e-assessment practice is becoming widespread in educational institutions, the military vocational college, embodying the context of this study, has been slow to take action about this subject.
- To develop and implement effective e-assessment and e-learning systems, understanding student perceptions regarding e-assessment is the first step.

Contribution of this paper to the literature

- Implementing e-assessment can change paradigms in assessment practice and can play a notable role in the future of education.
- The main purpose of this study was to implement an e-assessment system deployed through MOODLE LMS and to investigate related student perceptions in a military vocational college.
- Data from the online questionnaire resulted in mixed responses from students on the perceived usefulness, content of questions, behavioral intention to use, and technological complexity of the e-assessment. If students felt that e-assessment was useful, their behavioral intention to use it was more positive.

(Davis, Bagozzi, & Warshaw, 1989), and unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003).

In terms of acceptance of different technologies, the most widely used and dominant model is TAM (Davis & Venkatesh, 1996). According to Venkatesh and Davis (2000), TAM had limitations about perceived usefulness (why a person finds a system useful) so they revised TAM and named it Technology Acceptance Model-2 (TAM2). TAM2 extended TAM to explain perceived usefulness and behavioral intention with new variables. According to TAM2, perceived usefulness and behavioral intention are influenced by cognitive instrumental processes such as job relevance, output quality, result demonstrability, and perceived ease of use; and social influence processes such as subjective norm, voluntariness and image (Venkatesh & Davis, 2000). There have also been attempts to expand TAM2 to become UTAUT, which was formulated with four core determinants of behavioral intention and use of new technology acceptance, and few moderators of the main relationships (Venkatesh et al. 2003). Moreover, Terzis and Economides (2011a) proposed Computer Based Assessment Acceptance Model (CBAAM), derived from TAM, TPB and UTAUT. They used perceived usefulness, perceived ease of use, computer self-efficacy, social influence, facilitating conditions, perceived playfulness from previous models and added two variables, content and goal expectancy, to their model.

In the current study, to examine student perceptions, TAM2 (Venkatesh & Davis, 2000) was utilized as a theoretical model; and concepts of perceived usefulness and behavioral intention from TAM2, and perceptions about content of questions from CBAAM were adopted and examined. TAM2, as shown in Figure 1, considers perceived usefulness as a major determinant of behavioral intention for actual system use.

TAM has been applied in numerous studies such as personal computers, word processors, e-mail systems, e-collaboration, the internet, e-library, Blackboard LMS, online shopping, and e-Commerce to test validity (e.g. Dasgupta, Granger & MCGarry, 2002; Davis et al., 1989; Gefen, Karahanna, & Straub, 2003; Koufaris, 2002; Landry, Griffeth & Hartman, 2006; Lederer, Maupin, Sens, & Zhuang, 2000; Yusoff et.al., 2009; Zhang & Prybutok, 2004). TAM2 has had a similar impact to explain technology acceptance. However, there is limited research on acceptance of e-assessment technology in higher education with respect to either models (Terzis & Economides, 2011a; 2011b). Therefore, this study is an extension and adaption of perceived usefulness and behavioral intention to use (TAM2) and perceptions about question contents (CBAAM) onto the e-assessment context.

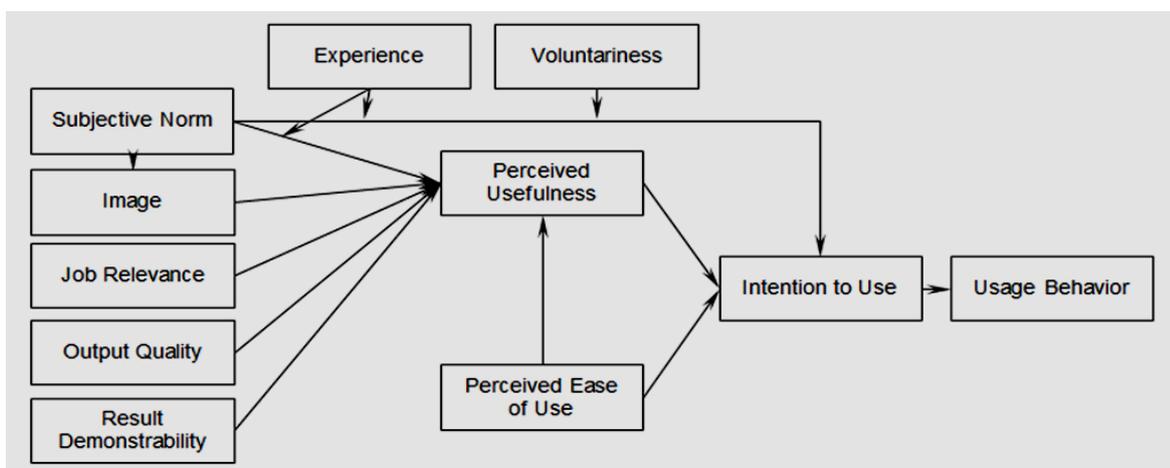


Figure 1. Technology Acceptance Model-2 adapted from Venkatesh and Davis (2000)

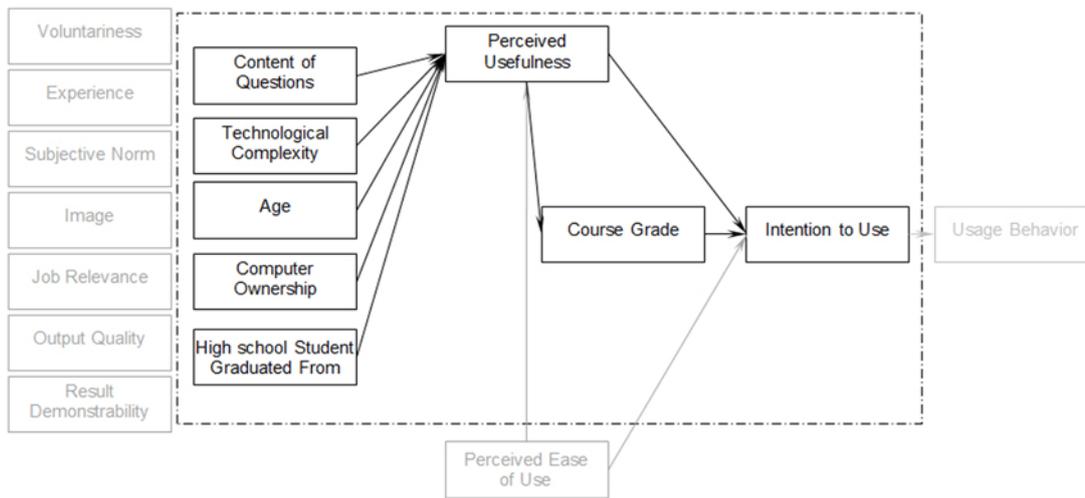


Figure 2. Hypothesized Research Model

TAM was transformed in the past with new concepts such as technological complexity, user factors, and environmental factors (Cheung & Huang, 2005; Hasan, 2006; Ngai, Poon, & Chan, 2007). This study aims to enhance the understanding of TAM2’s and CBAAM’s aforementioned dimensions as well as to explore the impact of certain external variables. A research model is developed as shown in Figure 2. The model hypothesizes relationships between the original TAM2 factors of perceived usefulness, and behavioral intention to use; CBAAM’s perceptions about question contents; and the external factors of technological complexity, age, computer ownership, the type of high school student graduated from, and course grade. The dotted line in Figure 2 shows the model of our framework and relationships among the variables under investigation. The grayed out factors show the constructs that exist in the original TAM2 but were not explored in the current study.

Perceived usefulness is “the degree to which a person believes that using a particular system would enhance his/her job performance” (Davis, 1989, p. 320). Perceived usefulness reflects a person’s salient belief that using the technology will be helpful in improving performance (Taylor & Todd, 1995). Numerous studies (Adams, Nelson & Todd, 1992; Davis, 1989; Davis et al., 1989; Straub, Limayem, & Karahanna-Evaristo, 1995; Szajna, 1996) reported that user acceptance of an IT system is driven to a large extent by perceived usefulness.

Content refers to the student perceptions about the content of the e-assessment. E-assessment is used to identify students’ progress based on the course content. Perceptions about the content of questions can affect perceived usefulness and behavioral intention to use e-assessment system (Terzis & Economides, 2011a). The questions of e-assessment system are based on Computer Networks course content. If questions in online quizzes are clear, understandable and relevant to the course content, then it is more likely to expect utility and satisfaction by students (Terzis & Economides, 2011b). According to Wang (2003), too, content is a significant variable to determine e-learners’ satisfaction. Therefore, it is reasonable to think that student perceptions about the content of questions in online quizzes affect perceived usefulness of the e-assessment system.

TAM’s basic assumptions establish a direct effect of attitude towards using a technology on behavioral intention. Perceived usefulness affects a person's attitude toward use and thus advances behavioral intention, which then leads to actual systems use (Davis, 1989; Davis et al., 1989). Theory of reasoned action is a fundamental model used to explain behavioral intention to use a new technology (Venkatesh et al. 2003). Behavioral intention is defined as “the degree to which a

person has formulated conscious plans to perform or not perform some specified future behavior” (Warshaw & Davis, 1985).

“The individual’s perception of the degree of difficulty involved in understanding and using a specific type of IT” is referred to as technological complexity (Rogers & Shoemaker, 1971, p. 154). In the current study, technological complexity refers to the degree to which a new system is perceived as relatively difficult to understand and use (Thompson, Higgins, & Howell, 1991). There has been little research in technological complexity with regard to the e-assessment systems.

User characteristics have been found to affect behavioral intention to use a new technology (Davis et al., 1989). A person’s behavioral intention to use a new technology, e.g. a computer, is also influenced by a variety of factors such as achievement (Bandalos & Benson, 1990), age and gender (Kutluca, 2010), computer self-efficacy, years of computer use (Teo, 2008), and home computer ownership (Chen & Chang, 2006). Considering this study’s focus on e-assessment, TAM2 (Venkatesh & Davis, 2000) is hypothesized to provide insights into how student-related relevant external factors such as perceptions about the content of questions from CBAAM, technological complexity, age, computer ownership, and the type of high school student graduated from influence behavioral intention to use. Additionally, the predictive role of these factors on course grade is also mediated to explain behavioral intention.

Notwithstanding the widespread practice of e-assessment, research on student experiences of e-assessment is very limited. In a study conducted on Turkish military vocational college students, who had taken optional online quizzes in Mathematics course, it was found that in general students were neither optimistic nor pessimistic about online quizzes. But, students who had computers, Internet connection at home and web-based exam experience were more optimistic than students who did not have the same qualities (Cigdem & Tan, 2014). Sorensen (2013) surveyed student perceptions about e-assessment in a college chemistry course in the UK. She found that participants were in favor of implementing e-assessment more often, not only in chemistry, but also in other courses. Students thought that taking e-assessment facilitated their learning. At another study in the UK, Dermo (2009) surveyed students who participated in online formative and/or summative assessment. Students were acceptive of the reliability, security, validity, and accessibility of the online assessment. They thought e-assessment promoted their learning. Terzis and Economides’s (2011a) study based on Computer-Based Assessment Acceptance Model with 173 introductory informatics course students also investigated perceptions on acceptance of computer-based assessment. Results revealed that while perceived ease of use and perceived playfulness had a direct effect on use of computer-based assessment, perceived usefulness had only an indirect effect.

As understood from the literature, student perceptions are generally positive or not excessively negative about e-assessment (Cigdem & Tan, 2014; Dermo, 2009; Sorensen, 2013); students find e-assessment to be beneficial for learning (Cigdem & Tan, 2014; Dermo, 2009; Sorensen, 2013; Walker, Topping, & Rodrigues, 2008) and majority prefer taking e-assessment (Marriot, 2009). Perceived usefulness has an indirect effect on behavioral intention to use in terms of e-assessment (Terzis & Economides, 2011a). Moreover, students perceive e-assessment to be more contemporary and systematic than the traditional assessment methods (Ozden, Erturk, & Sanli, 2004).

The trend in e-assessment is rapidly expanding into all educational domains. It has been used for entrance exams, foreign language exams, commercial training exams, military training exams, and so on. Most available research on e-assessment is about effects of e-assessment strategies on teaching. In the literature, many

practical solutions regarding how to conduct effective e-assessment and evaluation can be found. Various case studies exist outlining how to implement e-assessment institutionally (Wang, 2007, 2010, 2011; Wang, Wang, Wang, Huang, & Chen, 2004; Zakrzewski & Bull 1998) and numerous articles examine security issues and risk factors related to e-assessment (Zakrzewski & Steven 2000; Ricketts & Zakrzewski 2004; Harwood & Warburton 2004). Attitudes of instructors, e-learning experts, and educational technologists towards e-assessment were also examined (Bull & McKenna, 2004; Warburton & Conole, 2003). Little research has been carried out regarding what students think about e-assessment (Cigdem & Tan, 2014; Dermo, 2009; Sorensen, 2013; Terzis & Economides, 2011a; 2011b), even though student attitudes and opinions are vital for functionality. Student perceptions can be associated with the validity of the interface of e-assessment systems (Dermo, 2009). They might provide clues about which properties of e-assessment system are important for the students and which factors affect intention to use e-assessment. Also, it is important to identify perceptions for practitioners and lecturers, in order for them to revise and improve existing e-assessment modules as well as to develop new e-assessment modules. Therefore, the purpose of this study is to investigate student perceptions of an e-assessment system on MOODLE as a current technology, administered for the Computer Networks course at a military vocational college.

Research questions

The following research questions were explored in this survey research study.

1. Can perceived usefulness be predicted from perceptions about question contents after accounting for the effect of technological complexity, age, computer ownership, and the type of high school student graduated from?
2. How does perceived usefulness impact course grade along with the influence of age, computer ownership, and the type of high school student graduated from?
3. Can behavioral intention be predicted from course grade along with the proposed contribution of perceived usefulness?
4. What are the perceptions of students about e-assessment system? What are the emergent themes based on student experiences?

METHODOLOGY

Participants

Participants consisted of 291 undergraduate students enrolled in the Computer Networks course at a military vocational college in Turkey. Of those, 30 students were from the Computer Technology Department; the remaining was from the Electronics and Communication Technologies Department.

Context

Computer Networks was designed and developed as a blended course. Course materials were deployed over the intranet on LMS (MOODLE). In the instructional design process, formal and informal data, gathered from students who had already taken this course in recent years, were examined. Next, instructors specified the intended course outcomes (learning objectives). Finally, course content, learning activities, and assessment tools were developed based on the objectives.

Duration of the course was 15 weeks. There was a 100-minute, face-to-face (F2F) lecture every week. At each F2F session, students were also presented with the objectives. After the lectures, students practiced "networking topics" in the networking lab. A short summary, feedback, and discussion related to common

mistakes followed. Students who could not participate in the F2F lectures were expected to log onto the course site individually through the intranet. Students could read the course content, download resources such as lecture notes, videos, slides and journal papers, and follow instructions to complete activities of the week anytime they want. Course quizzes and self-evaluation questions were administered online, which are called e-assessment throughout this paper.

E-assessment

Short quizzes containing multiple choice (with one or more correct answers), short-answer, true/false, and/or matching questions were available online to allow self-testing of understanding (see Figure 3 for examples). Students received instant feedback after completion. If a response was incorrect, the correct option was provided.

Three such quizzes were prepared for Computer Networks course. The first two were not only to make students familiar with e-assessment, but also to encourage them to revise their understanding of the lecture notes. Each quiz consisted of five questions. All students had the same questions but in different order. The first quiz subject was “IP addressing”, while the second was “subnetting”. There was no time limit. For the first quiz, there was no limit for the number of attempts to solve the quiz; for the second quiz, only five attempts were permitted.

The third – the final – quiz had 12 questions. Dynamic type questions were included, as well as three new questions about “IP addressing” and five new questions about “subnetting”. The questions and choices were randomized within multiple-choice questions. Students had 30 minutes to complete it and it was available for five days; from Monday 08:00 a.m., when the last lecture of the

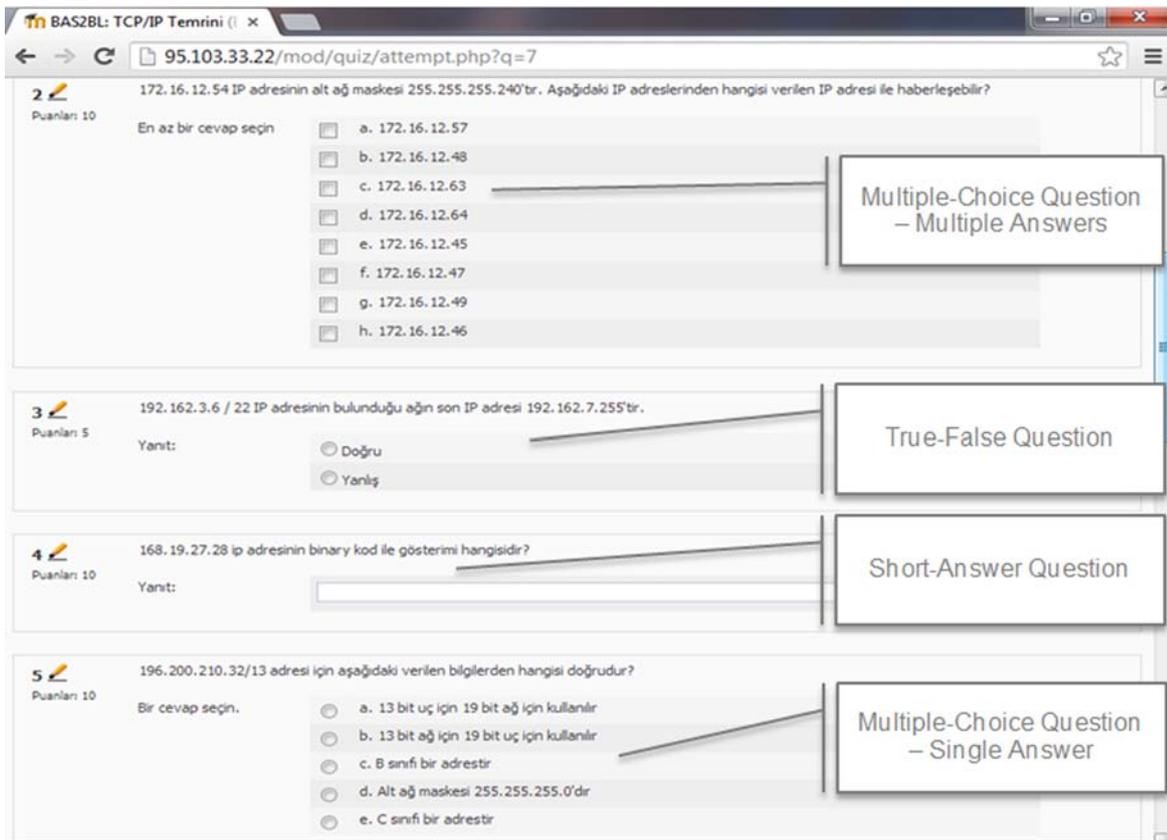


Figure 3. A sample screen capture from the online quiz

respective part ended, to Friday 5:00 p.m. Only one attempt was permitted. The

dynamic questions were intended to be more difficult than the questions for testing basic concepts. Nevertheless, they were mainly based on examples covered in the lectures. All student contributions to lessons were graded. Evaluation was based on their performance in the third quiz and the exam paper delivered at the end of the semester. Course grades were calculated by averaging these scores.

Data collection instruments

The research design involved quantitative and qualitative methods. Students completed an online questionnaire consisting of three sections at the end of the semester. The questionnaire was completed through Computer Networks course website, using MOODLE. The first section was related to demographic data such as age, gender, and experience on e-assessment.

The second section covered perceptions about the e-assessment system. There were 18 five-point Likert-type items, adapted from Dermo (2009) and Sorensen (2013). The items were organized in the framework of perceived usefulness and behavioral intention of TAM2; student perceptions about question contents of CBAAM; and technological complexity of Thompson, Higgins, and Howell (1991). The original items were reworded to reflect the e-assessment system at Computer Networks course. The items of the measurement instrument are shown in Table 1 categorized in the four constructs. The instrument included items such as "E-assessment has an important role to play in higher education," and "In many questions it was possible to get a correct answer by guessing" (negative item). There were five other items related to students' general perceptions about e-assessment implementation that were not included in the analyses.

There were positive and negative statements. Items were coded from 1 (strongly disagree) to 5 (strongly agree), and then negative items were recoded to show the same scale.

The third section had one open-ended question through a text entry box. The question inquired whether students liked or disliked the e-assessment they were subject to. It also tried to discover reasons of choice.

Table 1. Distribution of survey questions* to factor structure

Factor	Item*	Mean	SD
Perceived usefulness			
	I1	3.15	1.26
	I2	3.32	1.25
	I4	3.17	1.19
	I15	3.20	1.18
Content			
	I14	2.97	1.19
	I16	2.98	1.15
	I17	3.21	1.22
Technological complexity			
	I3	3.00	1.29
	I7	2.88	1.22
	I13	3.07	1.19
Behavioral intention			
	I11	2.93	1.35
	I12	3.37	1.29
	I18	2.85	1.41

* Items were adapted from Dermo (2009, p. 212) and Sorensen (2013, p.181).

** The item was reverse coded.

Response rate

Subjects were guaranteed confidentiality. They were told the data would only be used for research purposes. All 320 students completed the questionnaire and 161 expressed opinions about e-assessment system. 29 had missing responses. Therefore, the final sample for the quantitative analyses comprised of 291 (91%) students.

Data analysis

This study uses a two-step strategy of structural equation modeling (SEM), using the method of maximum likelihood (ML), operationalized in the Analysis of Moment Structures (AMOS) software. A confirmatory factor analysis (CFA) was performed to validate the quality of proposed measures, and then an SEM was conducted to validate the entire model in AMOS. The sample size in the current study was at an acceptable level with 291 subjects, as the sample with the use of ML is suggested to be above 150 observations (Hair, Anderson, Tatham & Black, 2008).

For the last question, content analysis was performed on the qualitative data, obtained from the open-ended question. Each text response was considered an idea unit. During the content analysis, first, a rater coded the idea units into themes. Five themes emerged out of this coding process: (a) grading, (b) time, (c) saving paper (d) quiz content, and (e) innovation. And then another rater, using the themes identified by the first rater, independently coded the data for the second time. An idea unit could be coded into more than one theme. So agreement between the raters was calculated separately for each theme. The percentages of one-to-one agreement between the two raters' codes were 91.30% (147 out of 161), 94.40%, 99.37%, 95.03%, and 91.92%, respectively. As a better indicator of inter-rater reliability, Cohen's Kappa coefficients were calculated. The Cohen Kappa coefficients were found to be .74, .74, .96, .88, and .82, respectively. The agreements above .70 are considered "good agreement" and above .80 are considered "almost perfect agreement." Disagreements were later resolved by discussion. After initial coding for each theme, direction of the responses was also determined with three possible options (positive, negative, and undecided). The percentage of one-to-one agreement between the two raters' codes was 87.83% for this final coding. And Cohen's Kappa inter-rater agreement coefficient was found to be .79, which is accepted as "good agreement," being above the threshold of .70.

RESULTS

Descriptive statistics

Demographics data were as in the Table 2. The context was a male dominated school as it was a military vocational college. Most participants reported their age as being 20 or 21. Most graduated from vocational high school and were sophomores. There was a more balanced distribution of computer ownership in comparison to the other variables.

Quiz results

The first two quizzes returned satisfactory results, with most students attaining very high scores. The overall average was 44.19 out of 50 for the "IP addressing" quiz and 38.15 out of 50 for the "subnetting" quiz. The difficulty was intentionally kept easy to make the initial quizzes sound easy and motivating. Although there were no attempt limit and time limit to complete, some of well-performing students completed the quizzes with perfect scores, in nearly five minutes.

The overall results of the final quiz were not as high as the first two, with a mean score of 51.60 out of 100. Out of 291 students who completed the final quiz, 74

Table 2. Demographics

Variable	Option	N	f (%)
Gender	Male	289	99.30
	Female	2	.70
Age	18	1	.40
	19	20	6.90
	20	136	46.70
	21	93	32.00
	22	33	11.30
	23+	8	2.70
The Type of High School Student Graduated From	Vocational High School	245	84.20
	High School (non-vocational)	46	15.80
Grade Level	Freshmen	30	10.00
	Sophomore	261	90.00
Has Computer	Yes	184	63.20
	No	107	36.80

students received 60 points or more, while 70 students received 40 points or less. The lowest score was 7.50.

The course grade is, the most important assessment indicator averaging all individual performance measures. Mean course grade was 67.05 out of 100. 218 students received 60 points or more, while seven students received 40 points or less. The highest score was 95, and the lowest score was 22.

Validation of the data collection tool

The suitability of the dataset for factor analysis was checked. Kaiser–Meyer–Olkin (KMO) coefficients on the scale returned the value of .89 and indicated that factors would be reliable (Field, 2000). Then, a CFA based on AMOS 20 was performed to validate and confirm the research model. Hair et al.'s (2008) recommendations were adapted to set $\chi^2/df < 3$ as the acceptable level for good model fit, together with multiple indicators to obtain a more objective conclusion to avoid power problems from using the Chi-square test in a large sample. Based on the present data, the modification indices for covariances, which are available through AMOS, suggested linkage between a few observed variables as shown in Figure 4. The final model returned $\chi^2 = 74.150$, $df = 56$; $\chi^2/df = 1.324$ with a probability level $p = .053 > .05$. Several fit indices are reported here, including the root mean square error of approximation (RMSEA) = .033, goodness of fit index (GFI) = .961, adjusted GFI (AGFI) = .936, in which GFI and AGFI were greater than .80 and RMSEA was lower than .05. All these values suggest that the measurement model fitted the data well. The final model with estimated factor loadings is illustrated in Figure 4.

Test of the structural model

After ensuring the validity of constructs in the measurement model, the structural model is evaluated by adding age, the type of high school student graduated from, computer ownership and course grade to the measurement model. To determine the relationship of the constructs in the proposed model, the structural equation model was tested using AMOS 20 with the default maximum likelihood estimation method. The model returned $\chi^2 = 122.949$, $df = 109$; $\chi^2/df = 1.127$ with a probability level $p = .171 > .05$; and RMSEA = .021, GFI = .953, and AGFI = .934. All fit indices obtained in the present study have shown good structural model fit to the data for the proposed research model.

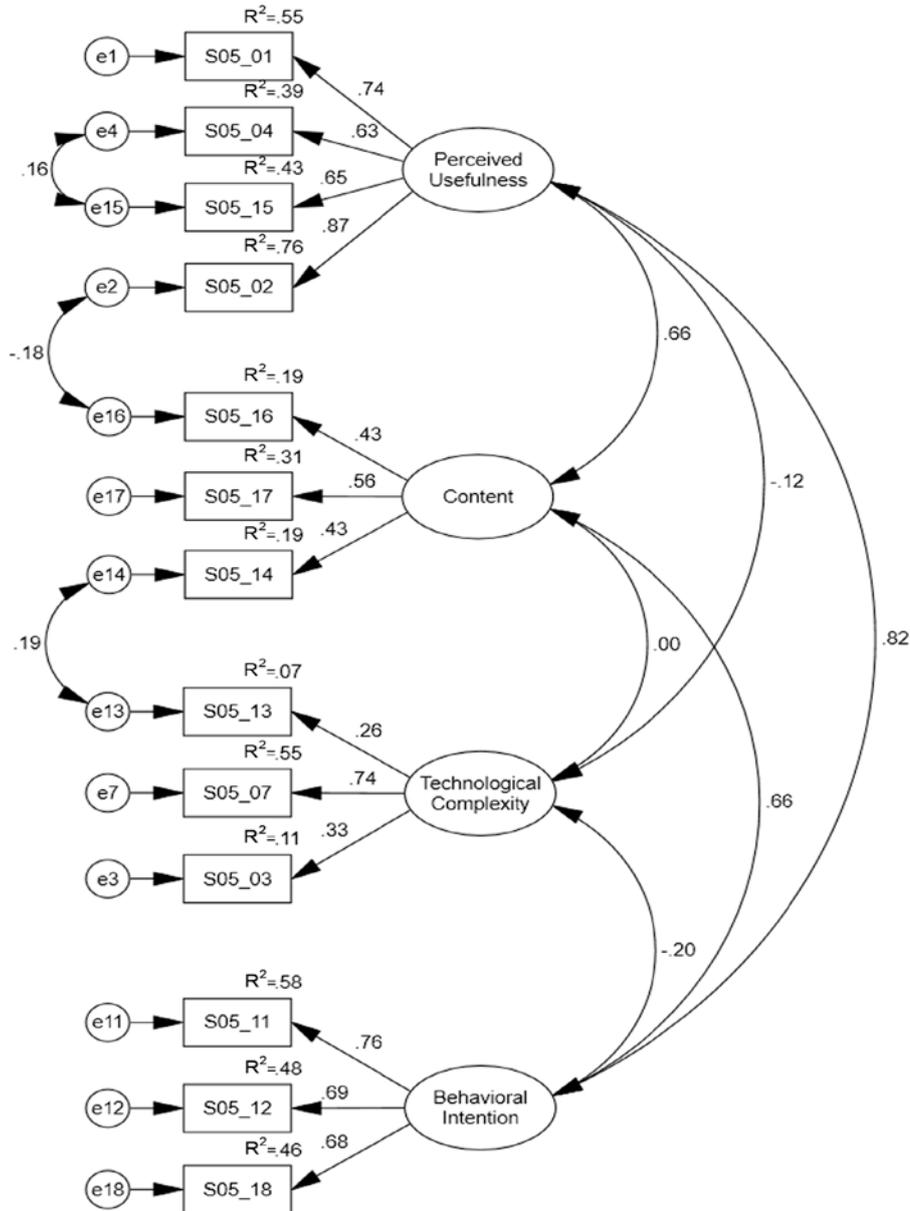


Figure 4. Confirmatory factor model for the four-factor solution (Measurement model – standardized estimates)

The resulting parameters of the research model are shown in Figure 5. The results indicate that only the perceived content of questions significantly affects the perceived usefulness scores. Also, in line with various TAM research, perceived usefulness directly predicted behavioral intention. However, the relationship between perceived usefulness and other constructs was non-significant. Findings indicated a significantly negative link between age and course grade, as well.

Student Opinions about E-Assessment

Student opinions based on the open-ended question were investigated from two dimensions: (1) emerging themes, and (2) direction (positive, negative, and

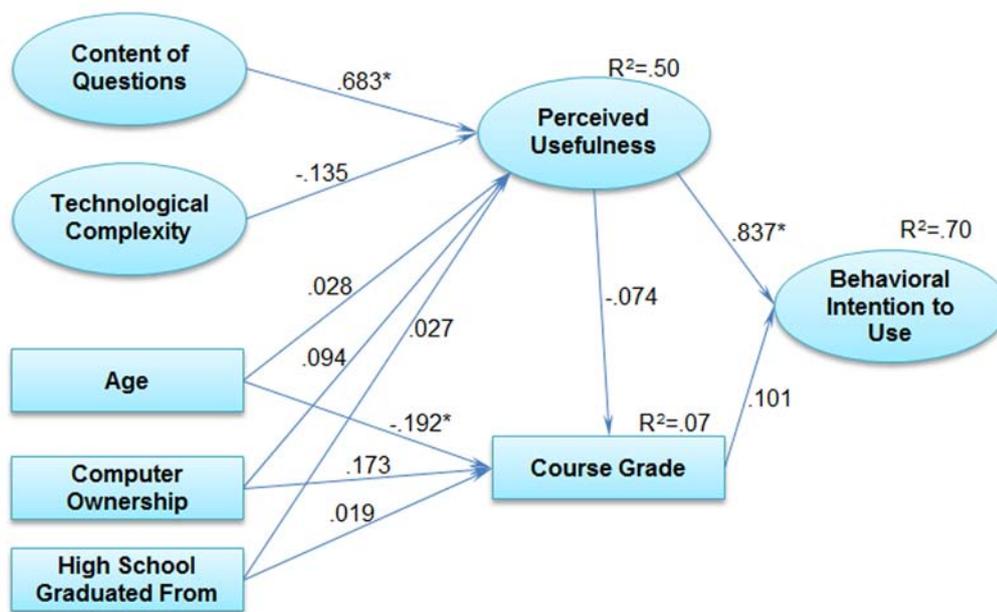


Figure 5. Result of research model (SEM – standardized estimates)

Table 3. Emergent themes based on student opinions

Theme	Positive		Negative		Undecided		Total	
	N	%	N	%	N	%	N	%
Innovation	50	52%	45	48%	22	49%	117	50%
Quiz content	18	19%	21	23%	9	20%	48	21%
Grading	10	10%	15	16%	9	20%	34	15%
Time	5	5%	12	13%	5	11%	22	9%
Saving paper	13	14%	0	0%	0	0%	13	6%
Total	96	100%	93	100%	45	100%	234	100%

undecided) as introduced previously. Table 3 shows how the themes grouped into these perspectives from the most frequent to the least.

As seen from Table 3, the most frequent theme was innovation. Although most students saw the technique as a novelty, almost as many students thought the system was an “ineffective novelty.” Many other students pointed out to both the positive and negative aspects of the systems’ originalities.

Because of space constraints, the themes were briefly described in Table 4. Example exact quotes for positive, negative, and undecided opinions were provided in the same table. The direction was determined by deciding whether a comment was sympathetic or antagonistic. The comments that were neither of those, or presenting feelings of both were coded as undecided.

The least frequent theme was “saving paper.” This theme always appeared sympathetically, as the students enjoyed how the system prevented from wasting paper. On the other hand, all remaining themes were biased towards the antagonistic direction. Positive comments on quiz content were usually about first two quizzes, which had no time and attempt limit, while negative comments were generally about third quiz, which projected such limits. It was also obvious that participants did not like “strict grading”. They favored the tolerance factor granted by the instructor in the paper-based grading. Time was another issue. Students did not like the system to log the user out after a certain time, which restricted students’ control.

Table 4. Theme descriptions and sample quotes

Theme / Description	Direction	Example Quote	Also coded as
Innovation Seeing the new e-assessment system as "novelty."	Positive	Quiz over the portal was of course marginal, as we have not had such a quiz before; it was nice and impressive.	
	Negative	I mentioned this before. It was a terrible method. Only this application makes the project look bad. I think the quizzes should not be taken over the portal, better if we write on paper theoretically.	Quiz content
	Undecided	The method was nice, but questions and understanding the questions was difficult.	Quiz content
Quiz Content Issues such as "difficulty of quiz," and "characteristics of questions."	Positive	The quiz was really nice. I think it is a good study towards the exams. Seeing our mistakes and studying the failing topics help understand the topics.	
	Negative	The quiz over the portal was difficult and there were confusing questions.	Innovation
	Undecided	The quiz was good "multiple-choice-wise," but not as good "text-wise" because everybody's mentality is different. The person preparing the quiz and the person taking the quiz explain the same issues in different ways. So, it would not be healthy for assessment.	Grading
Grading Grading issues such as "fair grading" and "strict grading."	Positive	Because the quiz over the portal was on computer, there were zero mistakes and the results came as we deserved.	Innovation
	Negative	We had one quiz over the portal and everybody failed sir. The previous system was better.	
	Undecided	The quiz through computer is nice but it needs to be done with zero tolerance.	Innovation
Time Issues referring to time such as "quiz time," "not enough time," and "freedom of time."	Positive	I am really satisfied because it prevents wasting time.	Innovation
	Negative	I find it inappropriate because while we take the quiz we are unable to follow the time. The possibility of making a mistake is high. As optical illusion happens often, the quiz needs to be on individual paper.	
	Undecided	The quiz over computer was nice, but its kicking you out after a certain time is bad, because solving the problems requires calculation and time.	Innovation
Saving Paper Issues referring to how the system prevents wasting paper.	Positive	We avoid wasting paper because of the quiz over portal. It was also an experience. It would be very nice to have this application in the other courses.	

DISCUSSION AND CONCLUSION

The main purpose of this study was to implement an e-assessment system deployed through MOODLE LMS and to investigate related student perceptions in a military vocational college. According to Whitelock and Watt (2008), e-assessment can change paradigms in assessment practice and can play a notable role in the future of education. Understanding perceptions regarding e-assessment is the first step for developing and implementing effective e-assessment and e-learning systems. Different forms of e-assessment systems have been used in higher education by the help of integration of ITs. TAM2 (Venkatesh & Davis, 2000) is an effective model to understand the student behavior about information technology, specifically e-assessment in the context of this study. The model, which explains student's behavioral intention, is formulated by using a number of variables suggested in TAM2 (Venkatesh & Davis, 2000) and the literature. The primary contribution attempted at this research is to expand the understanding of variables affecting intention to use of the e-assessment system. Therefore, the relationship between TAM2 factors of perceived usefulness and behavioral intention to use; the CBAAM factor of perceived content of questions (Terzis & Economides, 2011a); and

technological complexity were explored with respect to the relevant external variables.

Perceived usefulness, behavioral intention, content of questions and technological complexity – analyzed through the descriptive quantitative data – returned mean scores (between 2.99 and 3.20) that were just a little over the mid-point indicating that the participants had generally positive attitudes toward the e-assessment system (see Table 1). However, the results were hardly above neutral, meaning that participants did not quite find the system useful to themselves, nor have they significantly positive feelings towards using the system in line with previous studies (Cigdem & Tan, 2014; Dermo, 2009; Sorensen, 2013).

The relationships between the variables were investigated through SEM. Contrary to the assumption employed in this study, the only significant contributor of perceived usefulness was content of questions. This finding, consistent with the literature (Terzis & Economides, 2011a), suggests that content has a significant direct effect on perceived usefulness in the e-assessment system. This indicates that if student perceptions are positive about content of questions in e-assessment, they would be keen to think it is useful. A greater score on content meant that students thought the questions were easy and they had enough time/means to answer them. Creating easier exams in favor of increased e-assessment system use certainly does not make sense. However, creating questions that are easier to understand and handle can probably have a positive impact on the system use. This would include forming quality questions. But more so than that creating questions that can make use of the advancements of the technology. In that sense, it would be reasonable to claim that the results encourage us to create questions that are more creative. Animations, simulations, drag and drop questions, questions with video, audio, and any other creative way would have great potential.

Furthermore, the results showed that perceived usefulness significantly affects behavioral intention of the e-assessment system. This is consistent with TAM literature. The implication is that if students feel that e-assessment is useful, their behavioral intention to use it is stronger. Perceived usefulness e-assessment system does not have any different impact than perceived usefulness about any other technology. Therefore, techniques to improve perceived usefulness in any other means will have positive impact on the use of the system.

The external variables utilized in the study did not have any impact on the dependent variables except for the impact of age on course grade. The older students performed worse in terms of course grade. Nevertheless, this result does not have an impact on the TAM framework as course grade did not have any significant contribution towards behavioral intention to use. Considering that the course grades were high, it is possible to say that regardless of the student opinions, the e-assessment system was somewhat functional in evaluating the student performance. However, “whether the students would be more successful, had they taken the test on paper” remains to be tested. There are many types of online assessment such as the ones that incorporate multimedia, animations and simulations. The current study was an example of text-based online assessment, which is an incremental enhancement over the paper-based assessment. Examinees can possibly have different attitudes over different types of online assessment. The findings should be interpreted through the lenses of text-based assessment.

The qualitative findings show clues for the balanced (almost neutral) posture of students obtained from the descriptive statistics. Complaints accumulated around time, grading, and quiz content. Students complain that the system does not allow for time control. They were unable to follow the time on the browser screen. Moreover, a considerable portion of participants claimed that they could have greater points if the quizzes were applied using paper and pencil, because the e-assessment system has stricter grading approach. Therefore, it is possible to claim

that students still prefer quizzes on paper because of the teacher (tolerance) factor. This is consistent with findings of Llamas-Nistal et al. (2013). In contrast, some other participants expressed that grading in the e-assessment system was fair and it did not allow cheating due to the randomized questions and answers. This parallels Dermo's (2009) findings. Furthermore, students complained about the hard and confusing questions.

All these complaints seem not to originate from the nature of the "e-assessment," but rather to originate from the nature of the "assessment" itself. For example, students would not have any control of time even if they took the test on paper in the traditional system. Even then, the system offered some of the quizzes without time limit. So these would not be easily distinguishable from usual student complaints in traditional exams. Nevertheless these shall have implications for blended courses, in particular, in designing and utilizing e-assessment tools to meet the expectations of students.

Some difficulties have been experienced because e-assessment system was new for students. To avoid such difficulties, students appear to require training about LMS and e-assessment. Additionally, better infrastructures are needed to cope with technical problems. Some limitations also exist; greatest of which is the fact that the study was completed in a male dominated military vocational college. Future research can therefore try to eliminate the imbalance of gender. Also, the limited number of participants and abundance of variables prevented from using more variables. For example, our study did not include perceived ease of use and other variables of TAM2, which can possibly be included in future studies with more participants.

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